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ROYAL COMMISSION ON THE SANITARY STATE OF THE
ARMY IN INDIA.

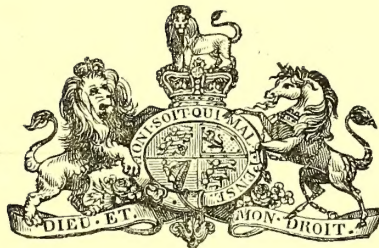
VOL. I.

R E P O R T
OF
THE COMMISSIONERS.

PRÉCIS OF EVIDENCE.

MINUTES OF EVIDENCE.

ADDENDA.



L O N D O N :
PRINTED BY GEORGE EDWARD EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY,
FOR HER MAJESTY'S STATIONERY OFFICE,

1863.

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COMMISSION.

Victoria, by the Grace of God of the United Kingdom of Great Britain and Ireland, Queen, Defender of the Faith.

To Our right trusty and well-beloved Councillor, the Right Honourable Sidney Herbert, and to Our trusty and well-beloved Robert John Hussey Vivian, Knight Commander of the Most Honourable Order of the Bath, a Major-General in our Indian Forces, and a Member of the Council of India; Proby Thomas Cautley, Knight Commander of the Most Honourable Order of the Bath, a Colonel in our Indian Forces, and a Member of the Council of India; Thomas Alexander, Companion of the Most Honourable Order of the Bath; Edward Harris Greathed, Companion of the Most Honourable Order of the Bath, a Colonel in our Army, William Farr, M.D., James Ranald Martin, Esquire, and John Sutherland, M.D., greeting:

Whereas it hath been humbly represented to Us that, considering the great importance of maintaining and improving the Health of all ranks of Our Army serving in India, it is expedient that certain Inquiries should be made:

Now know ye, that We, having taken into Our Consideration the Premises, do hereby order and direct you, the said Sidney Herbert, Sir Robert John Hussey Vivian, Sir Proby Thomas Cautley, Thomas Alexander, Edward Harris Greathed, William Farr, James Ranald Martin, and John Sutherland, to inquire, firstly, into the Rate of Sickness and Mortality, and Invaliding among Our Troops, both of the General and Indian Services, in all Stations throughout India and its Dependencies; and into the class of Diseases from which such Sickness and Mortality arise.

And, further, We do order and direct you to inquire into the Causes of such Sickness and Mortality; whether as relates to Climate, Locality, state of Barracks, Drainage, Water Supply, Diet, Drink, Dress, Duties, or Habits of Troops.

And, further, We do order and direct you to inquire into what existing Stations are unhealthy, and to indicate how such Unhealthiness may be removed, if possible, and the nature of the Sanitary Improvements required.

And, further, We do order and direct you to inquire into the subject of Healthy Positions generally, with the view of recommending the most healthy for future Occupation, and of ascertaining whether healthy Stations may not be found within moderate Distance of such existing unhealthy Stations as may be of Political or Military Importance; also into the general subject of Sanitaria and Hill Stations, with the view of pointing out the most healthy Positions on them.

And, further, We do order and direct you to inquire as to the best Construction of Barracks, Huts, Hospitals, and Tents for India.

And, further, We do order and direct you to inquire into the present Regulations or Practice for preserving the Health of the Troops, and enforcing Medical and Sanitary Police.

And, further, We do order and direct you to inquire into the present Organization of the Army Sanitary and Medical Service.

And, further, We do order and direct you to inquire as to the Practicability of establishing a general system of Military Statistics throughout India, and to ascertain whether any, and what Means exist, of comparing the Diseases and Mortality of the Troops with those of the Civil Population, English and Native.

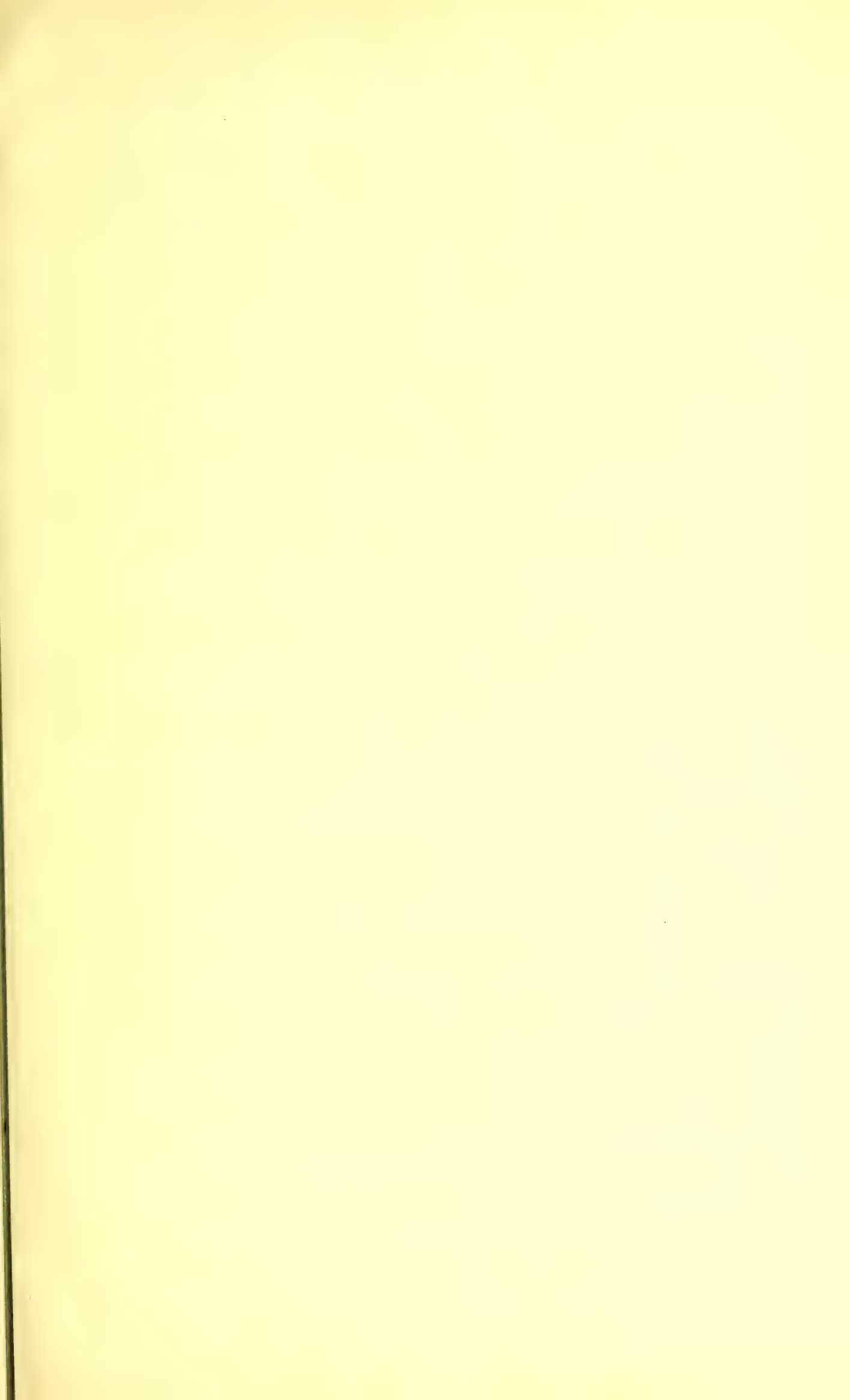
And, We do further command and require you to Report what Changes you may consider it expedient to make in the present Practice, with respect to any of the Subjects above mentioned.

And, it is Our further will and pleasure that you, or any Five or more of you, do obtain Information touching the Matters aforesaid, by the Examination of all Persons most competent, by reason of their Knowledge, Habits, or Experience, to afford it; and also by calling for all Documents, Papers, or Records, which may appear to you, or any Five or more of you, calculated to assist your Researches and to promote the formation of a sound Judgment on the Subject, and that you, or any Five or more of you, do report to Us, under your hands and seals, your several Proceedings by virtue of this Our Commission, together with your Opinions touching the several Matters hereby referred for your consideration.

Given at Our Court at St. James's, this Thirty-first Day of May, in the Year of Our Lord One thousand eight hundred and fifty-nine, and in the Twenty-second of Our Reign.

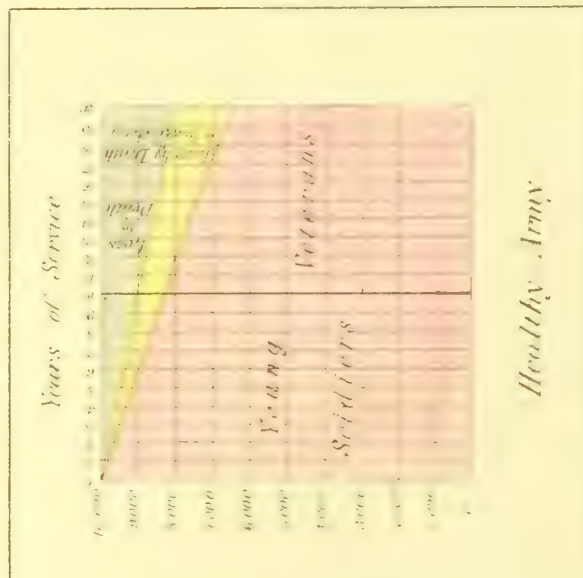
By Her Majesty's Command.

(Signed) STANLEY.

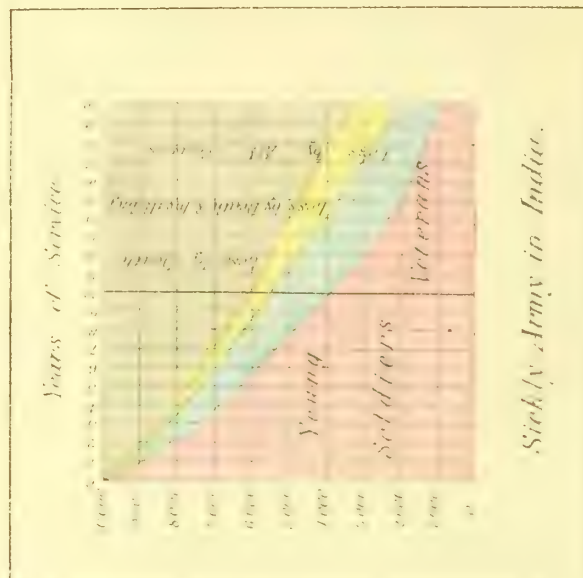


DIAGRAMS — SHOWING THE LOSS OF STRENGTH IN THE ARMY AT HOME, AND IN THE EUROPEAN ARMY IN INDIA BY DEATH, BY DEATH AND INVALIDING AND BY DEATH, INVALIDING AND ALL CAUSES.

I. Representing the Army at Home if the Mortality were the same as it is in the Male population of England at corresponding Ages.



II. Representing the European Army in India.



Note. The small parts of the Diagrams represent the losses of the Young, Soldiers and Veterans in the same time under the assumed conditions.

The Force 166,910 represented by the Red Area in Diagram I. is assumed to be maintained by 10,000 Annual Recruits, which if there were no loss by Death or by Invaliding would sustain a force of 240,000 men represented by the whole of the square. The loss of Strength shown in Diagram I. is equal to 73,090 or 17 per Cent. in Diagram II. to 88,815 or 44 per Cent. if no other loss were sustained than by Death and Invaliding. The Dark Area represents the loss of Strength by Death. The Dark and Yellow Areas represent the loss of Strength by Death and Invaliding. The Dark Yellow and Blue Areas in Diagram II. represent the loss of Strength by All Causes. It will be borne in mind that many of the Invalided die soon after leaving the Army. 10,000 Annual Recruits in Diagram I. would sustain a force of 166,910. In Diagram II. 10,000 Annual Recruits would sustain a force of 111,185 if there were no loss from any other Cause than Death and Invaliding. Each of the 200 small parallelograms represents 1000 men.

DIAGRAMS — REPRESENTING THE RELATIVE ANNUAL MORTALITY FROM ALL CAUSES, ZYMOTIC DISEASES, LUNG AND TUBERCULAR DISEASES AND OTHER DISEASES IN THE MALE POPULATION OF ENGLAND AGED 15-45, IN THE INFANTRY OF THE LINE SERVING AT HOME, AND IN THE EUROPEAN ARMY IN THE PRESIDENCY OF BENGAL.

I. Male Population of England, aged 15 45 1848 54.

Deaths Annually to 1000 living from All Causes 9.8	Deaths from Zymotic Diseases 2.4 to 1000 living	Deaths from Lung and Tubercular Diseases 1.5 to 1000 living	Deaths from All Other Diseases 3.3 to 1000 living
--	---	---	---

This dotted parallelogram represents the additional Area which would be occupied in representing the Mortality among the Male Population of England if they were as unhealthy as the European Army in the Presidency of Bengal.

II. Infantry of the Line serving at Home 1859 61.

Deaths Annually to 1000 living from All Causes 8.56	Deaths from Zymotic Diseases 1.96 to 1000 living	Deaths from Chest & Tubercular Diseases 4.2 to 1000 living	Deaths from All Other Diseases 3.4 to 1000 living
---	--	--	---

III. European Army in the Presidency of Bengal 1830 45.

Deaths Annually to 1000 living from All Causes 6.7	Deaths from Zymotic Diseases 58 to 1000 living	Deaths from Lung & Tubercular Diseases 34.11 to 1000 living	Deaths from All Other Diseases 6 to 1000 living
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The Lung and Tubercular Diseases comprise all those included in the Tubercular and Chest Diseases (exclusive of Heart Diseases) of the Classification adopted by the Registrar General of England.

Diagram N^o 3. is constructed from a Table showing the Diseases of the European Forces in the Presidency of Bengal for the 16 Years 1830-45. (see miscellaneous Tables p. 46.)

REPORT.

TO THE QUEEN'S MOST EXCELLENT MAJESTY.

MAY IT PLEASE YOUR MAJESTY,

WE, the Commissioners appointed to inquire into the sanitary state of Your Majesty's Army serving in India, humbly present to Your Majesty the results of our investigation, which we do in this our Report, as follows:—

The inquiry in which we have been engaged has been one of unusual extent and duration, and from its nature has led to considerable delay in preparing our Report. We had, in the first place, to lay the foundation for our inquiry by an elaborate examination of the available statistical and sanitary documents in the India House. In doing so it was perceived at the very beginning that we could not arrive at our object by taking oral evidence only, and that it would be necessary to carry out a preliminary local inquiry at all the Indian stations before a true estimate could be formed of what were the real conditions of the problem with which we had to deal. With this view a series of printed questions was drawn up and sent to all the stations to be there replied to and signed concurrently by the commanding, engineering, and medical officers. We had to await the results of this part of the inquiry; and as on some important statistical points the replies from two Presidencies were incomplete, we called for further information, which has not yet been received by us. This, together with other engagements of members of the Commission, has led to considerable but unavoidable delay, which we are grieved to say has been increased by the losses which the Commission has sustained since its first meeting. The late Lord Herbert, who was our first Chairman, was compelled by official occupation, and latterly by declining health, to suspend the meetings for some time. Previous to that period, Sir Robert Vivian had been obliged by his other duties to resign as member of the Commission, and we had further to deplore the death of Mr. Alexander, the late Director-General of the Army Medical Department. To supply these losses, Dr. Gibson, the present Director-General, and Colonel Durand, since called to India, were added to the Commission, and Lord Stanley consented to succeed Lord Herbert as Chairman.

Appendix.
Vol. 2d.

We have thought it necessary to make this statement to account for the lengthy period which has intervened between the date of Your Majesty's Commission and the date of this Report.

An inquiry extending over so large an area, and including so great a multiplicity of details, many of them of a minute character, has been necessarily voluminous and expensive; but the evidence which it has called forth appears to us to be so important, not only to the interests of troops serving in India, but to those inextricably interwoven with them of the native population, that we have not scrupled to publish it for official use, partly for the purpose of spreading information, and partly in order that the correctness of the statements made by us might be fully sustained by authority.

Appended to the Report, we have given a précis of the evidence; and, separately, the oral evidence, with some important addenda made to it by the witnesses, an abstract of all the stational reports, and a valuable paper of comments on these reports, contributed, at the request of the Commission, by Miss Nightingale.

The medical statistics for the troops of the late East India Company, and also for those of the Royal army (the latter prepared at the Army Medical Department), which follow, have been drawn up from the best available data, supplied partly from India, partly by His Royal Highness the Commander-in-Chief, and by the Secretary of State for India. These, together with a paper on the geographical distribution of Indian climates prepared at our request by Mr. Glaisher, contain the main statistical facts of the inquiry. Involving a wide range of subjects, our researches have been minute, and the evidence by which our conclusions are borne out is necessarily voluminous. But we believe that the abstracts referred to contain the substance of all the facts in such a form as to render reference to the evidence almost needless, except for the purposes of verification and more minute analysis. It has been our object to present a large mass

of facts and detail within as limited a compass as the nature of the questions we have discussed allowed.

In dealing with the evidence we have considered it best to arrange the facts it contains in distinct divisions, beginning with the statistics of mortality and disease. Under this head we have given,—

The strength and distribution of the army in India.

The total mortality among British troops, and at different ages and periods of service.

The annual waste of life in each year of service.

Nature of the diseases occasioning the mortality and the loss of efficiency from sickness.

We next give an estimate of the cost of placing the soldier in India, and the pecuniary loss occasioned by the present death and sick rate.

This discussion is followed by a statistical estimate of the mortality among native troops, among natives, and among Europeans and mixed races in India.

Following on this general statistical investigation we next give the results of our inquiries into the mortality of particular groups of stations.

Having in this manner arrived at the facts regarding mortality and disease we next proceed to examine into the influences affecting the health of European troops, as these are described in the evidence and stational reports.

Under this part of the inquiry we have included a general discussion on the topography and climate of India,

The sanitary condition of stations, towns, and bazaars.

Drainage and water supply.

Construction of barracks, together with the state of their ventilation, cubic space per man, ablution and bath accommodation, cook-houses, latrines, &c.

Accommodation for officers and married soldiers.

Having considered the questions arising out of the soldier's barrack accommodation we proceed to discuss the influence of his diet, dress, and duties. Next the very important subject of intemperance and its concomitants in their influence on health and efficiency, and the amount and kind of occupation and recreation provided for the soldier to fill up his spare time.

This is followed by an inquiry into the state of the hospital accommodation, including the questions of construction, ventilation, cubic space, drainage, water supply, hospital conveniences, and attendance.

The very important question of hill stations follows next in order.

And, lastly, the sanitary condition of native lines and hospitals.

Having completed our survey of the causes of sickness and mortality we consider the present state of sanitary administration in India with the improvements required to enable the causes of disease to be dealt with, and we conclude, after a recapitulation of the leading results of the inquiry, with the recommendations we have to make for improving the health of troops serving in that part of the empire.

In conformity with this arrangement of subjects, we proceed, first, to discuss connectedly the facts which in this inquiry admit of numerical analysis.

STRENGTH AND
DISTRIBUTION.

STRENGTH AND DISTRIBUTION OF THE ARMY IN INDIA.

The British army consisted of 227,005 officers and men on April 1st, 1861; and 82,156 of them belonged to regiments in India at that date; 144,849 to regiments at home or in the colonies. The strength of the regiments serving in India was 94,829 in the previous year.

Horse
Guards' Re-
turn, dated
29th July
1862.

Thus a large proportion of the regiments is in India; and a still larger number may be called to that part of the empire in great emergencies.

Four regiments in eleven were serving there; so should those proportions be maintained, and every regiment go in its turn, it will be exposed 10 years in every 27½ years, or four years in eleven, to Indian influences. But as some corps never go to India, the service will fall more heavily on the rest.

The full establishment of a royal regiment in India was 1,119,* including 41 officers, 138 non-commissioned officers and drummers, 940 privates. And of this strength about 220 of each regiment in India figured in the dépôts at home.

The distribution of the army at the latest date (April 1862), we will now give from the returns, including for Bengal the non-commissioned officers and men only.†

Horse
Guards'
Return.

At this date some of the changes resulting from the incorporation of the Indian forces in the Queen's army had been carried out, and the European officers in the return amounted to 3,962, the non-commissioned officers and men to 70,489; the native officers and men to 108,382, exclusive of 11,652 men in the Punjab local force, and of numerous police corps which have been created in all the provinces.

In Bengal, the North-west Provinces, and the Punjab, that is, in the territory filling the vast plain of the Ganges and of the Five Rivers, from Calcutta and Assam to Peshawur, a force of 85,966 men were stationed, consisting of 46,290 Europeans (officers, 2,160), and 39,676 Indians.

The Presidency division extends over the whole of the populous delta of the Ganges, from the Dhumrah river to Darjeeling in the Himalayas between Nepal and Bhotan, and along the Brahmapootra to the extremities of Assam. The military force consisted of 3,593 Europeans and 6,047 natives; namely, 1,539 Europeans and 624 natives at Fort William and Alipore, covering Calcutta; 580 Europeans, 708 natives at Barrackpore; 413 Europeans at Raneegunge, 297 at Berhampore, and 319 at Dacca. The Europeans at other stations were few; a corps of 1,088 natives was in Assam. The Benares division consisted of 3,390 Europeans, and 3,198 natives; 1,075 of the Europeans were stationed at the plateau station of Hazareebaugh, 680 at Dinapore, 678 at Benares, 406 at Goruckpore, and the residue at four other stations. This populous district, by the side of the independent state of Nepal, lies around the Gunduck, and the Gogra on the north, and the Sone on the south of the Ganges, which here receives their waters.

The Saugor district, in the midst of small feudatories, has 2,243 Europeans and 4,746 Indians; of the Europeans, 874 are at Jubbulpore, and 848 at Saugor. In addition here are two native corps from the Madras presidency.

In proceeding up the Ganges, the Oude and Meerut divisions, with the Gwalior on the left, and the Rohilcund division to the right, extending to the Himalayas, consist of a force of 18,987 Europeans and 13,391 Indians. 1,302 Europeans, 1,351 Indians, are stationed at Gwalior; 738 Europeans and 413 Indians at Jhansi. Oude is occupied by a strong force of Europeans, of whom 1,386 are at Allahabad, 1,294 at Cawnpore, 2,085 at Lucknow, 597 at Roy Bareilly, 1,256 at Fyzabad, 799 at Gonda, and 610 at Seetapore. Only 2,848 natives of India are in Oude; and 554 Europeans, 302 Indians, in the Rohilcund district, are at Shahjehanpore; 1,074 Europeans are at Bareilly, 406 at Moradabad, 241 at Nynee Tâl.

Of the troops in the Meerut division, 578 Europeans are at Futtyghur, 1,206 at Agra, 506 at Muttra, 1,165 at Delhi, 2,094 at Meerut, 632 at Roorkee (the head quarters of the Ganges canal operations), and 156 at Landour, one of the lofty hill stations.

* See Colonel Baker's Paper, No. 52, Appendix to Report of Commission to inquire into Organization of Indian Army.

† There is a great want of uniformity in the returns of all the Presidencies. And for various purposes it has been necessary to use returns of different dates, sometimes supplied by the Adjutant-General, and at others by the India Office.

4,874 men of the European force, and 2,524 of the native force, are in the Sirhind division, between the Jumna and the Beas; namely, 1,840 Europeans at Umballa, 263 at Jullundur, 220 at Phillour; and in the high hill districts, 630 at Dugshai (16 miles from Simla), 76 at Kussowlie, and 935 at Subathoo.

The Punjab is held by 11,043 Europeans and 9,770 of the native army. At Umritsir there are 621 Europeans, 501 natives; at Sealkote, 1,471 Europeans, near the Chenab, flowing from Gholab Sing's dominions, 1,266 at Lahore, 819 at Ferozepore, and 1,171 at Mooltan. At the three latter stations, 3,221 men of the native army are located.

The Peshawur district of the Punjab, lying against the Khyber Pass and Afghanistan, is held by 157 Europeans at the station on the Jhelum flowing from Cashmere; 1,438 at Rawul Pindi, 214 at Attock on the Indus, and 711 at Nowshera, near Peshawur, which is itself occupied by 2,027 Europeans, and 2,849 natives.

The East India railway runs through the Bengal military divisions, and, with that of the Punjab, connects them all from Calcutta to Lahore on one strategic line, which is prolonged by the grand trunk road to Peshawur.

Another railway line extends from Allahabad on this base to Jubbulpore and Bombay, nearly parallel to the remoter line going from Lahore to Mooltan.

The European forces of this command are stationed, with few exceptions, at the bottom of the Ganges plain, near the chief cities on the rivers.

Descending the Indus, the Bombay Presidency is entered through the Sinde division, where 293 Europeans are stationed at Hyderabad, the summit of the delta of the Indus, and 1,219 at Kurrachee, with 841 natives at the former, 773 at the latter station. There are 83 officers, 1,512 Europeans, and 4,155 natives, including the frontier brigade in Sinde, lying between the Suliman range, with the Belochs on the north-west and the desert on the south-east.

The force in all the Bombay presidency,—including 465 Europeans, 2,380 natives in the presidency division,—consists of 12,198 Europeans and 29,681 natives. They are commanded by 852 officers.

The northern Bombay division, extending over the Cutch and Guzerat from Sinde to Poona, has 908 Europeans at Deesa on the Bunnass, 302 at Ahmedabad, 60 at Surat, and 46 on Mount Aboo, making, with the troops at two more stations, 1,318 non-commissioned officers and men, besides 5,940 natives, at the same stations, at Baroda, Bhooj, and elsewhere.

The Mhow division, of 3,478 Europeans and 4,527 natives, occupies a central territory intersected by the Aravulli and Vindhya ranges of mountains, whose waters flow into the Nerbudda and the Chumbul. The territories of Holkar, Sindia, and the warlike Rajpoots lie around the stations, of which Mhow, near Indore, is held by 1,680 Europeans, Nusserabad by 1,060, Neemuch by 564, and Ajmeer by 61. The railway from Agra to Bombay goes through this country, south of the desert, but parallel with the distant Indus.

The Poona division carries us further into the tropics, but higher over the Deccan and the Ghauts; it surrounds the presidency, and holds the ancient seat of the Mahratta power with 235 officers, 3,323 European non-commissioned officers and men, and 6,515 natives. Of the Europeans, 1,850 are at Poona, where the Peishwa resided, 438 at Kirkee, in its vicinity, 724 at Ahmednuggur, 215 at Sattara.

The Belgaum division, further south, but north of Goa, consists of 98 European officers, 1,132 men, and 3,794 natives; the Europeans being at Belgaum, the native force, with their European officers, at Dharwar, Kulladghee, Kolapore, and Vingorla.

The presidency of Fort St. George, Madras, had under its command 14,161 Europeans, besides 950 European officers, and 39,025 native officers, non-commissioned officers, and rank and file.

It had two native corps in the Saugor division, which has been before referred to, and is also occupied by troops of the Bengal force.

The Nizam, in his dominions of nearly 100,000 square miles, and more than 10,000,000 inhabitants, in the centre of the Deccan, has a considerable military array, consisting of an auxiliary force under British officers, paid by him, irregulars, and dependants of Ameers.

The British subsidiary force of 183 officers, 3,161 Europeans, 4,272 Indians, occupies cantonments at Secunderabad, near his capital, at Jaulnah, and other stations. The Nagpore force of 86 officers, 1,603 Europeans, and 2,484 native officers and men, is at Kamptee, Hoosingabad, and several detached posts, in a country which was, like Hyderabad, recently under the Rajah of Berar, and lies between the Nizam's dominions and Bengal.

77 officers, 906 Europeans, and 3,445 native officers and men occupy the ceded districts which were detached from the Nizam's territory, south of the Kistnah, by treaty. 57 officers and 902 Europeans are at Bellary.

The Northern division, chiefly of natives, is diffused on the coast country, extending from the mouths of the Kistnah over those of the Godavery and the Mahanuddy to the river Dhumrah, which separates it from Bengal. The division consisted of 65 European officers, 106 men and non-commissioned officers, 5,929 native officers and men.

The Mysore division of 229 European officers, 3,486 non-commissioned officers and men, and 7,354 native officers and men, was stationed chiefly at Bangalore, at Mangalore and Cannanore, at Mercara, at Hurryhur on the Tumbudra, and at the French Rocks. The Europeans are chiefly at Cannanore, on the Malabar coast, and at Bangalore, which is 3,000 feet above the sea level, and joins Madras by a railway. Seringapatam, Hyder Ali's capital, was abandoned on account of its insalubrity.

The Neilgherry hills are on the borders of the Mysore, and of the Southern division, which extends over all the southern extremity of the peninsula. 59 European officers, 691 men, and 3,586 native officers and men are in the districts of Trichinopoly, Palamcottah, and Quilon. Trichinopoly is above Tanjore, the fertile delta of the Cauvery, on an extensive open plain.

The Central division of 112 officers, 2,101 non-commissioned officers and men, and 4,076 native officers and men, occupies the stations around Madras. The Europeans are at Fort St. George, St. Thomas's Mount, and Palaveram, from which numerous detachments are sent. Two native corps are at Vellore and Arcot.

Since the Burmese wars (1826 and 1852) the province of Pegu, east of the bay of Bengal, in addition to Arracan and Tenasserim, is British territory; and the Pegu division consists of 85 European officers, 2,096 European men, and 4,561 native officers and men. The Europeans are at Rangoon, in the delta of the Irawaddy, at Thayet Myo above Prome, on the same river, and at detached posts; some of them on the Madras side of the bay of Bengal. The native corps are at Tonghoo and Moulmein.

At the extremity of the Malay peninsula, native corps of the Indian army, consisting of 18 European officers and 1,378 men, occupy the Prince of Wales's island and Singapore, which command the Malacca straits, and afford the protection of the British flag to the surrounding people and to the commerce of China.

A native corps of 14 European officers and 938 men, from the Bombay presidency, was in China; and the same presidency returns a small native force of 342 in the Persian Gulf, at Bushire, at Bussorah, where there were factories, and on marine duty.

A brigade at Aden, on the way to Europe by the Red Sea, consisted of 29 European officers, 584 men, and 1,053 Indian officers and men.

India has been the centre of military operations carried on in the Red Sea, in the Persian Gulf, and in the China seas; and the army, now incorporated with the army of the Empire, exists for its defence. This has necessarily to be borne in mind in the distribution of the Indian forces.

MORTALITY OF THE BRITISH TROOPS IN INDIA.

Having given this brief sketch of the present distribution of troops throughout India and its dependencies, we next proceed to show what is the rate of mortality and the effect of this on the efficiency and on the cost of the Indian army.

The medical reports, special investigations of the casualty rolls which we have had made, and a great variety of returns, supply the materials for determining the mortality of the European non-commissioned officers and men in the various arms and in the presidencies.

In a spirit of providence the servants and officers of the late Company established funds for the sustenance of widows and orphans; but without adequate data, and hence it has been necessary to submit their experience to the investigation of several actuaries in London, who have at various periods reported on the mortality of the members and of the services. These reports exhibit the mortality of Indian civil servants, of military officers, of wives, widows, and children.* From another source we are able to follow

* We have been able to use some of these reports by Griffith Davies, and Neison, which have been published for private circulation; and have particularly to thank Mr. Samuel Brown for the MS. results of an investigation into one of the funds, bringing down the inquiry to the latest times. Major-General Hanynghton has placed a valuable table at our disposal. A valuable series of statistical returns have been collected by Sir Ranald Martin in his work on the Influence of Tropical Climates. The papers of Dr. Chevers, the digest of the vital statistics of the armies of India by Dr. Ewart, and other publications show the interest that the medical officers of the Indian army take in the subject. The evidence of Sir Alexander Tulloch, Dr. Balfour's tables, and the second army report have been consulted. We have relied much upon the tables in the addenda to evidence which have been procured for the Commission.

the Indian officer home, and to determine his lifetime after passing through the perils of India. With the non-commissioned officers and men we can now, for the first time, deal in the same way.

The variations of the rate of mortality among men depend on two great classes of causes; the first class inherent in the organization itself, the second external. Thus, under similar circumstances, the force of life declines, the mortality per 1,000 increases year by year after the age of 15. Among females, never exposed to the risks of war or of dangerous occupations, it is 7·65 at the age of 20; 8·94 at the age of 30; 9·98 at the age of 40; 11·92 at the age of 50; 21·62 at the age of 60; 49·92 at the age of 70; and 118·66 at the age of 80 in the healthier districts of England and Wales. The increase of mortality up to the age of 50 is at the rate of about $1\frac{1}{2}$ per cent. for every year of age, or 16 per cent. for 10 years; so that if the rate of mortality is 10·00 at the age of 40, it becomes 10·15 at the age of 41, and nearly 12·00 at the age of 50. After the age of 50, the mortality increases annually at the rate of 8·7 per cent., and is doubled in every $8\frac{1}{4}$ years of age.

Sex, and perhaps race, as well as age, are other inherent elements affecting the rates of mortality. Each age or sex is subject to a mortality which may be called natural in the present state of mankind; but that natural mortality is everywhere augmented by bad habits and unfavourable conditions. The natural standard is therefore undetermined; but the ascertained rates of mortality actually prevailing among large bodies of men will serve temporarily all the practical purposes of the exact natural standard.

Now the mortality of men of the soldier's age in the healthy parts of England and Wales is such that, on an average, 8 die annually to 1,000 living.*

Recruits for India undergo careful examination; and when soldiers are attacked by consumption, or any disease that is not soon fatal, they are invalided. So that their recorded mortality in peace, under such conditions as can be commanded for the army at home, should not exceed that experienced in the healthy districts of England, which as regards their salubrity, are by no means perfect models.

Half the population of England and Wales is concentrated in town and city parishes, under many unfavourable conditions, and the annual mortality of Englishmen of the soldier's ages is 9 in 1,000.

The mortality of men of the same ages in the unhealthiest towns of England, and in the unhealthiest trades, is at the rate of 12 in 1,000.

Thus the mortality varies in different cases; and as it rises from 8 to 9 and 12, unfavourable sanitary conditions are discovered accounting for every degree of increase. The same principle holds in the mortality of the British army at home, which was at the rate of 17 per 1,000 annually, and is now declining in proportion as the causes of disease are abolished or mitigated.

The mortality of the non-commissioned officers and men serving in the British army abroad in the four years 1857-60 was at the rate of 41 in 1,000; of the officers the mortality was 30 in 1,000.†

The annual mortality of officers serving at home and abroad was 17, of non-commissioned officers and men 33 in 1,000 during the years 1839-53, of European peace.‡ Sir Alexander Tulloch gave in his evidence a series of War Office returns of the strength, deaths, and mortality of the Royal army in India during 39 years, 1817-55, from which it appears that the mean strength in the three presidencies was 20,332, and the deaths 55,584, so the annual rate of mortality was 70 per 1,000. The Mahratta, Pindaree, Burmese, Afghan, Sind, Sutlej, Punjab, and Chinese campaigns account, according to his estimate, for 10 of the 70 annual deaths.§

Those who are conversant with military statistics are well aware of the difficulty of obtaining results at once exact and precise. This difficulty is increased in India, and the necessary calculations are further complicated by the distribution of European officers among the native corps, by the mixing up of officers and men, or of the Royal army with that of the late Company, or of men at home in depôt with men in India, and by the confusion of invaliding from disease with the discharge of soldiers whose terms of service have expired. The medical returns for some time appear to have included only the deaths in hospitals.

* 7·7 per 1,000 is the exact proportion. See Tables by Dr. Farr, in Appendix to Report on Sanitary Condition of the Army, p. 521, and Evidence, p. 12.

† Registrar-General's Report for 1860.

‡ Appendix to Report on Sanitary Condition of Army, p. 521.

§ See p. 319 of Evidence, and pp. 178-186 of Evidence before Commission of Inquiry into the Organization of the Indian Army, 1859.

After carefully examining all the documents at our disposal, we selected for analysis the nominal rolls of strength and casualties at the India House relating to the late Company's European troops. The collection of annual casualty rolls at the India House was "com-
" piled upon the principle of accounting for every man becoming ineffective in the year." Verified by the signatures of the commanding officers and adjutants of corps, the rolls are perfectly intelligible and substantially correct; they have been, therefore, analysed elaborately for the purposes of this inquiry. The troops of the Company, unlike the Royal army, served only in India, where they remained until death, or until they returned home.

The deaths in the 57 years 1800-56 among all the Company's non-commissioned officers and men, including invalids in India, amounted to 40,420, out of an aggregate of 588,820 years of life, obtained by adding up the average annual strength in those years; so the annual rate of mortality has been 69 in 1,000 during the present century.

The mortality rate was as high as 134 in 1804, in the first Mahratta war, and it was as low as 41 in 1852. It was high again in the years of mutiny, and it has been subsequently lower than the Indian standard. From the rate of 55 in 1770-99, the rate rose to 85 in the 30 years 1800-29; and the mortality fell to 58 in the 27 years 1830-56; so that the death-rate of the British soldier since the first occupation of the country down to the present day has oscillated round 69 per 1,000.

If the mortality is set down at 69 in 1,000, it follows that, besides deaths by natural causes, 61, or, taking the English standard, 60 head per 1,000 of our troops perish in India annually. It is at that expense that we have held dominion there for a century; a company out of every regiment has been sacrificed every 20 months. These companies fade away in the prime of life; leave few children; and have to be replaced, at great cost, by successive shiploads of recruits.

THE RATES OF MORTALITY AT DIFFERENT AGES IN INDIA.

To determine the rate of mortality among British troops in India, of different ages, as well as of different terms of service, the returns of the 10 years 1847-56 have been used. The mortality in the Bombay and Madras presidencies was much lower in those years than it had been previously; and the Table includes the non-effectives—invalids, pensioners, and men on the town major's list—at advanced ages. The mortality of war in India is, therefore, relatively unimportant; and we can appreciate the effects of the ordinary causes of mortality on men of all ages, from 10 to 75.

The mortality of boys, and of all under the age of 20, is much lower than it is ever afterwards; and other evidence shows that young men in favourable circumstances, and children with proper care, suffer less than adults in India.

The mortality per 1,000 at the age of 20-25 is high (56·4); at the next age (25-30) it is less (48·8); and then it rises gradually to the age of 40; at the age of 40-45 the mortality is again higher (61·6) than it was at the earlier age of 20-25; the mortality afterwards falls.

It is worthy of remark, however, that the excess of mortality in India is nearly the same at all the seven quinquennial periods of age from 20 to 55, except at the first and the fifth, when the recruits join and leave their corps in greatest numbers. This points to the influence of the term of service, which we have also investigated, and seems to justify the inference that the fatal causes in operation produce nearly the same fatal results in India at all the ages, from 20 to 55, among men exposed to the same extent to their influences.

From the age of 55 the excess grows less, and at 70 and upwards the old men die nearly at the same rate in India as in England. Although the facts at the extreme ages are few, it is evident that the men of the middle ages are, under present circumstances, the greatest sufferers.

From the rates of mortality we have had a life table constructed, and the mean duration of life, as well as the value of annuities dependent on soldiers' lives in India, can be deduced. These mortality and actuarial tables have been prepared by Dr. Farr.

The mean after-lifetime, or, as it is sometimes called, the expectation of life at the age of 20, is 17·7 years in India, 39·5 years in England; so life is shortened by 21·8 years.

An annuity is at the age of 20 worth 12 years' purchase on a soldier's life in India, or less by 10 years than an annuity on an average life at home.

What is the effect of residence in India on the after-lifetime of men who return to England at the age of 40? We have the means of determining this effect by comparing

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the after-lifetime of the Indian Table with that of the pensioners who have served in India.*

The after-lifetime at the age of 40 is 15 years by the Indian Table, 22 years by the Table of Indian pensioners resident for the greater part in England, and 26 years by the English Life Table.

INFLUENCE OF TERM OF RESIDENCE IN INDIA ON THE RATES OF MORTALITY.

INFLUENCE OF
RESIDENCE ON
MORTALITY.

Table 4,
p. lxxxvi.

This involves the important question of acclimation. In the Table 4 the facts for 1847-56 are arranged with reference to the soldiers' years of service; and it is evident that the mortality (65·2) during the first year of residence is higher than it is subsequently. It decreases gradually, and becomes sensibly less in the fifth year, 44·1; it then rises slowly, and is 47·0 at the second quinquenniad (5-10); 52·8 at the third. The reduced number, 43·0, at the fourth period of residence (15-20 years) arises probably from the elimination of the sickly by invaliding, which then becomes active (6 per 100). This, however, although it takes away a fourth of the numbers annually, does not prevent the mortality, partly from advancing age, rising to 62·5 per 1,000 in the last periods of service.

It is evident that when men are exposed to the operation of very unhealthy places, many of the weak are cut off at once; while of the survivors some are exceptionally left capable of resisting the local poison, and others are so enfeebled by its influence that they rapidly succumb. These two sets of causes in conflict are nearly in equilibrium in India, so that the mortality always remains high; and if acclimation in the ordinary sense takes place, it is at advanced ages. The causes which destroy Englishmen in India, like arsenic or any other poison, do their fatal work in every year of age and of residence; and indeed the zymotic agents which produce cholera, dysentery, liver disease, diarrhœa, and fever in all its forms comport themselves like organic poisons.

This view is confirmed by a new combination, in which a Table shows the mortality in different years of service among those entering India early and late in life. But, upon the whole, early entry into India appears to be an advantage not only at first, but in after-life.

It is further evident, from a comparison of the mortality in the several corps and presidencies, that the mortality in India depends on the intensity of zymotic poisons, and the time at which the men are exposed to the influences rather than on the incident that they have resided one, two, ten, or more years in the climate of the tropics.

LIVES WASTED IN INDIA IN EACH YEAR OF SERVICE.

It is possible to exaggerate the waste of life in India, and this has sometimes been done by assuming that the reduction in the numbers is due to the deaths alone in such cases as the following: "Of the troops which Sir Abraham Shipman brought with him to Bombay in 1662, there remained in 1664 only 93 out of 500." "At the time of Major Kilpatrick's death, in 1757, only 5 of the 250 soldiers who accompanied him from Madras in August of the previous year survived him."† A return handed in by Brigadier-General Russell throws some light on the reductions. Out of the 1,064 non-commissioned officers and men of his regiment (the 84th) who landed at Moulmein in 1842, only 93 landed in England on its return in 1859; thus the numbers were reduced from 1,064 to 93 in the 17 years, and the regiment was almost completely renewed in India. It was joined by 1,248 recruits, and the deaths were 817. Now had the mortality been uniformly 5 per cent. per annum (and the witness said it had been 3 per cent. for 14 years prior to 1857), the original numbers would only have been reduced in this case, by death, to 455. There are, besides death, many casualties which reduce the corps in India, and we shall shortly advert to them.

Again, the author of the useful book on the "Vital Statistics of the Anglo-Indian Armies," "demonstrates" that the European army in India has hitherto disappeared in about 13½ years. This follows, he infers, from the fact that the mortality and

* The Life Table for the Indian pensioners has been deduced from the facts supplied by Mr. Robinson in the Appendix to a War Office Report. The great irregularities observable in the probabilities of living a year, as given by Mr. Robinson, are evidently accidental, and are partly referrible to the state of the pensioner when he is placed on the list. The Table is, therefore, graduated by the method of differences applied to the logarithms, so as to give a uniform series.

† Moore, *Health in the Tropics*, pp. 50, 51.

No. 17,
p. 539.

Tables
1 to 39,
pp. 531-575.

LIVES WASTED
IN EACH YEAR.

Evidence,
Addendum,
3900.

invaliding are at the rate of 7·4 per cent., while in reality 1,000 men would only be reduced, at that rate, to 368 in 13½ years.*

LIVES WASTED
IN EACH YEAR.

We have the means of determining from the returns of the 10 years the casualties by death, by invaliding, and by other causes, in the late Company's European troops; and the results are shown in the Tables 5 and 6. The Table 6 has been constructed from the facts in Table 5 by the same methods as are employed in constructing life tables, for there is no simpler method of obtaining accurate results.

It will be observed that 100,000 men are reduced to 9,604 in 20 years of service, by 90,396 casualties of every kind; 40,447 by deaths in the service, 14,627 by invaliding, 3,558 by purchasing their discharge, 8,972 by the expiration of their terms of service, 968 by promotion, 5,724 by transfers to the town major's list, 13,976 by transfers to other corps, 1,818 by desertion, and 306 by other causes. The half of the deaths (21,499) takes place in the first five years; and the numbers invalided increase slightly in each quinquennial period.

Table 6,
p. lxxxvii.

The decrement, year by year, of the force in India is shown in the annexed Table 7, in which it will be seen that 1,000 effectives are reduced to 96 in 20 years. Now, the 1,064 men of the 84th were reduced to 93 in 17 years; and this, while it agrees very closely with the tabular results, points to the fact that the Queen's regiments are reduced more rapidly than the Company's by the shorter terms for which the men enlist.

p. lxxxvii.

The mean term of service in India, immediately deduced from this Table, is 8·6 years,† and 11 recruits are required annually to every 100 men.‡ To maintain an army of 85,856 men, 10,000 annual recruits are required, even where the term of service is as prolonged as it was under the late Company's regulations. The recruits entering are reduced to less than half their original number in eight years; their probable term of service was, therefore, between seven and eight years.

The half of a regular army so constituted consists of men who have served less than six years, and not more than a fourth of the men are veterans of 10 years' standing, on whom the discipline and solidity of an army greatly depend.

It is evident that the recruiting is more difficult, and that the losses from other causes than death are greater in an unhealthy than in a healthy army, for the invaliding, the desertion, and the discharges from all causes are influenced by sickness.

We have constructed two other Tables, the one showing how the same number of recruits (100,000) would be reduced year after year by death alone, and the other showing the reductions by death and invaliding together.

Table 8 & 9,
p. lxxxvii.

By death alone 1,000 would be reduced in 20 years to 344; by death and invaliding to 216; by death, invaliding, and other causes, as we have seen, to 96.

Out of 1,000, by the Table 9, it appears that, if none were discharged except by death, 656 out of 1,000 would die in 20 years; while by Table 6 it appears that out of the 1,000, only 404 die in the service; hence it follows that if the same rate of mortality rules out as rules in, 252 of the discharged will die in the 20 years out of the service.

The waste of life in India is illustrated in the diagram, where it is contrasted with the decrement of life at home.

Diagram p.v.

NATURE OF FATAL DISEASES AND ATTACKS OF SICKNESS IN INDIA.

The great endemic diseases of India, those which injure the health or destroy the life of the British soldier, are fevers, dysenteries, diseases of the liver, and epidemic cholera, which has for many years engrafted itself on the endemics of the country. Compared with these all other diseases are of minor extent and importance.

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DISEASES.

* This calculation has been adopted by other writers, and its fallacy is not immediately obvious. But assuming that the rate remains uniform, and is such that out of every 100 alive at the beginning of a year, 10 will die, &c., in its course, then the numbers will be reduced to 90 at the beginning of the next year; and, if the rate remain the same, nine, that is 10 per cent. of 90, will die in the second year; but upon the hypothesis of Dr. Ewart 10 will die every year until the 100 have expired; that is, 10 out of 90 will die in the second year, 10 out of 80 in the third year, and so on until, in the tenth year, 10 die out of 10 living, that is, the deaths, instead of being uniformly 10 per cent. on the strength, will be made by this procedure at last 100 per cent., which is contrary to the hypothesis of a uniform rate. Let n be any number living at any moment, and p be the fractional proportion living a year, then np^x = the numbers surviving at the end of x years on the hypothesis of a uniform rate. In the above case $n = 100$ and $np^x = 100 \times (.9)^{10} = 35$ nearly. This accidental oversight must not deprive Dr. Ewart of the credit due to him for his useful work; which has been compiled with care. (See Digest of Vital Statistics, by Dr. Ewart, p. 20.)

† The sum of the col. $(l_x) - \frac{l_0 + l_{20}}{2}$ divided by l_0 = the average term of service among the effective non-commissioned officers and rank and file serving for 20 years or less.

‡ The number of annual recruits is obtained by dividing the strength by the average number of years' service.

The four diseases here mentioned are almost exclusively diseases of the sultry plains of India, and when any of them are found in the elevated lands they are generally modified in degree and reduced in proportionate frequency, certain forms of bowel complaints, when the sufferers are removed from the plains to the high grounds, being the only exceptions. We shall notice briefly each of these diseases.

Fevers.—Sir Ranald Martin states that remittent fevers are found almost everywhere throughout the East Indies, varying in their intensity and in their complications according as they occur in deltas, along marshy banks, or at the embouchures of rivers in plains extending from the bases of mountain ranges, termed “Terrais,” in partially inundated or irrigated lands, or in tracts traversed by percolating streams, or occupied by jungles, or in certain low hilly districts. The seaboard, especially where there is jungle or salt marsh, and the adjacent islands when of a jungly or marshy nature are peculiarly pestilential, and so are often drying-up marshes and drying-up beds of rivers.

Of the various obstacles which bar the colonization of the white man in tropical regions, and of the many causes which reduce the strength of our armies there, remittent fever is the principal.

Sir R. Martin states that out of a British force of 25,431 men serving for eight and ten years respectively in Calcutta, Chinsurah, and Berhampore, all in Bengal Proper, there occurred 13,596 cases of fever; that in the healthier upper provinces of the same Presidency with diseases generally of less degrees of severity, out of an average British force of 23,731, men serving there during seven years, there occurred 14,159 cases of fever, and that throughout India, 50 per cent. of all the admissions into hospitals are from fevers, while in the Presidency of Bombay, amongst persons of all classes, castes, and countries, fever causes about 40 per cent. of the total deaths.

But besides the great prevalence, personal suffering, and immediate risk to the life of the soldier under fever, the disease entails more or less disposition to relapses, with more or less after danger, according as the original fever may have been more or less malignant in its nature. Added to these circumstances again, it is found that diseases of important organs, the consequences of malarious fevers, occasion much of the subsequent sickness, mortality, and invaliding among British troops serving in India.

Dysentery and Diarrhœa.—Next to fevers in frequency, but more fatal, comes the dysentery of India. In its causes it is intimately associated with tropical fevers, remittent and intermittent; so much so that where fevers are present dysentery is never far off. “Dysentery,” says Sir Ranald Martin, “has occasionally been found to assume a malignant character in low damp situations, so as to prove very deadly; but on removal of the sufferers to elevated sites and a better air, the disease has been rendered amenable to treatment.”

He describes the dysentery of India as most prevalent in the plains and during the hot and rainy seasons. “Out of an aggregate British force of 25,433 men of Her Majesty’s army serving in periods of eight and ten years respectively in the stations of Calcutta, Chinsurah, and Berhampore, all in Bengal Proper, there occurred 8,499 cases of dysentery and diarrhœa. The climate of Lower Bengal has always been very unfavourable to European health as compared to Upper India; but, making allowance for all circumstances, including the ill habits of life of the soldiery, the amount of sickness from dysentery and diarrhœa here exhibited is enormous.” “In the presidency of Madras, again, out of an aggregate British force of 82,342 men serving there from 1842 to 1848, there occurred 10,531 cases of dysentery and 9,189 cases of diarrhœa, making a total of 19,720 cases of bowel disease, exclusive of cholera. It thus appears that next to the malarious fevers of India, bowel complaints are the most prevalent, while the dangers to health and to life from these last are even greater than from fevers.” Sir R. Martin further states that amongst British soldiers 11 cases of dysentery occur to 1 amongst the native soldiery. In acute dysentery, as in malarious fevers, there is much present danger and suffering, and when the disease is not arrested at once, chronic suffering extending over years, or the prospect of death more or less distant in the hospitals, is all that remains to the soldier. The case is described by the older army surgeons as presenting “a spectacle of distress of as pitiable a kind as can be found in the history of human suffering.” Invaliding and death are the last events, and most of the casualties which occur amongst sick soldiers on the voyage homewards from India are from chronic dysentery.

Diseases of the Liver.—Sir Ranald Martin states that, whether as original or secondary affections, diseases of the liver are a very frequent and very important class of diseases in the East Indies. He adds that no official returns, under special heads, afford accurate information as to the actual frequency of liver diseases; for when these last occur as complications with, or as consequences of, fever, dysentery, diarrhœa, or cholera,

the cases are generally classed and numbered under the head of the primary disease. "It thus happens," he says, "that the numerical hospital returns do not yield anything like an approximation to a true estimate of the existing amount of hepatic diseases." "Acute inflammation of the liver," he states, "is essentially a disease of the hot plains; and its severity may be judged of by the fact that the chance of death is greater from one such attack than from 13 of fever of the various forms, as they ordinarily occur in India."

In acute disease of the liver the danger to life is so imminent that the case must, within a few days, terminate in a recovery more or less complete, or in death; while the chronic form of this malady, the injury to health, and the protracted distresses are very great.

He further states, that out of an aggregate British force of 211,993 men serving in Bengal from 1812 to 1832, there were 14,015 admissions into hospital on account of diseases of the liver, of which 924 died. From 1833 to 1854, out of an aggregate force of 331,775 men serving in the same presidency, there were 18,765 admissions and 1345 deaths from liver diseases.

Epidemic Cholera.—Epidemic cholera is the most acute of all acute diseases, and, like the last mentioned, it always ends in the more or less immediate recovery, or in the death of the sufferer.

This disease has been known to prevail as an occasional epidemic at different years, seasons, and places throughout India from 1774 to 1817; and there are authentic records of its existence in Batavia so far back as 1629. The symptoms described at the different times and places leave no doubt as to the sameness of nature of the disease, not to mention its uniform and great mortality.

But in India, since 1817, cholera has engrafted itself on the endemics of the soil, and has become a disease of annual recurrence at many of our large stations, commencing generally at the beginning of the hot season, but sometimes in the rainy and cold season. It has proved everywhere, all over the world, the same disease, with the same mortality whenever it has fastened on a congenial soil; and its great tendency is to attack populations living in low, damp, crowded, and ill ventilated situations, especially if supplied with impure water; while the proportionate mortality amongst those attacked has been about the same, whether at the lowest levels or on the loftiest mountains.

Here, however, there exists an important distinction, that while the proportionate mortality of those attacked is everywhere the same, the proportionate numbers seized in high and low situations differ most widely. Cholera and epidemic diseases in general are of rare occurrence in the elevated ranges of India, where the water is comparatively pure.

Troops, both European and native, while on the march, have been observed to become more liable to seizure by this disease, and when the attacks have occurred in cantonments after the march, it has been found that the virulence of the epidemic has been proportionate to the length of the march.

As regards the comparative mortality Sir Ranald Martin states that out of every 100 deaths of Europeans serving in the Presidency of Bombay, between 1830 and 1846, the proportions of deaths attributable to the four great endemic diseases were as follows :—

Fevers	-	-	-	-	-	23·054
Dysentery and Diarrhœa	-	-	-	-	-	32·441
Diseases of the Liver	-	-	-	-	-	9·597
Cholera	-	-	-	-	-	10·320

We have the means of comparing the deaths of soldiers from each disease in the Bengal presidency with the deaths of men from the same disease at home. The periods are for the 16 years (1830–45) in Bengal; and for the seven years (1848–54), including the two years when cholera was epidemic in England. The annual rate of mortality was 10 per 1,000 in England, and 67 per 1,000 in Bengal, of which 58 per 1,000 was by zymotic diseases. The fevers, ague, remittent and continued, killed 17 men in 1,000; dysentery and liver disease, 20; cholera and diarrhœa, 18. Delirium tremens, catarrh, syphilis, rheumatism, and scurvy were also much more fatal in India than in England. Among constitutional diseases, the deaths from phthisis, scrofula, and cancer were fewer in Bengal than in England; but these cases are of long duration, and are precisely such as are sent home on the invalid lists to die.

Of diseases affecting particular organs, apoplexy is the most fatal, and 3 deaths per 1,000 are referred to that disease, which at the age of the soldier is exceedingly rare in England. The frequent pneumonias are, probably, of a congestive character, or are like bronchitis, connected with influenza. Enteritis, phlegmon, ulcer, ileus, jaundice, and spleen diseases are either masked zymotic diseases, or their common sequels.

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The deaths from wounds are most numerous in India, but these deaths and all the deaths by violence in the return are less ($\cdot 8$) than 1 in 1,000, and less than the deaths by violence among the civil population of England (1.0). The medical returns under the old arrangements included only the deaths in hospital, and they did not include the killed in the field, which should be added. The two series of facts in the Table are strictly comparable, and show clearly enough how much of the mortality of India is due to a few diseases, which are rendered fatal by well-known causes.

No. 1, p. 576, and diagram. The fatality of these diseases to our armies in India is rendered evident to the eye in the two diagrams.

It is worthy of remark that nearly all these diseases fatal in India are accompanied by profuse discharges, with which the air, water, bedding, linen, closets, walls of hospitals and barracks become more or less infected. In a common building the *materies morbi* comes into contact with all the inmates.

In comparing the proportion of attacks of illness among British troops in India with that among men at home, we find that the East India Company formerly employed 2,461 labourers in London, and during the 10 years that observations were taken by the medical officer, 246 in 1,000 were attacked by illness annually; or each man was liable to one attack of illness of some severity every *four* years. This agrees with other observations, and includes cases of sickness of such gravity as disables artizans from following their ordinary work. In a Liverpool society, out of 1,000 members, 320 applied 400 times in the year for sick pay, and were treated by the surgeons, who also attended 350 more for slighter ailments, making 750 annual attacks of sickness, such as doctors attend to, among 1,000 members.*

Syphilis is not included in the returns of the friendly societies.

One thousand British soldiers at home experience about 1,000 attacks of sickness in the year, but in India the soldier's sickness is doubled. To one illness of the labourer, the soldier is liable to four, of at least equal severity. Thus, from a return supplied by Dr. Balfour, it appears that the 16,850 troops of the line in Bengal furnished the hospitals with 172,388 cases in the five years 1850-4, when 4,461 cases terminated fatally. A battalion of 1,000 men sent yearly on an average 2,045 cases to the hospitals; each soldier in India was exposed, therefore, to two attacks of illness in the year, instead of one. At Peshawur, during the same period, the admissions into hospital were 3,635 annually to 1,000 men, and in the hill stations of Kussowlie, Subathoo, and Dugshai, the admissions into hospital were at the rate of 1,783 per 1,000. The returns which Sir Alexander Tulloch gave in show that the attacks of sickness ranged from 988 to 3,225 per 1,000 men at different stations.

The attacks of sickness were sometimes slight; but in a large number of cases they were severe, painful, and fatal. Of the cases in the Bengal presidency before referred to, 75,535 were fevers, and 32,771 were diseases of the stomach, liver, and bowels, of which 2,517 were fatal. Add the 918 deaths by fevers, and the aggregate of 3,435 deaths leaves 1,021 referrible to other diseases.

LIFE-LOSS AND SICKNESS IN WAR.

LIFE-LOSS
IN WAR.

5563.

The mortality of the army from disease in India has always hitherto been raised by war. This is evident upon inspection either of the mortality among the Company's troops, or the Queen's. The Company's European troops died at the rate of 85, 134, and 101 per 1,000 in 1803-4-5; the period of the Mahratta war.† In the wars of the Marquis of Hastings, the mortality of the troops rose to 90 and to 117 per 1,000; in six of the years 1813-21, the annual mortality exceeded 90 per 1,000. In the Burmese war of Lord Amherst, the mortality of the Europeans was at the rate of 113, 106, and 130, in the three years 1824-6. Since that the Company's forces have been healthier in war; in the Afghan and Sikh campaigns their mortality has not exceeded 70, 80, or 84 per 1,000. The whole army is rarely engaged; consequently the effects of a war are partial, and fall upon particular regiments. Thus in the year

* See article "Vital Statistics" in McCulloch's Statistics of the British Empire, vol. 2, p. 589. According to Mr. Neison the number of members sick during each year at the soldiers' age is 220 per 1,000 in friendly societies. Contributions to Vital Statistics, p. 160.

† The troops had sometimes salt provisions and drank hard. Such passages as the following meet the eye in the Wellington Despatches:—"Urge the gentlemen there to send forward 3,000 or 4,000 gallons of arrack. * * * Salt provisions will also be much required, as the Bombay sheep contractor had failed entirely."—Camp at Poona, 15th May 1803, vol. v. p. 576.

1845 the mortality of the Queen's troops was at the rate of 199 per 1,000 in Bengal, but did not exceed 46 in Madras, and 71 in Bombay. The Queen's troops in 1840-8, out of a force varying from 8,000 to 12,000 in Bengal, lost numbers ranging from 781 to 2,213 annually; and the mortality frequently exceeded 10 per cent. It is impossible to read the losses of particular regiments in the war of the mutiny without being struck by the inextinguishable valour of the British soldier; but it was disease, and not the enemy that killed him. For out of 9,467 men dying among regiments in India prior to the mutiny, or sent out in 1857-8, only 586 were killed in action or died of wounds. All the evidence goes to show that the mortality in the wars of India is chiefly from the diseases before referred to; and that the diminution in the mortality of wars before the mutiny was due to improvements in the sanitary arrangements. The battles in Sind and the Punjab were as fiercely contested as any in which English troops have ever engaged native forces.

LIFE-LOSS
IN WAR.

5563.

INEFFICIENCY IN THE ARMY OF INDIA FROM SICKNESS.

Of 1,000 of the East India Company's labourers in London, 16 were constantly sick, on an average at the ages 20-30; and in the friendly societies of England the amount of disability among artizans is nearly the same at the same ages. At the next decenniad the proportion of constantly sick becomes 17 or 20 in 1,000.* It was calculated by Mr. Annesley, the author of a standard work on the diseases of India, that 100 sick out of the same number was a normal state in India! This important element has not hitherto been sufficiently attended to in the army statistics;† and as we have not the new returns, recently introduced, it is impossible to show how much of the inefficiency is caused by each disease. Several diseases, such as rheumatism, ophthalmia, and syphilis, which are rarely fatal, cause a great deal of inefficiency, of which the admissions into hospital furnish a very inadequate measure. On the other hand some fatal diseases, such as cholera and consumption, produce very different amounts of sickness; for a fatal case of consumption lasts two years, of cholera two days.

INEFFICIENCY
FROM
SICKNESS.

The Table shows that, on an average in the stations of Bengal, 84 men in a battalion of 1,000 were constantly in hospital.‡ We have not illustrated this by a diagram, but it is easy to conceive the facts; 1,000 men are at a station; 84 of their number are sick in the hospital, where 69 die annually.

With this amount of sickness, an army of 70,000 British in India has, so to speak, a vast hospital of 5,880 beds constantly full of sick, and loses yearly by death 4,830 men, or nearly five regiments.

COST OF THE BRITISH SOLDIER IN INDIA.

The military expenses of India for the year 1856-7 amounted to 13,322,859*l.*, including the home charges for recruits, transports, and ineffectives. Deducting 166,386*l.* for the local civil corps, 13,156,473*l.* remain.§

COST OF THE
SOLDIER.

The European officers and men in India in 1856 were 45,104, to which should be added, perhaps, 9,021, in depôts at home or on their passage, making 54,125 in the pay of the Indian Government.||

The financial accounts do not enable us to determine directly the cost of the European force, as the expenditure is mixed up with that of the native army. But an approximate estimate can be framed. The native non-commissioned officers and men in the year

* McCulloch's Statistics of British Empire, art. Vital Statistics, p. 582 and p. 587, and authorities there cited. See also Ratchiffe on Sickness of Members of Friendly Societies, 1862. The observations on the East India Company's labourers in London extended over the 10 years 1823-33.

† The new English system had not at that time been introduced in India.

‡ Average annual strength, 18,285; number constantly sick, 1,542·25; annual admissions into hospital, 36,814; annual discharges and deaths, 36,767; annual deaths, 1,040. Sanitary Statistics, p. 589.

§ Parl. Pap. (32), 18th Feb. 1861.

|| On Sept. 3, 1858, the total strength of the [European] cavalry and infantry regiments in India was 81,971; but only 50,979 were fit for duty, 6,616 being sick, 11,555 on passage out, and 12,821 in the depôts at home. To 57,595 in India, including the sick, 24,376 were away; to 100 present 42 were absent. Colonel Wood says nothing about the numbers "on passage home," but in pronouncing the number on passage out large, says, that "when a force is stationed at a distance from home, there must always be a large number in transit *to and fro*." The number absent at this period was unusually great, and instead of adding 42, we have added 20 per cent. to the numbers serving in India. The legitimate purposes of the depôt are recruiting and training in order to maintain the efficiency of the regiments in India. (Appendix to Report of Commission on Organization of the Indian Army, p. 24.)

COST OF THE
SOLDIER.

were 235,221. The ratio of the cost of the Europeans to that of natives may be set down as 289 to 100, or nearly as 3 to 1.* Consequently the cost of 235,221 native soldiers is equivalent to the cost of 81,349 European soldiers. This number, added to the 54,125 Europeans, makes the cost of the Indian army equivalent to the cost of 135,474 Europeans. But the total military expenses, 13,156,473*l.*, divided by 135,474, gives 97*l.* per man as the annual cost of the European force; or, taking only the Europeans serving in India (45,104), the whole force is reduced to 126,453, and the cost per man is 104*l.*

For our present purpose it may be assumed that 100*l.* a year on an average is expended on the European soldier serving in India; this cost including the cost of arms, recruiting, and retired allowances for officers and men.

The finance accounts of the army are defective, and often delusive; but the various recent reports, and particularly the papers by Colonel Baker and Sir Alexander Tulloch, on the relative expense of the late Company's European troops, throw much light on the subject, which has also been discussed with impartiality and judgment by Mr. Hammick. We have appended a Table, compiled from his, giving the chief results; for the sanitary state of the army is intimately linked with the finances of India, and influences them to a large extent.

The frequent errors in estimating the cost of troops in India arises from the omission of important items; indeed Colonel Baker omits, in his Table, staff charges in India, and the cost of camp equipage, ammunition, arms, stores, punkahs, bedding, hospital attendants, medicines, and transport in India, which raise the cost of a regiment 1,000 strong to 100,000*l.*

The annual pay of infantry non-commissioned officers and privates is at the rate of 60*l.* 13*s.* 11*d.*, or nearly 61*l.* per man; (including clothing, victuals, barracks, and allowances); the cost of transport by sea, including officers, 7*l.* 1*s.* 5*d.*; of levy money, recruiting, and depôts, 4*l.* 14*s.* 4*d.*; and of pensions, 9*l.* 3*s.* 2*d.*, or in the aggregate, with the pay of officers, 81*l.* 12*s.* 8*d.*, which is raised to about 100*l.* by other expenses.

It will be observed that the charge for barracks and buildings is 13*l.* 3*s.* per man, so that the accommodation of ten men costs 131*l.* a year! This is a high rent; yet Colonel Baker says he had in his late office of Secretary to the Government of India peculiar opportunities of knowing the cost of permanent barracks for European regiments on the enlarged scale lately introduced, and is satisfied that the annual amount will not be less than 15,000*l.* a regiment.† Sir Alexander Tulloch quotes a return, on the other hand, to show that the building of a barrack for a whole regiment 10 or 20 years ago cost only 22,213*l.*, which implies, he says, an annual expenditure of 2,200*l.* a year.

The value of a man who, with all his arms, costs the country 160*l.* a year, reckoned at only a few years' purchase, is considerable, and either the loss of his life, of his health, or of his efficiency, is not to be lightly regarded, especially as it occurs most frequently and inopportunately in the field, when his services are required.

PECUNIARY COST OF SICKNESS IN THE INDIAN ARMY.

COST OF
SICKNESS.

It may be assumed, as the sick soldier is a serious incumbrance in warfare, that the 5,880 sick cost the country as much as 5,880 effectives; if there were no sick, the army might be reduced to that extent. And as it has been shown that the army expenditure is equivalent to 100*l.* per man, the cost of the sick at these rates is 588,000*l.* annually. Deduct 200,000*l.* for sickness, assumed to be inevitable, and 388,000*l.* remain.

MORTALITY AMONG OFFICERS OF THE INDIAN ARMY, THE CIVIL SERVANTS, RETIRED OFFICERS, AND PENSIONERS.

MORTALITY
AMONG
OFFICERS, &c.

The Royal army, out of 9,192 officers in the year 1860, lost all over the world 244 by death; and the mortality was at the rate of 27 in 1,000. The mortality of the 3,965 officers of the Royal army serving abroad was 30 in 1,000 during the four years 1857-60, including the period of the Indian mutiny. In 1861 the mortality of officers was 16 in 1,000.

* In the Appendix to the Report on the Organization of the Indian Army (1859), p. 55, the cost (including rations, clothing, and other charges) of 1,067 non-commissioned officers and privates of an infantry regiment of Her Majesty's service is set down at 25,999 rupees 8 annas monthly; and the cost of 1,140 non-commissioned officers and men, including 1,000 sepoy, of a native regiment at 9,606 rupees 14 annas monthly; the cost of the European is to that of the native soldier as 2·8915 to 1. The other charges not here brought into account are assumed to be in the same ratio.

† Appendix to Report of Commission on Organization of Indian Army, pp. 49, 50.

We have no recent returns of the mortality of officers serving in India, but there is no reason to believe that the rate varied much before the mutiny; and there is ample data for the essential purposes of this inquiry.

The 20th volume of the Asiatic Researches contains the results of an inquiry respecting the law of mortality for British India. The facts, procured by the Government, were arranged by the late Col. Henderson with clearness, and they may be used with confidence.

The East India Company had on an average, during the 20 years 1814–33, serving in India 4,219 military officers,* among whom 3,194 deaths occurred; consequently the annual mortality was at the rate of 38 in 1,000. Several of these officers were in civil employ, and some were on leave of absence; but they were all exposed to the Indian influences. This was not the case with the 1,079 officers of the Royal army, a considerable number of whom were apparently at the depôts in England; so the deaths were 742, and the annual mortality was at the rate of 34 in 1,000. The annual loss of the 5,298 officers of both armies was 197. Now of men of their ages in England about 53 die annually; consequently 144 officers died every year in India in excess of the natural deaths. In the 20 years the deaths at the English rate would have amounted to 1,060; and as 3,936 officers died, the excess by violent and unnatural causes was 2,876. Of this number 122 were killed in the field or died of wounds; consequently, while the danger to which they were exposed on the field of battle was fatal to 122 officers, the dangers from disease were fatal to more than 20 times that number!

The diseases were undoubtedly of the same character, and were, in fact, the same as those which kill the soldier. And the number of sick officers probably bears the same proportion to the deaths as has been found to exist in the returns of non-commissioned officers and privates. So the number of sick officers in India and on leave of absence from ill health is considerable, but it is not returned; and, if it were, the loss from the inefficiency induced by disease would be only imperfectly represented by the numbers on the sick list and absent from the field.

The value of the lives of officers, and the irreparable consequences of their loss to their families, pointed out at an early period the necessity of extraordinary measures for the promotion of life insurance, and led to the establishment of the various funds under Government encouragement.

One of the disadvantages to the officer arising from the insalubrity of India is shown by the high premium which he has to pay for the insurance of his life. Thus, at the age of 30, the annual premium of the insurance office on a life in England is 2*l.* 4*s.* 10*d.*; on an officer's life in India it is 4*l.* to insure 100*l.*

The soldier's life is still more precarious, and, allowing 10 per cent. for expenses, by his life table he would have to pay 5*l.* 15*s.* 3*d.* to insure the same sum at death. To the same extent as the shortening of life increases the risk of insurance it diminishes the accumulation of capital.

It will be observed that while during a long series of years the mortality of the soldier in India was at the rate of 69,† the mortality of the officer during 20 years was at the rate of 38 in 1,000. And it appears to be a fair deduction from this comparison, that the 31 annual deaths in excess of 38 are due to other causes than the climate of India; to which officers as well as men are everywhere exposed. We may proceed a step further in this direction; for the civil servants living in the unhealthy and healthy districts alike died at the rate of 20 in 1,000.‡

The mortality of the Bengal military officers of the Company was at the rate of 31, Bombay 39, and Madras 45, in 1,000. Of the officers of the Royal army in India, the mortality was 34 in Bengal, 33 in Bombay, and 36 in Madras.§

The local disadvantages of Bengal were in those days in some way compensated; and the returns of the military funds of the several presidencies confirm this result.

In order to determine accurately the mortality of officers, it is necessary to take their ages into account, as their mortality varies with age in India as in England; thus it will be seen that the mortality is greater in the higher ranks of officers than in the subalterns.

* Each officer, after 10 years' service, was entitled to absence from India for three years, and to further absence in case of sickness after or before that term. After 25 years' service, 22 in India, officers were entitled to retire on the full pay of their rank.

† During the 20 years 1814–33, for which the mortality of officers was 38, the mortality of the non-commissioned officers and men was 83 in 1,000. By taking the general rate 69, the case is understated.

‡ "In the civil service the per-centage of mortality for the last 40 years has been somewhat under 2 per cent. for the first 20 years of residence in India, a result far more favourable than that of the other services."—[Colonel Henderson, *Asiatic Researches*, vol. xx., p. 199.]

§ *Asiatic Researches*, vol. xx., pp. 201–3.

The mortality of officers of all ranks, deduced from the most authentic materials, is given below :—

Facts supplied by	Years.	Annual Deaths per 1,000.				
	Age -	20	25	30	35	40
Col. Henderson, (India) -	1814-1833	29	33	35	39	40
Mr. G. Davies, (India) -	1760-1839	27	28	31	33	37
Mr. Neison, (India) -	1800-1847	24	25	28	29	30
Do.	1840-1847	25	32	34	31	36
Mr. S. Brown, Madras Military Fund.	1808-1857	33	32	30	27	30
Men in all England	- - - - -	9	10	11	12	14
Men in healthy districts of England	- - - - -	7	8	8	9	10

The Table may be read thus: the mortality at the age 20 and under 25 was at the rate of 29 in 1,000 Indian officers, according to the return of 1814-33;* at the age of 40 and under 45 it was 40 in 1,000. The mortality varies in different times and places as its causes vary.

The rate of mortality in the whole of the civil service of Bengal was, according to the returns of Mr. H. T. Prinsep, at the rate of 21·0 at the age 20-25; 20·1 at the age 25-35; 28·7 at the age 35-45; and 41·1 at the age 45-55.† In the Bombay civil service the mortality ranged from 24 to 26 under the age of 50.‡ The experience of the Madras civil fund from 1760 to 1853 exhibits a still more favourable result. The mortality ranged at the ages of 20 to 45, from 14 to 18 in 1,000; and at these ages the authenticity of the Table is unshaken by criticism.§

To illustrate the extent to which the insalubrity of India affected civilians, officers, and soldiers in India, we take four armies, each consisting of 33,615 young men of the age of 19. The first army remaining in England experiences the ordinary rate of mortality, and loses 254 in the first year, 276 in the second, 281 in the third, and so on; it is reduced to 30,453 men of the age of 30 in 11 years. The second army loses also 254 men in the first year; and it then lands in India, where it loses 353, 412, 452 men, as it suffers from the diseases and dies at the rate of Madras civilians: it is reduced to 28,916 men in 11 years. The third army out of the same strength loses 254 in the first year, or at the age 19-20; it then lands in India, and experiences the same rates of mortality as the military officers, and loses 865, 840, 819, and so on in successive years until it is reduced to 24,610 in 11 years. The fourth army loses 254 in the first year; it then lands in India, and suffering from the diseases of the Company's soldiers, it loses 2,052 in the first year of its residence in India, 1,811 in the second, and so it is rapidly reduced by death to 19,617 in 11 years.

If there is much to shock the mind in these contrasts, they do not lack elements of consolation, for the unnatural death of the English soldier is apparently not the inevitable result of the climate of India; to which officers and civilians are also exposed. But, while the soldiers live together in common bedrooms in barracks, the officers generally reside in separate bungalows, where they have the due arrangements for cleanliness; their food and drink are of superior quality; their contact with the sick in hospitals is limited to periodical inspections; when ill themselves they have the advantage of separate apartments, and obtain leave to resort to healthy places. The military and civil servants of the Company were entitled, after 10 years' residence in India, to three years' leave of absence with gratuitous pay; and this period, by illness and medical certificates,

* See the annexed Tables 17, 18, 19, pp. xciii, xciv. For other returns, see the Report of Messrs. Finlaison and Lewis on Bengal Military Fund, as well as Mr. Neison's Reply.

† Asiatic Researches, vol. xx., p. 230.

‡ See Report of Griffith Davies on Bombay Civil Fund, dated 20th February 1836. In the reports upon the Indian Fund (p. 375) the probability of dying is incorrectly called the "*rate of mortality*," so as to mislead the unwary reader. Thus, if on an average out of 100 men living at the beginning of a year there are ten deaths in the year following, the probability of dying is expressed by the fraction $\frac{10}{100}$, which is incorrectly called in the reports "the rate of mortality;" but the rate of mortality is $\frac{10}{90}$, for the numbers living at the end of the year are 90, and the years of life are 90 + 10 half years, which it may be assumed are lived by the 10 who died in the course of the year. For the general formula for passing from the probabilities of dying to the corresponding ratio of mortality, see Table 12, p. lxxxix.

§ See Mr. Neison's Report on the Madras Civil Fund, dated 20th July 1855. The expectation of life is not higher by this Table at the age of 55 than it is by the Table for healthy English districts; but the discrepancy of its results with Mr. Neison's earlier table is by no means fatal to its authority.

could be extended to five years, which counted as a part of the 25 years entitling them to retire on the full pay of their respective ranks. In the hope of attaining higher rank or higher pensions, or for other reasons, the period of service in India was often extended.

The married officers are healthier than the unmarried. The civil servants are distributed all over India, and are necessarily exposed not only to heat, but to the influence of malaria, and occasionally to casualties from bad water; but their dwellings are, it is believed, better placed than the bungalows and barracks of the army; they also enjoy the comforts of homes, are married, and are exposed to none of the accidents of warfare in the field. They are occupied, and their minds are often actively engaged in the discharge of their duties. They are not driven to drink or debauchery by *ennui*.

The civil servant and the military officer at the close of their career habitually return to England, where they encounter the cold vicissitudes of a climate in which they were born, but to which they have long been unaccustomed. The "old Indians" are divided into two classes. The veterans who, like Hastings and the Wellesleys, bring home their native vigour, tempered in the Indian fire; and those who are either shattered by fevers, dysentery, liver diseases, and apoplexies, or are actually suffering from their sequels. Sir Ranald Martin has described their condition, and has shown how it can be ameliorated.*

The returned officers experience a higher rate of mortality at all ages under 65 than the people of England; but their mortality is lower at all ages than the mortality of officers remaining in the military service. Looking at some of the results it is questionable, however, whether veterans would not enjoy better health in retirement in the healthiest parts of India than they enjoy in England.

The pensioners in England who have served in the East and West Indies die much more rapidly than officers; but this is probably due to the circumstances in which they are placed. And it is not an easy matter to throw off at home the habits of dram drinking which they have been taught in the tropics.

The retired civilians probably enjoy the same advantages over the military in England as they enjoy in India; for many of their eminent members, after having served for a certain time in India, attain advanced ages. Only one governor-general (Cornwallis) died at his post in India during 90 years; and although the careers of the last two terminated prematurely, the 14 eminent men who have held that high office since 1772, for periods varying from one to ten years,—or six years on an average,—filled their expected number of years by the English life table.

In a previous section it was shown that the mortality of the British troops had been at the rate of 69 in 1,000 for a long series of years; but at stations in every variety of the climate of India the mortality has not exceeded 20 or 30 in 1,000; the excess of deaths over 10 being due to a few diseases, are referrible to local causes, which were at one time equally fatal in their operation in England. In the present section the facts lead to similar results.

1. The mortality of the officers who were stationed with the British and native troops (regular and irregular) all over India was excessive, and involved great losses of life and property; but it was less by 31 in 1,000 than the mortality of the soldiers. It follows that the lives of nearly half the soldiers, in less unfavourable conditions, might for the future be saved.

2. The civil servants at the soldier's age did not die at a rate higher than 20 in 1,000; and as they are distributed all over the country, it follows that the climate of India is not necessarily fatal to any higher proportion. The excess is due to other causes.

3. The diseases of the India civil servants, from which they have a comparative immunity in England, are known to be the same as are fatal to the soldier.

MORTALITY AMONG NATIVE TROOPS AND NATIVE POPULATION.

The Asiatic soldiers of the Company are called native troops in the returns, while the British are called Europeans. These are merely local designations, and, as such, the former term must be understood to mean that the troops are natives of India, but not always natives of the provinces in which they are stationed.† The natives of the upper provinces serve in Bengal Proper, which Colonel Henderson said is "so injurious to this class of *natives* that, although only one-fourth of the troops are stationed in Bengal, the deaths of that fourth are more than a moiety of the whole mortality reported."‡

MORTALITY
AMONG
OFFICERS, &c

See Table
16, p. xcii.

MORTALITY
OF NATIVES.

* Diseases of Tropical Climates, by Sir Ranald Martin.

† Assistant Surgeon E. Balfour, Jour. Stat. Soc., vol. viii., p. 199.

‡ Asiatic Researches, vol. xx., p. 192.

MORTALITY
OF NATIVES.

The secretary of the Bengal medical board returns the mortality of the native corps at the several stations of the army where European troops are cantoned as 7·6, or less than 8 in 1,000;* but the rate was as high as 27·6 at the presidency station, 18·0 at Barrackpore, and 15·0 at Dum-Dum. At many stations the mortality of the sepoy was as low as 4 in 1,000; but, in addition, “many unrecorded deaths occurred at their own homes, where bad cases were allowed to proceed on medical certificate.” The more recent returns have been drawn up from other sources; and a paper by Colonel Sykes gives the mortality of the native troops from the military returns in an authentic form for the 20 years 1825–44.†

The mortality of the native troops of the three presidencies was at the rate of 18 in 1,000. At the same time 19 in 1,000 were invalided. The ages of the men range from 18 to 45; and their ascertained mortality is therefore about 8 in 1,000 higher than the mortality of England. It was 36 in 1,000 less than Colonel Sykes makes the mortality of the European troops (54) for the same years, when the Europeans also lost 29 in 1,000 by invaliding.

The ascertained mortality of the native troops was, in Bombay, 13; Bengal, 18; and Madras, 21 in 1,000; the invaliding having, however, been in very different proportions in the three presidencies, namely, 33 in Bombay, 15 in Bengal, and 20 in Madras. Invaliding is, unfortunately, a very vague term in the language of the army, for as it includes a variable proportion of the men annually discharged, the results are to be used with caution; and it is certain that many of the invalids carry away fatal diseases, so that the mortality of the native army was, probably, not less than 20 in 1,000. Of the mortality, the proportion by cholera was 2·8 in Bombay, 2·2 in Bengal, 5·8 in Madras.

Inspector-General Macpherson, of the Madras presidency, gives a return, from which it appears that the mortality of the native troops was at the rate of 18 in 1,000 during the 16 years from 1842 to 1858; and as 6 in the 1,000 were deaths from cholera, the mortality, if that disease could be extinguished, would be 12 in 1,000. The invaliding is not given. The mortality of the native troops, according to Inspector-General Pearse, during the 10 years (1847–57) was at the rate per 1,000 of 7 at Jaulnah, where the European mortality was 10; 8 at Bellary; 8 at Cannanore; 9 at Secunderabad; 10 at Bangalore; 11 at Madras; 16 at Trichinopoly; 17 at Singapore; 23 at Moulmein in the Pegu division; 29 at Labuan. In Sind the Bombay native army died at the rate of 43 in 1,000 during the years 1842–4.‡ The mortality of the “native [Indian] troops” in the last China expedition was, in 1860, at the rate of 32 in 1,000; when the mortality of Europeans was 48, or, including invalids who died on the way home, 54. Applying a similar correction to the Indians, their mortality per 1,000 must have been about 36 in 1860, and 60 in the previous year, chiefly from the zymotic diseases.§

The Bombay army consisted before the mutiny of Hindoos to a large extent (75 per cent. of their number); and in Bengal the proportion in the infantry was higher (83 per cent.); while in Madras the proportion was lower (60 per cent.) In Bengal, too, the Hindoos were principally Brahmins and Rajpoots, while in Madras the lower castes predominated.||

5780. The native troops are for the most part married; their pay exceeds the earnings of the rest of the population; and, except in Bengal, the wives live with their husbands in small huts, which are made with skill and a little labour, of the bamboo and matting. The Brahmin of Bengal leaves his wife at home, but visits her hut periodically on furlough. A hut, Dr. Wallich supposes, does not cost above two rupees, and lasts for a few years. The men have their bed-steads outside, except in the rains, and generally sleep outside. The Hindostance sepoy does not taste meat, fish, or spirits, but lives almost exclusively upon unleavened cakes of wheat flour, daily baked upon an iron dish, and washed down with water.¶ Mahomedans and low-caste Hindoos, such as the Mahrattas, who are Sudras, consume animal food, ardent spirits, ganja (hemp water), and opium. A return from Madras for 1848 shows that in that year the mortality of the Hindoos was at the rate of 12, when the mortality of the Mahomedans was 10 in 1,000.

The attacks of sickness among the Indians were at the rate of 667 in 1,000 during

* Asiatic Researches, vol. xx., pp. 193, 209–10.

† Journal of Stat. Soc., vol. x., p. 100–31.

‡ Journal Stat. Soc., vol. x., p. 104.

§ Army Medical Report, 1860, pp. 101–11.

|| Journal Stat. Soc., vol. x.

¶ Colonel Sykes' Stat. Jour., vol. x., p. 124. Other cereals are also used, as well as wheat.

the same period of 20 years ; when the Europeans sent more than twice that proportion (1,590) to hospital.*

The numbers admitted into hospital give an imperfect idea of the sick-time from each cause ; but the excess of mortality among the native troops is chiefly due to cholera, dysentery, and fevers,—the same diseases that are fatal to Europeans ; and the disparity in the deaths by these diseases is not considerable. Thus, in the Madras presidency, when the mortality of the Europeans was 48·6, and of the native troops 16·1 per 1,000 from all causes, the mortality of the two classes from cholera was at the rates of 7·6 and 4·0, of fevers 5·6 and 3·5.† Far different were the mortalities from the other diseases ; thus, among the two classes the mortality per 1,000 was 15·0 and 1·0 by dysentery, 5·6 and 0·1 by liver diseases, 1·7 and 0·2 by apoplexy, inflamed brain, and insanity. Three diseases, exceedingly prevalent, serve to show that the attacks of sickness also differ in the Europeans and natives ; thus, taking 1,000 men of each class, and under the rheumatism of the army 102 cases of Europeans are recorded, 53 of natives : by ulcers and abscesses 74 Europeans, 42 natives suffered. But the Europeans sent cases of syphilis to hospital at the rate of 192, the natives at the rate of 23 in 1,000.‡

In Bengal and the North-western provinces (1852–3) the admissions of native troops into hospital were at the rates of 1,181 per 1,000 of the strength, including 678 cases of fevers, 127 of dysentery, diarrhœa, and cholera, and 28 of syphilis. The mean number of natives sick in 1,000 at the beginning and end of the year was 30 ; 9 by fever, 3 by bowel diseases, 3 by rheumatism, 2 by syphilis, 6 by abscess and ulcer, 2 by wounds and injuries. Table Nos. 7 and 8, p. 583.

The English troops of the Madras army in 1842–6 sent 189 cases per 1,000 annually to hospital for syphilis, while the native troops sent 31. Colonel Sykes says “ *only* 31,” and adds, “as might be expected from the majority of the men having their families with them.”

Further instances will be found in innumerable returns, which it is unnecessary to discuss, as it is evident that the mortality of the native Indian troops does not exceed 20 in 1,000, and that in many healthy stations it does not exceed 10 in 1,000. The excess over 10 is not inevitable, for it is referrible, as we shall afterwards show, to malaria, bad water, and bad sanitary arrangements. The army is besides always surrounded in India by a multitude of followers, among whom cholera and other epidemics often break out and infect the troops. The sepoy's pay does not exceed a third of the pay of the Englishman, but he has an instinctive horror of barracks, and retires from duty to the lines, where he finds his hut, into which not even the doctor dares to penetrate. The sepoy there is free ; his hut is his home. There he enjoys quiet ; he has often the society of his wife, and children. The sepoy, in a hut which costs two, or, it may be, four rupees, appears to live three times as securely as the English soldier in barracks, which cost 131 rupees per man annually.

The census and the registration of deaths have never been carried out effectively, so as to enable us to determine the mortality of the native population with certainty, even in the cities, except perhaps for Calcutta. Dr. Strong has shown that among the natives of all ages, the mortality was at the rate of 51 in 1,000 ; the Hindoos dying at the rate of 57, the Mussulmans at the rate of 35 in 1,000.§ The mortality fluctuated in 11 years from 37 to 81 ; and winter, as in England, was the unhealthiest season. The mortality of the suburbs is unknown.

The mortality in Delhi, containing 119,860 inhabitants, was at the rate of 36 in 1,000 in 1833 ; and the mortality of males differed little from that of females. The palace of 20,000 people is not included. It is, as might be inferred from its situation, less unhealthy than Calcutta.||

The mortality of Indian cities is not higher apparently than that of the European cities in the same unhealthy conditions.

* The old medical returns overstate the attacks of sickness, or the numbers “treated,” by erroneously adding the remaining at the beginning of each year to the new cases admitted during the year. The numbers treated are approximately represented by the mean of the cases admitted and discharged in the year.

† Years 1827–38. Paper by a Committee of the Statistical Society on data furnished by Mr. Annesley, the President of the Madras Medical Board.—*Journal Statistical Society*, vol. iii., p. 127.

‡ See also *Journ. Stat. Soc.*, vol. xiv., p. 129, where the same disparities are shown for the years 1842–6.

§ *Stat. Journal*, vol. viii., pp. 50 and 52. The population of Calcutta city in 1837 was 229,705, while the suburbs held 217,193. The city contained 144,893 males, 84,812 females, in this, as in some other respects, resembling St. Petersburg. See also a Paper by Mr. Bedford, the civil assistant surgeon, on the Vital Statistics of Chittagong (*Journ. Stat. Soc.*, vol. xv., p. 129), in which he estimates the mortality of that town at 27 in 1,000. See also Sir Ranald Martin's valuable Report on Calcutta.

|| *Asiatic Researches*, vol. xx., p. 191.

MORTALITY
OF NATIVES.

The native troops, it will be seen, experience a rate of mortality nearly the same as that of the civil servants, living also in homes, but born in England; and they suffer from nearly the same fatal diseases. But the sepoy's superiority in health over the English soldier has often hitherto been explained on the hypothesis, that his organization is especially adapted to the climate in which he was created! But it is found that the sepoy suffers when he leaves his home, whether quartered in Bombay or in Southern China; and when taken from his hut he is shut up in Indian prisons, in his own climate he dies at greatly increased rapidity,—84 in 1,000 in Lower Bengal during 10 years—and of some of the same fatal diseases as destroy the English soldier in Indian barracks.*

The famine fevers, which are periodically fatal in India, as they were formerly in England, can be mitigated by improvements in the systems of culture, storage, and intercommunication. The Asiatic cholera, which sprang into epidemic life in India, may, like the Pahli plague,† be arrested at its source.

Fevers, rheumatisms, diarrhœas, choleras, dysenteries, scabies, herpes, lepra, and ulcers, which now abound, and afflict so heavily the natives of India, may be diminished. But the task is undoubtedly difficult. It depends largely on the general improvement of the people. Their superstitions stop the progress of vaccination;‡ the women derive little benefit from medical advice, as they are seldom willing to see the surgeons of the dispensaries, and the sanitary condition of their towns is utterly neglected.

Java, under the tropics, is increasing rapidly in population, and in certain districts the mortality of the natives does not exceed 17 in 1,000. There appears to be no reason why India should not make equally rapid progress in population and salubrity under English rule.§

MORTALITY AMONG EUROPEAN POPULATION: OFFICERS' WIVES AND CHILDREN; EURASIANS.

MORTALITY
OF EUROPEAN
POPULATION.

The English population in India, according to the returns of the several Governments, amounted to 125,945;|| consisting of an army 84,083 strong, its wives and children, and people in civil life, including the civilians in the public service.¶ Allowing for any defects in the returns, it is evident that, exclusive of the army, the population would not fill one English county town; and including the army, it would be less than the population of the London parish of Marylebone.

Of the Royal army, the proportions married, it will be seen, vary at each age; 93 per cent. of all ages were unmarried men; of the Europeans of the late Company's regiments, 70 per cent. were unmarried; of the civil population, of the age of 20 and upwards, 50 per cent. were unmarried,—a large proportion as compared with the unmarried population of England.

A higher proportion of the officers than of the men in the Royal army is married.

The rate of mortality among the married soldiers and the unmarried has never been ascertained in either service; but Mr. Griffith Davies ascertained that the married officers in the Bengal Military Fund died at the rate of 27 in 1,000 annually, the unmarried at the rate of 38 in 1,000. The subject requires further investigation. This excess of 11 deaths annually is the more remarkable, as the unmarried officers are younger than the married. The married ensigns died at the rate of 16, the unmarried at the rate of 36 in 1,000 annually.¶ Here the life without a home in India is triply fatal.

The women and girls enumerated as "British-born subjects in India" amounted to 19,306, of whom 9,773 were 20 years of age and upwards, including 7,570 wives, 1,146 widows, and 1,001 unmarried women. 786 wives under the age of 20 make the number

* "Last year, I am afraid," said Dr. Mouat, "the mortality has averaged 12 per cent. [120 in 1000] "upon the average number who were in custody in Bengal."—Evidence, Qu. 5792. See Dr. Mouat's able Report on Indian Prisons, Stat. Journal, vol. xxv., pp. 175–218.

† The fever called Pahli plague is of a malarious, remittent type, becoming in its progress of the continued character, and manifestly infectious under the favourable conditions of privation, filth, crowding, and defective ventilation. The term plague was applied to this fever from the circumstance that it became typhous in its course, and that glandular swellings arose, as in true plague, in the groins, axillæ, and neck. It has been known in India from 1815 to 1820, in Kattywar, Kutch, and parts of Guzerat. In 1836 the same form of fever prevailed at Pahli in Marwar, whence the designation latterly given to it in India.

‡ 23 in 100 deaths are by small-pox among the Hindoos of Calcutta. Jour. Stat. Soc., vol. viii., p. 54.

§ The population of Java was 6,368,090 in 1824, and 9,542,045 in 1845. In a population of 40,688 in 188 villages, Mr. Crawford ascertained that the marriages were 514; the births, 1,691; and the deaths, 696. Stat. Journal, vol. xii., pp. 61, 69.

|| The European officers and men of the army in India were 84,083, the civilians were 22,556, and the women were 19,306 at the census of 1861. The Registrar-General of England has kindly supplied us with the results of the last census, which was made at his instance in 1861. We are indebted to Major Graham and his department for much valuable aid in other respects.

¶ Journal of Stat. Soc., vol. viii., p. 54.

of wives of English origin, under the age of 45, to be 7,626, scattered all over British India.

The wives of several Indian officers, if invalids, go to England; but the numbers in India in the early periods is so great that the mortality of the wives of officers of the Indian army may be taken to represent the mortality of English women in India. At the ages from 20 to 40 the mortality of wives and of widows in the Madras Military Fund does not, according to Mr. Samuel Brown, exceed 14 in 1,000. They are exposed to many of the same unsanitary influences as the soldier and the officer. The mortality is not higher than it was in London during the last century. All the deaths over 10 in this class, as in the others which have been investigated, are by the diseases not only of India, but of all unhealthy places. They may be reduced by energy and action, as they are increased by inaction.

Young children are generally easily affected by the climate, and it is found that the mortality of English children in India is lower than the general mortality of children at home. It is higher than the rate of mortality which the children of the same classes experience in the healthiest districts; but it is lower than the rate of mortality which the children of England generally experience. As age advances, large numbers of the children are sent home at great expense; and in Lower Bengal it is well known that if they remain they become feeble, and suffer from impaired health.

The wife and children of the non-commissioned officer and soldier do not fare so well, as the provision for their accommodation is inadequate. The women are exposed to great hardship; they die at the rate of 35 per 1,000, including women of English birth and Eurasians.* In the lower orphan school of Calcutta the mortality was double or treble the English rates;† but more favourable results are obtained at the Lawrence military asylum in the hills.

At the census 11,636 women above the age of 15, of English origin, including 8,356 wives, were enumerated, and 98,888 men. Hence a certain number of soldiers marry Indian wives. The sons and daughters of the two races, known as Eurasians, or East Indians, or half-castes, amount to considerable numbers. They exceeded the English in the city of Calcutta at the census of 1837; for while the English amounted to 3,138, the Eurasians were 4,746,‡ or including those in the suburbs, 5,981. Mr. Tait and others have investigated the mortality from imperfect data; and we see no reason to justify the inference that the mixed race of Anglo-Indians is an exception to the rule, that the mortality of all the races in India bears a constant proportion to the variable sanitary conditions in which they live.

Having given an account of the mortality and diseases to which British troops in India have been exposed, we next proceed to state briefly a few facts regarding the mortality at the more important stations.

STATIONS IN THE DECCAN AND SOUTHERN INDIA.

The station of Trichinopoly is within the tropics,§ in southern India, and is reckoned one of the hottest to which troops are exposed. The mean temperature of the latitude is 82°, according to Mr. Glaisher. The temperature of night is high, and of the day still higher in the shade; the sun being even in winter nearly vertical at midday. The mortality was at the rate per 1,000 of 44 for 19 years, of 31 for 11 years, and of 20 for the four last years (1850-3), for which we have returns. The strength of the 84th Regiment, stationed there, was 1,001; the mean number constantly sick was 62; and the annual admissions into hospital 1,533. Table 120, p. 751.

STATIONS IN
SOUTHERN
INDIA.

Upon turning to the diseases it will be noticed that 4,593 of the 6,202 admissions into hospital are from zymotic diseases, so that 1,148 are admitted annually from these affections, and 402 from all other causes. 41 of the 81 deaths were from zymotic maladies; six from common fever in the army sense, 24 from diarrhœa, dysentery, and cholera. Moreover 53 cases of *vermes* occurred.

Deduct the deaths from zymotic diseases, and the annual mortality of Trichinopoly is reduced to 10 in 1,000. Among the other deaths, eight are returned as apoplexy, and seven as hepatitis.

We now cross over the Ghauts and descend to Cannanore, low on the Malabar coast, where the rainfall is 140 inches, and the temperature is still tropical. The mortality of a mean force of 903 in the 10 years 1847-56, was at the rate of 21 in 1,000; or,

* Moore, *Health in the Tropics*, p. 55.

† See Tables in Sir Ranald Martin's work on *Tropical Climates*, from a paper by Mr. H. Prinsep.

‡ *Jour. Stat. Soc.*, vol. viii., p. 50.

§ Lat. N. 10° 50'.

deducting the deaths from zymotic disease, 11 in 1,000. Of 192 deaths in 10 years, 53 were by dysentery, and 25 by hepatitis.

Ascending the Cauvery from Trichinopoly into the Mysorean territory, instead of going on to Seringapatam, which has been abandoned on account of its unwholesomeness,* we turn northwards to Bangalore, far from the coast, and about 3,000 feet above the sea. The mortality of the 1,342 men at this station during the 10 years of the return was at the rate of 20 per 1,000 annually; and it was less in the last five years. The cavalry, strength 644, died at the rate of 17, the infantry at the rate of 24 per 1,000. Upon inspection it will be seen that cholera and dysentery and hepatitis were the chief fatal diseases, and if we exclude the zymotics, the mortality of the station from other diseases, including hepatitis, is less than 11 per 1,000.

Large numbers of European pensioners have resorted to Bangalore since the removal of the restrictions prohibiting permanent residence. They live on plots of ground in clean, comfortable cottages, and were enrolled during the mutiny. If they had grants of land for gardens they might supply the troops with vegetables. The veterans, numbering with their families more than 1,100, have the prospect of enjoying, with good sanitary arrangements, as long a life in India as their companions who return to England.

Northwards, at Belgaum, lying east of the Ghauts, 986 men were stationed; the mortality was for six years at the rate of 19 deaths in 1,000 living, of which 11 were by zymotic diseases, chiefly dysentery. Belgaum was formerly part of the collectorate of Dharwar, where the culture of the New Orleans cotton has been successfully inaugurated; and it is probable that the mortality of Englishmen will, when the causes of dysentery are removed, be as low as in Europe. The mortality at this station was formerly at the rate of 28, and even 41 in 1,000.

The 10th Hussars and the 14th Dragoons were stationed at Kirkee, above Bombay, in the 10 years 1847-56, and their mortality was at the rate of 19 in 1,000, or, exclusive of zymotic diseases, cholera, dysentery, and fever, 7 in 1,000. The mortality from all causes subsequently to 1855 ranged from 6 to 15 in 1,000 at Kirkee.

At Poona, of which the town, filled by 80,000 inhabitants, is $3\frac{1}{2}$ miles from Kirkee, the mean mortality was at the annual rate of 26 deaths per 1,000 living in ten years, but of this number 16 were by zymotic disease: fever, dysentery, and cholera prevailed in the first five years, when the mortality was at the rate of 34 in 1,000. During the last five years the mortality at the station among 1,127 men was at the rate of 16 in 1,000, including a certain number of deaths from dysentery, cholera, and hepatitis. During the years 1857-60 the mortality was at the rate of 11, 6, and 34 annually, cholera having been epidemic in the latter year.

Across the Nerbudda by the way of Baroda to the desert, we find Deesa, which is on the river Bunnass, but is visited by the breath of the burning desert, so that though out of the tropics, its temperature is extreme. The mortality of 893 men was at the rate of 26 in 1,000 during 10 years, or 12 exclusive of the zymotic diseases. The excess on the mortality over 10 is chiefly referrible to cholera, dysentery, remittent fever, and hepatitis. By the decrease chiefly of those diseases, the mortality from all causes in the last five years of the ten was reduced to 20 in 1,000.

STATIONS IN THE VICINITY OF LARGE CITIES.

India differs from the colonies in one essential particular; it is peopled by the inhabitants of villages, towns, and large cities, as well as by families engaged in agriculture. As we shall afterwards show, the cities are still undrained, the earth is saturated with organic matter, the water is contaminated, and other sanitary defects abound. In these cities, zymotic diseases are aggravated, and assume the same destructive forms as they did in London before it was drained, and was supplied with water free from enteric impurities.

The health of the English army is indissolubly associated with the health of the population of the country which it occupies; hence it will be found that the mortality of the troops is above 20 in 1,000 at all the stations of the great Indian cities. The numerous camp followers always connect the cantonments with the city, and they exist in a community of suffering, as well as of advantage.

* The Duke of Wellington was not misled by this presumed unwholesomeness. His own regiment was uncommonly unhealthy there, but he writes:—"I apprehend, however, that Seringapatam is not really more unwholesome than Bangalore." "I apprehend that a great part of the sickness at Seringapatam is to be attributed to the nature of the buildings which the officers and the troops have occupied," &c.—Despatches, vol. i., pp. 352, 353.

Hyderabad, the capital of the Nizam's dominions, is on high land near the centre of the Deccan; it is surrounded by fine sites; but the barrack for the European regiments is in an unhealthy locality at Secunderabad. A regiment, of which the mean strength was 753, died at the rate of 64 in 1,000 annually;* in one year, a third of the force was killed; and the deaths in the 30 years (1804-33), chiefly by dysentery, were about 1,435. The barracks were emptied twice by deaths in 30 years; and the graveyard close above the barracks was filled; for a crowded barrack crowds the churchyard. New barracks were erected on the same site, and the mortality declining, still remained as high as 37 in 1,000 during the years 1837-58. In the last year of the period, 104 of the First Royals died out of a strength of 1,098.† The officers lived in detached bungalows, and their mortality rarely exceeded 20 per 1,000.

STATIONS NEAR
CITIES.
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2381-2.

The mortality for eight years in the force at Fort St. George, Madras, was 35 in 1,000,‡ 18 being by zymotic diseases: and 81 were constantly sick. For the latter four years the mortality was less than it had been. For 34 years the mortality at Fort St. George was at the rate of 40 in 1,000 annually.

In Bombay and Colaba a return of one year exhibits a mortality in a small force of 59 in 1,000; for 23 years the mortality was at the rate of 63 deaths annually to 1,000 of strength at these fatal stations.

5565.

The other stations of the Presidencies of Madras and Bombay have hitherto experienced intermediate rates of mortality for the years for which the stational returns are supplied; the rates of mortality per 1,000 were at Hyderabad, 36; Kamptee, 35; Kurrachee, in Sind, 34.

STATIONS ON THE GANGES.

The stations in the basin of the Ganges present some peculiarities. That river receives in a thousand streams the waters of the Himalayas, and of the Vindhyan range of hills, besides the abundant rains that flood the plains in the wet season. Moisture and heat produce luxuriant vegetation, which feeds millions of animals, and the plain is inhabited by millions of men. Perhaps no river in the world has on its banks so many populous cities, which are in constant communication through the water, the air, the boats, and the stream of traffic on the roads. The low ground is subject to inundations, and the flood, as the banks of the river are high, is left to evaporate after its subsidence.

STATIONS ON
THE GANGES.
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There is, then, in the plain of the Ganges, danger from malaria of the undrained lands, besides the various dangers generated in the barracks, in the canteen, in the bazaar, and in the city.

The delta of the Ganges is a great epidemic centre, and there cholera first took the form in which it ravaged the world.

The capital of India is still undrained, uncleansed, and unsupplied with fresh water; so its diseases are as fatal as some of the diseases of London in former times. The main artery of the commerce of Asia, the Ganges, does the same work as the Thames; it also carries down 236 million cubic yards of soil annually; it floods the land, and besides ships, its tides waft up and down the unburnt and unburied dead of the Hindoo population.

Fort William, as might be anticipated, enjoys no sanitary immunities, for the mortality of the infantry during ten years, within its walls, was not at the rate of 20 or 10, but of 102 per 1,000 for ten years! For long periods the mortality is cited at 69 and 58 per 1,000. At Dum Dum the mortality was 77; and at Chinsurah, the old Dutch settlement, 54 and 70.

These stations, and Barrackpore, are on the delta of the Ganges, where the invalids embark and recruits are landed. The Rajmahal hills offer superior sites for troops; and at Hazareebaugh, only 1,900 feet above the sea, the mortality was, amidst many unfavourable circumstances, 57, and during two years 34 in 1,000.§ Upon ascending the river and 212 feet above the sea, but on a dead level, we come to Dinapore, where the mortality was 63 in 1,000; at Ghazeeapore, still further up the river, the mortality

* Report of Dr. Crawford in Army Medical Report for 1860, p. 320. It is here assumed that the annual deaths (63·76) which Dr. Crawford has given, express the rate of mortality per 1,000. If, as stated, those deaths occurred in a strength of 752·8, the mortality must have been at the rate of 85 in 1,000, and the total deaths in the 30 years 1,913.

† See the Evidence of Dr. Maclean, and the Report of Dr. Crawford, in the Army Medical Report for 1860, pp. 313-29.

‡ Strength, 825 for 8 years, 1847-54. Vide returns pp. 735, 750.

§ In the year 1860 the mortality was at the rate of 27 in 1,000 (Army and Medical Report for 1860, p. 114).

STATIONS ON
THE GANGES.

was 47 in one year. For twenty-two years, the mortality was 78 in Dinapore; for nineteen years 52 in Ghazee-pore. At Allahabad the mortality is excessively high; at Cawnpore, it was 91 in 1,000 for seven years. For twenty-nine years the mortality was 66 in 1,000 at Cawnpore. For seven years at Agra, 800 feet above the sea, and 50 feet above the surrounding country, the mortality was at the rate of 42; for twenty years it was 48 in 1,000.

At Meerut, 800 feet above the sea, and 100 feet above the country on the Doab, between the Jumna and the Ganges, the mortality of the infantry per 1,000 (816 for 10 years) was 45, of which 31 was by zymotic disease. Dysentery, diarrhœa, and cholera prevailed; ophthalmia was epidemic; apoplexy, and hepatitis, and alcoholism, implying hard spirit-drinking, were also fatal to the infantry at this station, where the cavalry, lancers and dragoons, (630 for 6 years,) died at the much lower rate of 20 in 1,000, or, exclusive of zymotic disease, 8 per 1,000. The mortality of the large force (1777) at Meerut in 1860 was 11 in 1,000.

The mortality of Meerut was at the rate of 32 per 1,000 for 19 years; so that the mortality (44) of the next fourteen years, and of the infantry in 1847-56 (chiefly the 29th, 32d, and 81st foot) must have been due to some accidental disturbance.

All the Bengal regiments enter India at the Calcutta stations;* and if through crowding, or any other cause, they contract zymotic disease, it follows them; for a regiment carries its diseases with it. Thus the 29th regiment of foot arrived in India on July 29, 1842, and it was stationed at Chinsurah, where it lost 106 men before April 1, 1843. Proceeding to Ghazee-pore, it lost 158 men, and 260 men respectively, in each of the next two years. Its valour was not extinguished by disease; for 141 of the men were killed, and died of their wounds in the Sutlej campaign, and 48 in the Punjab campaign. These terrific losses were, however, exceeded at Chinsurah and Ghazee-pore, before it had seen the enemy. This was one of the regiments which brought discredit on Kussowlie. It lost 1,061 men by death in India before it embarked for England on September 30, 1859. Its mean rate of mortality during the seventeen years was 95, or exclusive of the killed and of those who died of wounds, 86 in 1,000.

So fearful are the consequences of zymotic diseases in a regiment entering India.

In reasoning about the mortality of the stations higher up the country, it is necessary to bear in mind that regiments sometimes carry some diseases with them and with their camp followers, from the stations below. Other illustrations of this principle will be found in the regimental returns, which though imperfect, are invaluable.

OUDE, THE CIS-SUTLEJ DISTRICT, AND THE PUNJAB.

OUDE, THE
PUNJAB, &c.

Oude has been only occupied recently; but it is gratifying to find that in the year 1860† the mortality of the large force in some stations is not much higher than the standard: thus at Seetapore it was 18 per 1,000; Gondah, 20; Roy Bareilly, 23; Fyzabad, 32. At Lucknow the mortality was 27 in 1,000. The zymotic diseases and their obvious causes account for the excess over 10 in 1,000. The mortality of Allahabad and Cawnpore is reduced.

The stations of the Punjab were not always well selected, and they were necessarily, at first, in an unsettled state. The mortality was at the rate of 81 per 1,000 for infantry, 56 for cavalry, at Lahore; 80 per 1,000 for cavalry, and 56 for infantry in Ferozepore.

Upon leaving Delhi, the great road leads to Umballa, a large city on this side of the Sutlej, and thirty-five miles from the Himalayas around Simla. The station is about three miles from the city, and 1,050 feet above the level of the sea. The mortality during ten years (1847-56) was at the rate of 55 per 1,000; but the cavalry (dragoons and lancers) died at the lower rate of 23. The infantry fell from cholera, dysentery, fever, intemperance, and its sequels sun-stroke, and hepatitis. The 75th foot was the principal sufferer.

Crossing the Sutlej into the Punjab, the mortality before 1856 was, at Jullundur, among infantry, at the rate of 37; at Sealkote, 27 among infantry, 13 among cavalry; at Rawul Pindi, 29. Excluding the zymotic diseases, which are sometimes due to removable causes, and often the result of causes to which the regiments were exposed elsewhere, the mortality of all these stations is reduced to 6, 12, 13, or 14 in 1,000. It is, therefore, not naturally higher than the standard.

In fact, the mortality in the year 1860 from all causes, was in Jullundur 7, Sealkote 13, Rawul Pindi 13, Umballa 15 per 1,000.

* Fort William, Dum Dum, Barrackpore, Chinsurah.

† Army Medical Report, 1860, p. 114.

At the fortress station of Govindghur, near Umritsir, the holy city of the Sikhs, one death occurred in two years among a small force, where several, however, were attacked by ague.

The stations are at heights ranging from 900 to 1,500 feet above the sea level, and at some distance from the hill stations. The mortality at these elevations is not greater, therefore, than the mortality among British troops was formerly in England; and we feel justified in adding, after carefully weighing the facts, is susceptible of being reduced to the English rates, under ordinary circumstances. The Sikhs are a perfectly healthy, vigorous race.

The mortality in Peshawur was at the rate of 61 per 1,000 of the mean strength for eight years. Fevers, dysentery, apoplexy, and liver diseases abounded; and of a mean force of 1,674 men, 193 were constantly sick, down to the year 1856.

We sum up briefly the results of this portion of the inquiry as follows:—

1. The English troops in India, by the returns of 1861, consisted of 8,324 officers and 76,684 non-commissioned officers and men, making in the aggregate an army of 85,008 men. The annual expenditure on the army of India has been at the rate of 100*l.* a man.

2. The mortality of the officers in India has hitherto been at the rate of 38 per 1,000, which is 28 higher than the English rate of mortality. Of the sickness there are no returns, but it is, undoubtedly, as excessive as the mortality.

3. The mortality of the non-commissioned officers and men during a long series of years has fluctuated, and has been on an average at the rate of 69 in 1,000. The mortality of men in England at the soldier's age is at the rate of 9 in 1,000. 60 in every 1,000 men were killed annually in India by the causes there in operation; the numbers slain in battle being few compared with the deaths by fevers, dysentery, liver disease, and cholera. About 84 in 1,000 men were constantly inefficient and in hospital, from the sickness induced by thousands of attacks of disease, including a large proportion of venereal cases.

4. The excess which has hitherto been observed in the mortality of India is in every station due to nearly the same zymotic diseases. These diseases were for centuries equally fatal in the cities of Europe. In Europe they are also still prevalent under the same circumstances, and they are generally most fatal in the summer, when the sun is not so hot as in India, but is above the horizon a greater number of hours.

5. The experience of the civil service, of the military officers, of their wives and children, of the English troops in many stations, and of the native troops, proves that in the present state of India the mortality of the English troops there can be reduced to the rate of 20 in 1,000.

We have considered it necessary to enter into this lengthened analysis of the sickness and mortality affecting British troops serving in India, partly with the view of giving an authentic account of the facts with which we have to deal, but mainly to show the great importance of the subject to the public interests, and to enable us the more readily to ascertain to what extent this great sick and death rate can be diminished by known sanitary precautions. We next proceed to deal with this portion of our inquiry.

INFLUENCES AFFECTING THE HEALTH OF BRITISH TROOPS SERVING IN INDIA.

It will be seen, from what we have stated above, that out of the entire range of diseases to which European residents in India are subject, the diseases belonging to one single class, the zymotic, occasion by far the largest amount of mortality and inefficiency among troops serving in that part of the empire. It may be stated, in round numbers, that, at many stations, from one-half to two-thirds, or even more, of the deaths, and upwards of three-fourths of the admissions into hospital proceed from this class of diseases.

If to these be added heat apoplexy, and liver complaints, frequently the consequence of certain forms of zymotic disease, we shall have included the main causes of premature and preventible mortality with which we have to deal.

Were it possible wholly to put an end to deaths arising from the various classes of fevers, from cholera, dysentery, and diarrhœa, together with hepatitis and its consequences, the troops serving in India would become as healthy as any body of men in the world.

The practical part of our sanitary inquiry, therefore, resolves itself into ascertaining the causes of these diseases, so far as it may be possible to do so, and determining to what extent we may reasonably hope to mitigate their virulence, if not to prevent their occurrence.

The problem is not peculiar to India. Zymotic diseases have always been the chief causes of mortality in uncivilized or imperfectly civilized countries, and they have been

the special scourges of armies. If the vital statistics of all nations could be brought under review, they would testify to the fact that a great proportion of the ordinary every day mortality arises from some form of fever or bowel disease, increasing in severity during certain seasons and years; at times assuming the dimensions of pestilences known under the names of black death, plague, or cholera.

Whole regions of the earth which were formerly devastated by fever-pestilences, and dysenteries have long since been free from them, except in the milder forms in which they now occasion part of the ordinary mortality. England, which suffered, at various periods, as much as other countries, has shared in this exemption; and, guided by the light of experience, we see no reason why India should form any exception to the rule, that in proportion as the conditions of health become better known and complied with, these diseases, the *opprobria* of imperfect civilization, should diminish both in frequency and in malignity.*

Science has hitherto failed to discover the special cause of epidemic diseases. These diseases are observed to occur in very different degrees of intensity at different periods, amongst groups of population exposed to certain unhealthy conditions. Sometimes they take the form of pestilences, and immediately afterwards, the conditions remaining the same, they subside and all but disappear, again to renew their ravages at some future period.

The great difficulty of reducing their phenomena under any general law formerly led many persons to doubt the practicability of diminishing their prevalence; but a more rational mode of inquiry, pursued chiefly in this country, has led to the discovery, that, assuming the oscillation in intensity simply as a fact, there are certain well-defined conditions which influence most materially, not only their intensity, but also their frequency.

One of the earliest discovered of these facts was, that intermittent fever disappeared from places which it formerly ravaged after drainage of the soil and improved cultivation.

It was next discovered that by cleanliness, fresh air, and diminished crowding, the very worst forms of pestilential fever which used to commit ravages similar to those of plague, disappeared entirely from English gaols.

Fevers of the typhoid and continued class, and various forms of bowel diseases have been greatly diminished in frequency and severity by drainage, by improved domestic arrangements for removing human excreta safely and rapidly away from dwellings, by increased space, and better ventilation.

Under improved drainage and other sanitary arrangements, fevers of the remittent type have almost ceased to exist in certain localities where they formerly prevailed.

Cholera and dysentery are now well known to depend mainly for their frequency and severity on the neglect of known sanitary precautions; and so intimately are these diseases connected with the condition of the water supply, that while an epidemic prevails, the question whether a given population shall suffer or escape may almost be predicated by a chemical analysis of the drinking water.

So far as the experience of more temperate climates can be admitted as evidence, it tends to prove that the very class of diseases, formerly so fatal in this country, and which has occasioned so very high a rate of mortality, both absolute and relative, among the Indian army, is, to a large extent, dependent on removable conditions and habits.

In pursuing our inquiry, we have received much evidence of great value and importance from witnesses practically conversant with the sanitary state of the troops in India, and we have besides endeavoured to obtain an accurate account of the sanitary state of every military station in India and its dependencies, by the printed questions already mentioned, addressed to commanding, medical, and engineering officers at each station.

We have included in this part of our inquiry local topography and climate; the sanitary condition of cantonments, barracks, hospitals, bazaars, and neighbouring native towns; the source, quality, amount, and means of distribution of water supply; the diet, drink, clothing, accoutrements, duties, and recreations of the soldier, together with the observed effect of all of these conditions on his health. From the replies received to our questions, and from reports of inspecting medical officers, we have been enabled to collect a large amount of most valuable data, which not only throw much light on the subjects of inquiry committed to us, but which, we believe, will be in other respects of great use to the public service.

In dealing with the evidence before us it is necessary to bear in mind that the soldier's health in India, as elsewhere, is the product of all the conditions to which he is exposed. It is not solely the result of climate, nor of locality and dwelling place, nor of diet, habits, nor duties; it is the product of all of these. Some of the conditions to which the

* *Vide* Note on the Diseases of London, page xcii.

soldier is exposed are irremovable, and some admit of being modified or removed. To what extent this can be effected is, indeed, the main practical object of our inquiry.

INFLUENCES ON
HEALTH
OF BRITISH
TROOPS.

TOPOGRAPHY AND CLIMATE.

India extends over 26 degrees of north latitude. It has a superficial area of 1,500,000 square miles, enclosed on the north, east, and west by gigantic mountain ranges for 4,500 miles, and along its southern, eastern, and western sides by 4,500 miles of tropical seaboard.

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Much of the country consists of plains traversed by large rivers, having deltas projecting into the ocean, and hardly raised above its level. In other parts there are extensive table lands of greater or less elevation, rising from the plains below. Along the west coast there is a continuous range of mountains, intercepting the warm moist winds coming from the Indian Ocean, and influencing the climate for a considerable distance inland. Here and there are solitary mountain groups of varying altitudes, from 3,000 to 5,000 or more feet, presenting, from their elevation, very different climates from those of the plains within sight. The northern barrier of the Himalaya consists of a succession of ranges, increasing in height as they recede towards the north, until they attain altitudes of from three to five miles.

According to the popular notion, the mortality of the British in India is explained by the heat and strangeness of the climate. Hot climates are believed to be hostile to human life, and to be especially deadly to the English race. In the West Indies, on the Coast of Africa, and in India the forces have been at intervals decimated by epidemics, through the century that England has held possessions within the tropics, and the climate has always been blamed.

So much has been attributed to its influence in India, that we considered it necessary for our inquiry to place the documents at our disposal in the hands of Mr. Glaisher, who has for the first time given a comprehensive view of the geographical distribution of atmospheric phenomena over this vast and various peninsula.

India, according to Mr. Glaisher, enjoys in its temperature perpetual summer on the plains; it has there no frost or snow; the heat, however, is as excessive there in some months as the cold is in Europe in others: and rain is as abundant in the rainy season as it is frequent through the year in England. He shows that the observed elements of climate vary with the latitude, longitude, and elevation; that there is higher temperature and a much larger amount of dissolved water in the air than in England, although the relative amount of moisture to temperature is less in India. But as far as relates to the influence of moisture on health, the actual amount of dissolved water may be taken as indicating the amount of organic matter in the air, of which water is the solvent and vehicle; and hence, although the relative amount of water in the air in India is less than it is in England, the atmosphere considered in relation to the effect of humidity on health, is more humid than it is in England.

The sensible effects of climate in India vary as widely as the physical characters of the country. On the plains and deltas the climate is hot and moist with considerable rain-fall. In the southern parts of India there is heat and dryness. On the mountain ranges, the temperature falls with the elevation; and at certain altitudes diminution of heat is accompanied by a perceptibly moist condition of the air. Along the face of mountain ranges exposed to the monsoon, there is an excessive rain-fall, to be measured by feet rather than by inches, rendering the country almost uninhabitable for the time of its duration; while within a short distance to leeward, the atmosphere is dry and clear, with little rain. The climates of the seaboard vary with the direction of the wind. Sometimes they are comparatively cool, while at others they are warm, moist, and depressing. The climates of certain isolated mountain groups and table lands are almost as healthy as those of Southern Europe; while at the base of the same mountains there are local climates, which are absolutely pestilential.

At the majority of the stations occupied by British troops there is a high mean temperature, accompanied with much dissolved moisture. At many of them there is a considerable difference between the day and night temperature, accompanied by night and morning fogs, and by a feeling of coldness succeeding a high temperature during the day.

Heat, moisture, and variation between night and day temperature are the three special climatic conditions to which the soldier in India is exposed, and except in so far as the degree of humidity is the result of local defects in drainage, these conditions cannot be changed, unless by resorting to mountains or table lands as sites for military stations.

Such being the case, it is very important to consider—what amount and kind of influence

these climates are likely to exercise on the soldier's health? In dealing with this important question we are struck with the absence of direct allegations against climate in the stational reports. Although most of these reports contain statements more or less specific as to the effect of particular seasons on the amount of disease, the reporters do not attribute the soldiers' mortality to the climate of the stations. Other causes are usually assigned. This negative evidence is of great importance as against the common opinion regarding the fatal character of Indian climates. It is nevertheless certain that climate does exercise some effect on the general health of persons exposed to its influence. Experience shows, first, that long-continued exposure to Indian climates gradually deteriorates the constitution; and, secondly, that diseases of the epidemic class prevail most severely and extensively in localities where, and at seasons when, the elements of heat and moisture most predominate. If careful inquiry were to show that there were absolutely no other agents at work in producing these results except high temperature, then we should be driven to the conclusion that nothing short of change of climate and station would preserve the health of the army. But, as we shall presently show, there are many other agencies at work besides those due to climate *per se*: and first among them we must place that subtle, unknown agent, or rather that cause of disease known only by its effects, malaria.

At all the stations of India from the Himalayas to Cape Comorin the presence of malaria can be traced by its influence on health. It is the chief cause of periodic fevers and certain forms of marasmus and spleen disease among the native population. It underlies the cause of many other diseases, and it appears to exercise a powerful influence on the course of epidemics of cholera. It is most intense in its operation in low, warm, moist localities where there is a superabundance of vegetation and water, and it also shows its presence in dry situations, where these conditions are apparently wanting. At considerable elevations, where the air is cool and dry and the vegetation scanty, it diminishes greatly or disappears altogether. It is the product of heat, moisture, and vegetable decomposition. It appears to be absorbed largely and retained by the soil, and is given off on the first fall of rain or on turning up the ground, in sufficient intensity to produce disease in susceptible persons exposed to it. In districts where it exists, anything which retards a free circulation of air, such as jungle, forests, high walls, or similar impediments, adds to its force. And on the other hand, everything which tends to lower the standard of health of persons exposed to it increases their susceptibility to its influence. This malaria is universally believed by the natives of India to be conveyed in the drinking water.

The production of malaria can be checked by withdrawing any one of the three elements, on the co-existence of which it depends: but the experience of colder climates would appear to prove that subsoil water has more influence on its production than high temperature. High temperature, with a moist state of the air and subsoil, are the chief agents which influence the rapid decomposition of dead organized matter, while at the same time they produce a certain amount of susceptibility to disease in those exposed to them. Indian climates have therefore the double disadvantage of generating malaria and increasing its deleterious influence on health.

Whether it may ever be possible to banish this scourge from the soil of India it is hardly within our province to inquire, and the question could hardly be answered; but it is satisfactory to know that it has everywhere disappeared before clearing, subsoil drainage, and improved agriculture, changes which involve the removal of all excess of decomposing organized matter, and of water, the main element of decomposition; by which, moreover, the soil is repeatedly exposed to the action of the air, and brought under the influence of living vegetation. Part of the deadly terrai of Northern India has become comparatively healthy by clearing away the forest and cultivating the soil.

Considered with reference to its effects on particular stations, the extent to which malaria prevails appears to depend very much on the physical constitution of the surface and subsoil. The terrai, where it is most fatal, is a belt of country of greater or less breadth, situated at the foot of mountain slopes, formed to a great extent of débris, receiving and retaining a large amount of water from the higher levels, and covered with a dense vegetation, which, in the course of ages, has formed a rich, deep, vegetable soil.

In river deltas the conditions are somewhat similar, for they also are formed of débris and vegetable mould covered with vegetation and saturated with water.

The low banks of rivers, along which the subsoil becomes infiltrated with water, reproduce similar conditions.

Retentive soils, having imperfect natural drainage; expanses of shallow partially dried-up water; neglected tanks; hollows filled with water; marshy ground, and damp or wet ravines, are all well-known sources of malaria in India.

There are also porous soils which retain a large amount of moisture by capillary attraction apparently. To this class appear to belong the red earths and decomposed mountain rocks, especially granites; but the most common cause of the anomaly of porous soils giving off malaria is the existence of retentive beds below them, keeping water at no great depth below the surface. In some anomalous cases of this kind impure drinking water may possibly be an overlooked cause of disease.

A certain physical configuration of the surface, marked by the presence of valleys running up mountain slopes from the low country, is a cause of malaria being carried up mountain districts for thousands of feet above the terrai where it had its origin. Mr. W. Elliot states that he has seen several instances of this. In one such case a whole family living in an otherwise healthy locality was swept away by malaria rising from the low country. He says that a mist is seen rolling up the valley with the breeze, and that the malaria is taken up in that way. It is hardly necessary to insist on the value of this experience as affecting the choice of stations even on the hills. But the importance of these and similar facts was not recognized when stations were first occupied, and many of them were placed in deadly localities, which had in the end to be deserted after great cost had been incurred in their formation.

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In the present state of Indian drainage and agriculture it is clear that for all practical purposes we must assume the three peculiarities we have enumerated,—heat, moisture, and malaria,—as constantly present and everywhere influencing the sanitary condition of the country. These are ever tending to lower the general standard of health, and to predispose to epidemic diseases, but they are by no means the only causes in operation, although they exert a potent influence on the comparative intensity of other causes. The presence of any or all of them has the effect of rendering other causes of vastly greater importance than they would be *per se*. Negligence, or the absence of precautions, which, in cooler climates, would lead to little or no result, good or bad, become of great importance in India. A trifling degree of impurity of the air brought about by a stagnant state of the atmosphere, or by overcrowding and want of ventilation in a barrack or station, may lead to a fatal outbreak of disease. Impurity in the water supply, such as would be attended with comparatively little influence on health in England, may, in India, determine an endemic attack of cholera or dysentery. Some apparently trivial inattention to cleanliness or drainage, of everyday occurrence at home, may lead to disastrous results where a number of men are crowded together on a small area.

Personal habits, indulged in with impunity in this country, send men in large numbers to hospital in a climate where personal hygiene is as important as is public hygiene to the interests of the State.

In short, the whole sanitary question as regards India must be considered from this point of view, not only by the Government but by commanding and medical officers. The supreme importance of apparently trivial causes of disease is the lesson to be learned by all our past experience, and not till this is thoroughly understood and practically acted on will any great good be done in reducing the high mortality rate of the Indian army.

The evidence given before us by numerous witnesses, and also that contained in reports from the stations, clearly show that European troops during the period of their service in India are exposed to very important conditions besides those arising from climate.

We shall begin the consideration of the various influences affecting the health of the European soldier in India by a brief general statement of the nature of his service.

RECRUITING AND PASSAGE OUT.

Dr. Duncan Stewart, surgeon to the recruiting dépôt for the Indian army at Warley, states that the usual recruiting age lies between 20 and 35 years, and that it differs in the different arms of the service, but that a great many have entered under 20. Recruits from all parts of England were assembled at Warley, and sent to sea in detachments of from 200 to 350 men. It was the custom for men to enlist for particular arms of the service; but sometimes they were transferred at the dépôt from one arm of the service to another. On arriving at Warley they were carefully drilled under cover. At first they suffered from change of habits, diet, &c., and there generally was an average of about 6½ per cent. sick in hospital. Notwithstanding every care in selection, men were sometimes sent back from India as unfit for service. The average time spent in dépôt before the mutiny in 1857 was four months. At the time of the mutiny it was about six weeks; and it happened occasionally that men were embarked for India on the day of their arrival at Warley.

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The troop ships are stated to have been always good and specially ventilated. It used to be the custom to pay head-money on those landed in India. This has been

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discontinued, but, so long as it existed, the practice made it directly the interest of the medical officer to attend to the sanitary condition of the men.

Of late years a special code of instructions for troop ships has been in use; and no doubt great attention has been latterly paid to the health of the men while at sea.

One very injurious practice until very lately existed in permitting the issue of spirits during the voyage, and even the latest Queen's Regulations require no more than that the spirit should be mixed with three parts of water, and not issued till after dinner.

There are three points which require notice in this system of recruiting:—

1. Many of the men are exposed to laborious duties in a tropical climate at too early an age, and before the constitution is fully formed.

2. The period of drill is in any case too short, because it necessitates completing drill after the men arrive in India, and all the dangerous fatigue and exposure consequent on it in an Indian climate.

Deputy Inspector-General Stewart has pointed out the necessity of greater attention being bestowed on these conditions of a soldier's service. He states that no man ought to go out to India under 20, or from that to 25; and this opinion is supported by a great amount of testimony contained in the reports from the stations. Dr. C. Smith states that for the first few years of service men are very apt to suffer from fevers and inflammatory diseases, partly from greater constitutional liability, partly from inexperience in the case of young soldiers arriving in India, who take no care of themselves at all. Sir A. Tulloch is of opinion that recruits might be enlisted at 18, provided they had two or three years' training in a temperate climate before being exposed to a tropical climate or to the fatigues of a campaign. All the evidence derived from the stations is to the effect that none but fully drilled soldiers should be sent to India. The only question on which any difference exists is the place where the troops should be drilled. It has been proposed that the drill should take place at some intermediate station, as, *e.g.*, at the Cape, for the purpose of accustoming the recruit by degrees to change of climate. But the great preponderance of the evidence is in favour of completing the drill at home, and sending the soldier fully formed, both as to age and habits, direct to his destination.

From want of attention to these primary conditions, growing lads, who are very susceptible to disease when weakened by fatigue, have been sent out to India to learn their drill; their unformed constitutions are exceptionally liable to injury, and the overzeal of an injudicious commanding officer or adjutant may lead to loss of health and efficiency, if not of life.

We have here, then, a well-known preventible cause of disease, or rather of predisposition to disease, which can be put a stop to. It is true that under the altered circumstances of the army since the amalgamation of the two services these evils will be less likely to occur; but, anyway, the past experience is sufficient to prove that they should be avoided in future.

3. As regards the issue of spirits on board ship, there cannot be a doubt that the practice has been injurious to the health of the army. It can easily be understood how this arises, when it is considered that men, having little or nothing to do during a three or four months' passage, may gradually contract a taste for spirits which they never had before; and of course, immediately on arriving in India, they proceed to indulge themselves with any kind of intoxicating drink they can most easily obtain, so that on their first arrival in a dangerous country the habit acquired on board ship may lead, as indeed it has led in a great number of instances, to the destruction of health and life. Lately an issue of malt liquor has been made on board ship, but still the Regulation allowing the use of spirits is in existence, and ought to be repealed.

An issue of malt liquor, cheap light wine, or temperance drinks, tea, &c. is recommended by Dr. Bird. On board many ships in the mercantile navy the issue of spirits and beer has been altogether discontinued, with great benefit both to health and duty; and the example is quite sufficient to show that spirits at all events are not amongst the articles of a soldiers' ration on board ship which are indispensable either to his health or comfort.

In former times little or no attention used to be paid to the season at which troops were landed in India, and it was mere matter of accident whether or not their first introduction to an Indian climate was at the healthy or most unhealthy period of the year. On landing at any of the presidencies no efficient precautions used to be taken in the way of dress, diet, or accommodation, or for preventing the men from falling into intemperance and dissipation. After landing they were forwarded to their destination without much regard to season or means of conveyance. Not unfrequently, when boats were used, they were overcrowded, badly ventilated, and otherwise insufficient for the

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Vide abstracts of station reports.

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Vide abstracts.

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Queen's Regulations, 1859, pp. 338 and 360.

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purpose, and fatal epidemic attacks used to decimate the troops on board. These great evils have of late years been gradually abated to a considerable extent under Lord Ellenborough's administration, as stated by Col. Durand; but we think it right to mention their existence, because they in some measure account for part of the greater susceptibility to disease and the much higher rate of mortality which formerly existed in the Indian army. At the present time we believe that troops are as far as possible landed at the beginning of the cold season, that they are much better cared for now than formerly, but that even at present there is great risk on their first landing, from facilities for intemperance, which perhaps might be avoided, to a great extent at least, by additional care. The present practice is to forward troops direct from the port of debarkation to their regiments.

Where railways exist they are made use of; water conveyance is generally by means of well-appointed steamers, or a better description of country boats: and where neither of these means is available, the troops are conducted by short marches in the early morning.

The present practice is hence a great improvement on the former one, and has been attended with corresponding improvement in the health of troops.

DUTIES, &c.

The soldier's duties at stations consist of the usual guards, of drills and parades before sunrise or at sunset, and are described by Colonel Greathed as follows:—

"At gunfire he goes to parade, and, as a general rule in barracks, he gets his breakfast at eight o'clock; at half-past ten he parades again in the barrack, when the officers go round the barracks to see that they are clean. Then there is a roll-call again at dinner-time, and a roll-call at evening parade; then he has his supper. After that time he is free till tattoo, which is at eight or nine o'clock, according to the season. There are roll-calls during the night in all barracks, if men are supposed to be absent; it is done by the serjeant-major, and that is by what is called the check-roll and if there are two or three men absent the check-roll is called.

"3253. Does not that mean that the whole barrack is disturbed?—Yes; but it does not often happen.

"3254. For how many consecutive hours is the soldier on guard?—For 24 hours.

"3255. Does the practice in India differ from the practice at home in that respect?—No.

"3256. How many nights a week is a soldier in bed?—It varies occasionally; he is from 13 to 15 nights in bed very commonly; that is to say, that he does not come on guard above once in 13 or 15 days.

"3257. You mean that he is 13 nights in bed for one night out?—Yes.

"3258. Do you think that the amount of duty performed in India is greater or less than that which is performed in England?—It is less; there are no fatigue duties, or very few, compared with what they have in England; for instance, the fatigue duties of sweeping out the barrack-rooms, cooking, and carrying dinners to the men on guard, which is the most cruel thing upon the men at home, of all the duties thrown upon the soldier. That the soldier has nothing to do with in India, because his cook always goes with him."

As far as concerns his duties, the soldier cannot be said to be exposed to excessive fatigue if the Regulations are strictly complied with. But there are complaints that troops are sometimes unnecessarily subjected to duties after sunrise, and (as already mentioned) to drills. In this, as in other things connected with the soldier's duties and habits, Col. Durand states that "a great deal depends on the wisdom of the commanding officer: the wisdom of the commanding officer is really a thing of very immense importance in India, for almost everything is in his hands." Evening drill is complained of, apparently because it comes after dinner, so as to interfere with digestion. There is a concurrence of testimony to the fact that night duties, even in that climate, hardly ever act injuriously on health.

ACCLIMATION.

We have already shown, statistically, the influence of length of residence in India on the rates of mortality among soldiers. But there has been considerable difference of opinion as to the effect of acclimation on the health and efficiency of troops. It has been stated, on one hand, that men get accustomed to the climate by length of residence, and hence that there is hardly a period, so far as health is concerned, to which their term of service should be limited.

Others again have arrived at an opposite opinion, and one much more in accordance with observed fact. Dr. John McLennan, when asked whether a man of one year's service or of ten years' service would be the more able to endure fatigue and exposure, answers, "The fresh man, decidedly."

Col. Greathed says, "I believe that the medical officers will say that the longer a soldier remains in India the worse he gets. And I believe there can be no doubt of it; I do not believe in acclimatizing." "For the first five or six years a soldier is a very good man indeed in India, but after that he begins to break down, and he is not so good a man as he was."

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ACCLIMATION.

Sir Ranald Martin states that all statistical observations go to disprove anything like acclimation in the East Indies. On the contrary, he says, disease and death increase with length of service and age.

The opposite opinion seems to have arisen partly from the circumstance that some men have learned by experience the art of managing themselves, and so of preserving their health in unhealthy districts, and partly from confounding the effect of heat and moisture (*i.e.*, climate) with that of local sanitary condition. There is "acclimation" to heat; there is none to "endemic miasmata."

The whole tenor of the evidence in the stational reports is against the doctrine of acclimation, as generally understood, and in favour of limiting the period of service in India to about 10 years. It does not, however, necessarily follow that this limit need be maintained, if the sanitary condition of the troops be improved, as it may be.

CAUSES OF DISEASE.

Following up the history of the soldier after his arrival in India, we next proceed to inquire into the condition of the stations where he serves, his barracks and hospitals, his habits and pursuits, dress and diet, in order to ascertain whether (and, if so, what) unfavourable conditions are superadded to those attending on his recruitment and introduction to service, which can account for the high rate of inefficiency and death shown by Indian statistical returns.

In the course of the inquiry we have collected a large mass of most important information on all these points. But before discussing it, we shall give the general results of the evidence, showing the nature of the causes of disease which have arrested the attention of different observers, beginning with those which are incidental to the climate and country.

Sir Ranald Martin states that "taking any one cause, he should say that the union of heat, moisture, and malaria constitutes the most powerful one in destroying the integrity of the European soldier's health, and conducing to his fall by disease." And he goes on to state that "a certain amount of destruction and deterioration of European health must result from a residence at the stations on the plains, even if the soldiers were put into palaces."

But while laying this down as a fundamental sanitary principle, he says, at the same time, that there is a very great difference between the health of the officer and that of the soldier, always in favour of the officer. And that there is also a difference between the health of the officer and that of the civilian, always in favour of the civilian.

We have thus three classes of Europeans exposed to the same conditions of heat and malaria, presenting three quite distinct rates of sickness and mortality; a fact which indicates the existence of other causes of disease, operating with different degrees of intensity in each of the three classes.

Dr. Falconer considers excess of heat and excess of moisture as among the irremovable causes of disease in India, and as those which tell most upon the health.

Dr. Colvin Smith attributes the largest amount of injury to a malarious climate. But, then he adds to this, as of equal importance, intemperance and syphilis; and he says, "these are the three things which generally break up the constitution of a man in India."

Dr. James Bird says that pure liver disease, and that accompanying dysentery, are produced by the predisposition caused by a high temperature, followed by cold.

An opinion similar to that expressed by Dr. C. Smith, as to the prevailing causes of disease, is entertained by Dr. John McLennan, who attributes the largest amount of injurious effect on the health of the soldier to climatic influences, intemperance, and sexual disease.

This evidence, which contains the opinions of men of great experience, implies only that these causes, all but one of which are removable, lower the stamina of the body, cause ill health, and predispose to, and under certain conditions induce, disease. But all the witnesses admit at the same time the existence of other very potent causes which, although not incidental to the climate, are nevertheless rendered of greater importance by it. Even with regard to the presumed irremovable cause, malaria, Dr. James Bird states that miasmatic influences are removed by hygienic measures, in India as in England; and he cites, as a strong proof of this, the case of Batavia, in which, by the effects of Dutch sweeping, cleaning, and draining, the most deadly city in the world had become a healthy and agreeable residence.

He states that miasmatic emanations had been removed both at Cadiz and Gibraltar, and he sees no reason why similar results should not be obtained in India.

All the other causes of mortality assigned by the various witnesses belong to the class which, in this country, are considered as removable. We shall state these generally

and discuss them afterwards in detail. Some of them are connected with locality, others with defective barrack accommodation, and the remainder are attributable to bad habits or exposure on the part of the men.

Sir Ranald Martin states, in regard to epidemics, “of all the causes which go to foster and maintain epidemics, the ill selection of localities, the structural defects as to ventilation, drainage, cleanliness, and the personal habits of the soldiers, are the important questions.”

With reference to outbreaks of cholera, Dr. John McLennan states that this disease is known to have a certain connexion with damp and moisture, imperfect drainage, impure water, improper articles of food, close badly-ventilated sleeping places, and generally with what may be termed a bad sanitary state.

Referring to dysentery and cholera, Surgeon-Major Grant says that, in his experience, the most influential cause of these diseases is overcrowding in barracks; and that in gaols he has observed the most appalling mortality from bad air. Even at hill stations, far removed above the influence of malaria, he attributes the prevalence of diarrhœa to neglect of ordinary sanitary arrangements. He also says that bad water is a common exciting cause of cholera in India.

Dr. James Bird states that—

“Diarrhœa, dysentery, and fevers have prevailed, and have been attended with great mortality” at stations at which he has served, “from want of due precaution in the selection of sites. Cholera, as an epidemic, appears mainly to owe its development and origin to miasmata, favoured by elevated temperature, and peculiar atmospheric conditions of climate; this development being greatly aided by preceding established conditions of filthy endemic situations, badly-constructed and ill-ventilated habitations, unhealthy articles of food and drink, producing predisposition to disease, aided by unhealthy trades, and depraved moral conditions of vice and poverty. The other diseases are mainly local, and miasmatic in their origin.”

The evidence shows that the local causes of epidemic disease in India are precisely the same as those which exist in this country, aggravated by a higher temperature and by the presence of malaria.

Personal habits, as before stated, have more to do with health in India than at home. Many indulgences, which are comparatively innocuous in a cold climate, especially those connected with diet and regimen, become of serious consequence to health within the tropics.

Sir John Lawrence states that both men and officers are careless in these respects, and that their habits of life are very inimical to health; that the habits of a cold climate are extremely pernicious in India, and soon produce bad health and an increased mortality; that the men eat too much animal food, eating it sometimes twice or three times a day, irrespective of season or temperature; and that he thinks the Government might try to induce the men to use more vegetable diet in the hot weather.

Dr. Maclean considers that the habits of life of the European soldiers are very unfavourable to health, for undoubtedly they are very intemperate, and they suffer much from ennui and want of occupation.

Referring to the sources of disease within the tropics, Sir A. Tulloch says that he is disposed to regard idleness as one of them, and that the men would be more healthy if worked more.

And Staff Surgeon McCosh states that in his opinion soldiers in India do a great deal too little for themselves; that anything that would keep them out of idleness and out of the grog-shops would be conferring a benefit upon them, and that they are never so healthy as when undergoing the fatigues of a long march.

The causes of disease, described very generally in this evidence, are those connected with the selection of stations, the sanitary condition of stations, barracks, and hospitals, bazaars and native towns, the condition of the water supply, intemperance, and venereal disease, diet, occupation, and the want of means of instruction and recreation.

We now proceed to consider each of these in detail.

SANITARY CONDITION OF STATIONS, TOWNS, AND BAZAARS.

Important information regarding the topography and diseases of all the stations will be found in the stational reports, and in the abstract. We refer to these for details, and propose to introduce here a few examples only, illustrative of the general condition of stations.

Many of the stations occupied by British troops are either within or close to cities and towns, the inhabitants of which are decimated periodically by fevers, cholera, diarrhœa, and dysentery, connected with the most obvious local causes. The troops occupying this class of stations are exposed to any sanitary defects incident to the civil population, and suffer more or less from the same diseases.

CAUSES OF
DISEASE.

99.

1221.

4483, 4.

4523.

3589.

2941.

2942-6.

2354.

5551.

2686.

SANITARY
CONDITION, &c.

SANITARY
CONDITION, &c.

2233.

Other stations, known to be unhealthy, have been selected from time to time apparently for military or political reasons.

Referring to those in the Madras presidency, Deputy Inspector-General Maclean states that they were selected without any special regard to medical considerations, and that many of them were occupied merely because they happened to be the spots where the troops first pitched their camps on taking possession; that the nature of the soil, the water supply, and malaria were never thought of.

6, 7, 8, 9.

Sir Ranald Martin says that stations have been selected without care; that no station he has ever visited was exempt from malarious influences; that the soils are damp, the situations low and ill drained, the surface irregular, the ground jungly, and some of the stations subject to flooding.

1024.

Captain Nicolls, of the Madras Engineers, describes the stations on the plains as all of one description, the country being flat, with very slight undulations, just sufficient to carry the water into the nullahs; the hill stations being situated on a ridge or spur of a hill.

6.

Many of the old stations have proved so extremely unhealthy that they have had to be given up, after having entailed a great loss upon the service. More care has been bestowed of late years in the selection of new stations. Some of these, Sir John Lawrence states, have been extremely well selected; some very badly selected; there is a great difference in them.

2924.

The difference as regards health is due to the nature of the country and to the position and comparative elevation of the station itself. The sea-side stations are, of course, all at or very near the level of the sea, and have the great advantage of the sea breeze; but this advantage has been neutralized by a site having been chosen close to some muddy tidal estuary, as at Vizagapatam; or the sea breeze has been cut off from the barracks by a high wall, as at Madras, until the wall was lowered by Sir Charles Trevelyan. The low country stations in the Bengal presidency are only a little elevated above the level of the sea, following in this respect the level of the river. Fort William, one of the largest and most unhealthy of the stations, although 67 miles in direct distance from the sea, is only 18·16 feet above its level, and only one foot above mean high water in the river. Dum Dum is 84 miles from the sea. It is 18 feet above mean tide level; but during the S.W. monsoon it is only two feet above the level of high flood tide; at this time the ebb and flow of the tide is visible in the ditches at the station. Berhampore is 76½ feet above the level of the sea, but it is three feet below high water mark in the river. Allahabad, an unhealthy station, situated at the junction of the Ganges and the Jumna, is 368 feet above the sea, and about 40 feet above the surrounding country.

The N.W. stations are at a considerably higher elevation. Rawul Pindi is about 1,500 feet; and the large station of Mean Meer is 1,128 feet above the sea.

Secunderabad, in the Madras presidency, has an elevation of 1,800 feet. Bangalore, which is the highest of the larger stations in India, is 3,000 feet above the sea level. Belgaum, in the Bombay presidency, is about 2,200 feet, and Poona is 1,800 feet above the sea.

Many of the most important stations are thus at a healthy elevation above the sea level, if the sanitary condition of the station were determined by this element. But they are all more or less deficient in another element of perhaps greater importance, viz., their relative level as regards the surrounding country. Generally speaking they are little if at all raised above that level; and sometimes, as is the case with the highest of them, Bangalore, part of the station is actually below that level. Some of the most unhealthy stations are close to river banks.

In the great majority of stations, water is found at a short distance only below the surface. The only means of arriving at an estimate of the depth is by the wells; but as water is being constantly drawn from them, they do not afford a very accurate indication of the water level in the subsoil. Thus at Fort William the water level varies in depth from 12 feet in the dry season, to 2 feet in the wet season, although the ground is at all times close upon the water level in the river. At Dum Dum the water level in the dry season is at a depth of 9 feet, and during the wet season of one foot from the surface. At Kirkee, the depth is at 33 feet in the dry and at 19 in the wet season. And so of the others.

As might be anticipated, the soils and subsoils vary very much. A few stations are situated on dry sandy soils. In others the underlying rock comes close to the surface. But in the majority the soils are more or less retentive of moisture, and charged with decaying vegetable matter, and damp.

The natural result of this in a warm climate is the production of malaria. It is by no means certain, however, that this malaria exists equally over extensive tracts of country. There is on the contrary reason to believe that, like every other local cause of

disease, it is much more intense in some districts than in others. Some years ago, a committee was appointed to examine the effects of irrigation on health; and one of the most important facts elicited by the inquiry is stated by Deputy Inspector-General Dempster to have been the close proximity of some of the worst and some of the best localities. And applying this discovery to such stations as Cawnpore, Kurnal, Dinapore, Delhi, Ghazeepore, he says that nearly all these stations are irremediably vicious; but, nevertheless, he believes that good localities exist at no great distance from every one of them.

Although, as has been already stated, more care has recently been bestowed on the selection of stations, this important duty is not conducted on any fixed principle. No specially competent class of officers has been appointed for the purpose. A Committee is usually constituted of a commanding officer, an engineer, and a medical officer, with certain additional members, who proceed to make the necessary inquiries, and report. No doubt the intention is to obtain the best practical advice and opinion, but very special knowledge is required for such a purpose, while the consequences of mistake may be so disastrous that any mere chance selection of officers for the duty should be avoided. The Committees should either be constituted entirely of men of known competence; or else certain officers specially conversant with the whole subject should be selected for this particular service, and placed as *ex officio* members on all Committees. Officers should never be taken for such a service by roster; nor should officials on the spot be entrusted with the duty merely because they happen to be there.

The selection of new stations should in short be considered as one of the most important sanitary duties, and should be a recognised part of the sanitary service of the army.

We next proceed to consider the sanitary condition of existing stations as it bears on the health of the troops. But in doing so it is necessary to include the sanitary state of native towns and bazaars, because not only is a part of the soldier's time spent in these places, but the mere fact of their proximity to European barracks must necessarily exercise an injurious influence on the healthiness of both barracks and hospitals, if the native dwellings are in an unwholesome condition. It is indeed impossible to separate the question of health, as it relates to troops, from the sanitary condition of the native population; especially as it regards the occurrence of epidemics, which, whenever they occur among natives, indicate a condition of matters dangerous in the highest degree to the troops in the neighbourhood.

Referring to this subject, Sir Ranald Martin says, that when he was surgeon of the native hospital at Calcutta, he was always aware of the advent of cholera 15 or 20 days before it attacked the European population, by its prevalence among the natives, and that this was one of the reasons which led him to suggest sanitary improvements for Calcutta. The bad sanitary condition of this large city is indeed so notorious that Deputy-Inspector General Longmore who acted as sanitary officer at Calcutta during the mutiny, does not consider it necessary to describe it. He merely states that, as regards the chief part of the vast area covered by the city, that inhabited by the native population, the pestilential condition of the surface drains and yards, and many of the tanks among the huts and houses, would not be credited by any one who had not been among them. The influence in certain winds of these places is quite perceptible at Fort William, although there is a very good esplanade between the fort and the bazaars. He has no doubt that there would be much more mortality among troops, were it not for the esplanade.

This great city has grown up by degrees in the entire absence of any efficient sanitary supervision. There has hitherto been no proper drainage. The water supply has been defective and bad; and the houses are much overcrowded.

The sanitary condition of the town of Madras, as described by Sir Charles Trevelyan, is as bad as that of Calcutta. The soil upon which the city stands is white sand. The river Kooam, which passes through it, is a tidal estuary, receiving all the town drainage along its course; but as the mouth of the estuary is silted up for most of the year, it becomes a foul stagnant open cesspool, which is washed out once a year by the floods. Sir C. Trevelyan describes the drainage as being "extremely defective." There are, he says, plenty of drains, in one sense too many, for they are offensive in the extreme, because there are no means of propelling the offensive matter and getting rid of it. The drainage is effected by open drains "of the most offensive and scandalous description." There are no means of flushing them, on account of deficiency of water; and such is the offensive state of the general atmosphere from these defects, that a high wall is maintained between the Government House grounds and the body of the town, in one of the most thickly populated portions of the town, expressly for the purpose of

5314.

2138, 2146.
2147.

5303.

5306.

5305.

5309.

SANITARY
CONDITION, &c.

excluding the noxious smell that may issue from the drains, thereby excluding the sea breeze, and preventing the improvement of the adjoining part of the town, and thus greatly aggravating the evil.

5315, 5308.

The water supply for domestic use is likewise "extremely deficient," and it has become partially deteriorated by offensive matter from the drains. Sir C. Trevelyan states that the introduction of a pure water supply is an extremely popular subject, and extremely desired by the people; and that it is a matter of urgent necessity, on the commonest principles of duty, to provide it. He further states that the health of European troops must be more or less affected by those circumstances, and that he had proposed that the health of the European population of Madras should be improved (not by building a wall of separation between them and the natives, but) by powerfully acting on the conditions of health of the native population itself.

5317.

5310.

5314.

As to Bombay, the evidence contained in the Station Report is of a similar character. The population is between 400,000 and 600,000. The drainage is very defective, the native houses generally in a filthy condition, with much ordure within their precincts, which has been accumulating for years. Nuisance is experienced in the town barracks from the wind blowing over the densely-packed houses, and also in Fort George from butchers' shambles and public necessities about half a mile distant. Cholera follows its usual law of propagation in Bombay as elsewhere. Dr. John McLennan states that those natives living in the lowest, worst ventilated, and dampest part of the island, particularly in such places on the shore, suffer most. He also informs us that cholera and bad fever at one time frequently prevailed in the European crews of vessels undergoing repairs in the dockyard, a close, badly-ventilated situation, not far from the opening of a drain running into the harbour.

1221.

Dr. Haines shows that in 1861, the 16,200 deaths* among the population of Bombay were chiefly by zymotic diseases; thus, 1,600 deaths were by small-pox, 1,251 by cholera, and 7,024 by fever.

After calling attention to the insular situation of Bombay, its invigorating sea breeze, excellent water supply, and the abundance of open space for recreation, he goes on to add that when the streets are widened, when the water supply is rendered accessible to all, and when house drainage, and an effective system of sewage have been established, "there is no reason why Bombay should not rank among the very healthiest of tropical cities."†

The water supply at Agra is bad, and cholera has been fatal.

Delhi before 1857 was said to be unhealthy. Sir Charles Napier,‡ however, held that it might, perhaps, be made as healthy as any part of India. "In most parts of India," he says, "the effects of man's imprudence are attributed to climate! If a man gets drunk, the sun has given him a headache, and so on. Every garden at Delhi, if not kept clean, becomes a morass; weeds flourish, filth runs riot, and Delhi is unhealthy. The result is, that the grandest city in India has the name of being insalubrious, though it does not appear to have any natural cause to produce sickness; no natural swamps which would require vast labour, science, and sums of money to overcome. Nothing evil, in short, that does not appear to be of man's own creation."

The natural advantages of Bangalore are very considerable; but it has nevertheless afforded a high sick and death rate, and the population, civil and military, have suffered severely from dysentery and cholera. During the period included in the return from this station the barracks were bad, and their "conservancy," in the opinion of Inspector General Macpherson, worse. The natural drainage from the ridge on which the cantonment rests is good; but as it is not properly taken advantage of, the surface filth finds its way into the tank, which, during the dry season, supplies the dense native population with water. "Every obstacle," the Commander-in-Chief Sir Patrick Grant adds, in a note, "has been thrown in the way of procuring a copious supply of pure wholesome water, but it is hoped they are now (in 1860) in a fair way of being overcome."

Inspector General Macpherson further notices that the native population of Trichinopoly exceeds 100,000; that the streets are clean; but that the "environs of the military cantonments are resorted to by the natives for the purposes of nature," giving rise, "by the excessive accumulation of surface filth, to offensive odours injurious to the public health."

Evidence of a similar kind might be adduced with regard to all native towns near military stations; but this brief statement of the sanitary defects existing in the seats of

Stational
Report.

Report in
2nd Vol.

* 10,559 bodies were buried, 4,736 burnt, and 905 exposed to carrion birds.

† Fourth Report on Deaths in Bombay, by Rob. Haines, M.B., p. x.

‡ Sir Charles Napier, Defects of Indian Gov., p. 271.

government of the three presidencies and at two or three of the more important stations is quite sufficient for the purpose we have in view.

It is satisfactory at the same time to be able to state that Bombay has recently been provided with an excellent water supply, and that extensive works of drainage have been undertaken at Calcutta.

In all native towns there is some system of cleansing and removing nuisances in existence; but this, though indispensable as far as it goes, constitutes only a small part of the sanitary improvement required. There can be no doubt that well-considered measures of water supply, drainage, paving, cleansing, and general construction in these towns would be attended with most beneficial results to the health of troops quartered near them. And as regards the native population, we concur in opinion with Sir C. Trevelyan, who says, "I consider that not only the preservation of life and health is concerned, but the strength and comfort and general efficiency of the population are involved; they would be better and abler men, women, and children for all the purposes of life, if the average standard of mental and bodily vigour were improved by the removal of these local causes of a low state of health."

5307.

Every military station in India has its bazaars, mostly in close proximity to the European lines. They consist of huts or houses arranged on no general plan, and without any regard at all to sanitary conditions. They have grown up anyhow, and have increased with the bazaar population, which always bears a very high proportion to that of the European troops at the station; e.g., Bangalore, already referred to, has accommodation for about 1,700 European and 2,600 native troops. The native population within the cantonment is 124,000, three-fourths of whom live in the bazaar close to the European infantry barrack. There has hitherto been no limit to the proximity by which these large native populations may approach European barracks, nor to their position as regards prevailing winds. There are no regulations as to the general arrangement of the houses, the width or direction of streets, drainage, or water supply. The habits of the natives are such that, unless they are closely watched, they cover the whole neighbouring surface with filth; and if there be any ravines or pits in the neighbourhood they convert them into dangerous nuisances. There are generally no public necessities. There are often open cesspits among the houses. The surface drainage sometimes flows into tanks, from which the water supply is derived. Surface cleansing and removal of nuisances are enforced with more or less efficiency by the bazaar magistrates, but, in the absence of both paving and efficient drainage, it is impossible to effect either object satisfactorily.

Stational
Reports,
passim.

Sir R. Martin describes the cleansing and drainage of bazaars as quite deficient, and recommends systematic medical police arrangements for the purpose.

52-3.

Deputy Inspector-General Stewart states that the natives generally retire to neighbouring ravines, where these exist, and that there used to be, generally speaking, no proper police to maintain cleanliness.

645.

Sir Proby Cautley gives the following account of the bazaars at Cawnpore:—

3906.

"To give the Commissioners an idea of the state of these bazaars, I may mention that the natives build their huts entirely of mud dug out of holes as near as possible to the place where they build. In the Cawnpore bazaar I came upon ponds full of black mud and all sorts of filth, and the whole place was utterly unventilated, which was a very remarkable illustration of how ill-health was produced, not only in the immediate neighbourhood, but all round the place."

He states that the practice of pond-making, as a receptacle for refuse matter, is common to every town bazaar in India. They dig the mud for the huts close by, and do not fill in the hole again. This hole serves to receive all the filth of the town, where it remains exposed to the sun. As a bazaar becomes more populated it becomes less ventilated, and in time a very serious nuisance.

3907-8-9.

The Reports from the Stations confirm these general statements given in evidence, and show that in time past bazaars have been neither more nor less than native towns of the worst class, which have grown up in and around military cantonments, without any suspicion having been apparently excited, in the first instance, as to their probable influence on the health of the troops.

The bazaar police is more efficient in some stations than in others, so that all bazaars do not present the same defects; and the regulations are considered to be very good, as far as they go, provided they are efficiently carried out.

3132.

The evidence on the structure and arrangement of stations shows that there is a considerable difference among them in these matters. The older stations are all more or less defective in many most important points. Sir R. Martin describes the arrangements of barracks and hospitals, with which he is conversant, as very deficient. He says that

13, 19.

SANITARY
CONDITION, &c.

there has been a great neglect of the means of cleansing, and that the drainage is almost universally insufficient for the purposes of health.

In many of the older stations the buildings are so placed towards each other that the free external movement of the air, a condition essential to health in India, is obstructed so as to render the air positively stagnant. Sometimes high walls surround the buildings so closely as to produce the same result.

This class of defects, though existing more or less in most European stations, is most common in native lines, where the huts are often placed as close together as they can stand.

In new stations, such as those in the Punjab, at Umballa and Poona, there is more regularity of structure, and the different barrack buildings are sometimes arranged *en échelon* to catch the prevailing winds.

1065. But the older stations are very irregular, as *e. g.*, the barracks at Madras, which consist of closed squares of buildings, at Cawnpore, Dinapore, &c., where the buildings are arranged so as to make good ventilation impossible.

In fortified stations the barracks are often very much crowded together, and some of them are in bomb-proofs, hardly fit for human habitation in such a climate.

DRAINAGE OF STATIONS.

DRAINAGE OF
STATIONS.

Stational
Reports.

1698.

3105.

3905.

3912-17.

3928.

2922.

1697.

All the stations are surface-drained with more or less efficiency, but with very few exceptions this is the only form of drainage which exists at any Indian station. The surface drains are either mere cuts in the ground, or they are formed with brick or some other material; and are led to an outlet, generally a cesspit, a ditch, or a ravine or nullah, where such exists. But very often the water is conveyed only to a certain distance from the barrack, and left to provide an escape for itself. The whole procedure is that usually adopted for camps, and is wholly unsuitable for permanent stations. Colonel Greathed states, as the result of his experience, that when there is a heavy fall of rain, it is very commonly not carried off as well as it might be. Even this surface drainage is executed on no general plan. Sir Proby Cautley states that one reason of the defective condition of the surface drainage is that the drainage of cantonments is generally done in detached bits, instead of being carried out comprehensively. He states that the want of drainage has been a general defect, but that latterly great improvements have been effected; that he attaches great importance to a proper system, and that, were it carried out, he is of opinion that such places as Cawnpore, Delhi, Kurnal, would be comparatively free of disease. The annual mortality at Cawnpore has been as high as 91 in 1,000, chiefly from fever, dysentery, diarrhœa, and cholera; which Sir Proby Cautley states, has been due to the condition of the station, the want of drainage, and the filth in the bazaar. And on being asked whether he considers Cawnpore a fair illustration of the general defects of drainage in India, he replies, "A very good illustration," admitting at the same time that it is perhaps an extreme one. Sir John Lawrence considers that drainage has not been cared for so much as it ought, although it has been improved considerably of late years. The flushing of the surface drains is generally left to periodical rains, or they are swept out by the native establishment.

The abstract of stational reports gives information as to the condition of the drainage at most of the stations.

So far as we can learn from these reports, there appears to be no method of conveying away the roof water from buildings, which consequently sinks into the ground where it falls, and accumulates moisture close to the foundations of both barracks and hospitals. There is no such thing as subsoil drainage carried out at any station. The rain-fall no doubt partially runs away by the surface drains; but the great bulk of it, amounting to many feet in depth during each rainy season, goes to saturate the subsoil with water. The conclusion of the rainy season is generally attended with a great increase in epidemic diseases. And, inasmuch as wet or damp subsoils are well ascertained causes of this class of maladies, even in cold climates, in such a climate as India the neglect of subsoil drainage within the area of stations is doubtless one great cause of increased sickness and mortality. Indeed the effect of undrained subsoil on health is well known in low-lying stations throughout India.

3426-30.

The floors of barracks and hospitals are often damp from this cause. Dr. James Bird cites, as an illustration, the case of Colaba, which was not sufficiently drained; the barracks were extremely unhealthy, and about 85 per cent. of the sickness arose from fevers. The floors rested on the ground, and water could be found within three feet of the surface. Such sites, he continues, produce a large amount of sickness, and a large amount of mortality generally.

1672.

Major-General Goodwyn mentions the case of Berhampore, in which the barrack

square was pretty well drained; but the marshy state of native lines and of the parade ground, was a cause of unhealthiness.

In regard to Berhampore also, Dr. George Wallich says, "There is one part of it so unhealthy that Europeans will not live in it. One house has the name of 'Fever Hall;' and as certainly as any one goes to live in it, he takes fever."

The reason assigned for the absence of any but surface drainage is the want of sufficient fall at many stations; but if there be not fall enough to enable the subsoil to free itself of moisture, the ground is certainly unfit for occupation by troops, unless the water were pumped up and removed by machinery. All stations are not equally deficient in this respect; there must be many with fall enough for every purpose towards an available outlet.

There is, of course, no drainage for conveying away any of the fluid refuse of stations. In the majority of instances, this either passes off by the surface drains, or it is run into shallow cesspits, from which it is removed by hand, and carried or carted away. Sometimes the fluid refuse is passed into deep cesspits, at no great distance from the barracks, with the view of its draining into the subsoil; the water from the subsoil being, at the same time, the source which supplies the wells.

Neither latrines nor urinals are drained. For all the purposes to which drainage is applied in this country, as a means of preserving health, it is unknown in India. Our cities and towns, as well as our home stations, have been or are being drained, because the absence of drainage is well known to be fatal to health; while in the hot moist climate of India, no effectual step has been taken as yet to introduce this indispensable sanitary improvement.

The present surface drainage is altogether insufficient for conveying away fluid refuse. The drains are very liable to fall out of level, and to accumulate foul water at points dangerous to health. Were they ever so perfect in construction, they could only remove that part of the rain-fall which happened to flow into the surface drain along its line; but this would leave the subsoil charged with water and organic matter washed into the surface, the tendency of which is to render the ground more unhealthy (by the generation of malaria) than it would otherwise be, and, in course of time, to make it uninhabitable.

The evidence given before us, as well as the stational reports, when carefully considered, all go to prove that the drainage of Indian stations on a well-digested plan to suit local circumstances, is a work of urgent necessity for improving the health of the army.

IRRIGATION.

Considerable discussion has arisen as to the effect on health produced by works of irrigation carried on in the vicinity of stations. To increase the productiveness of dry soils the waters of rivers are conducted over certain parts of the country in canals, large enough for inland navigation, and the supply is let to cultivators, who are permitted to draw and apply it in their own way. In some places water for irrigation is collected in reservoirs. The land itself being undrained, can only take a certain definite quantity of water without producing malaria; but the natives give little consideration to this, and they flood the surface. The influence on health of this method of irrigation has varied in different districts of India. In the Madras Presidency, both Major-General Cotton and Deputy Inspector-General Maclean, state that no injury to health has been observed even among Europeans. In the Bengal Presidency, careless application of water is attended by prevalence of periodic fevers and spleen disease, which has led to the prohibition of irrigation within a considerable distance of military stations,—five miles, as regards rice cultivation. A committee was appointed to examine into the alleged unhealthiness of the process. They found that whenever the soil was of very tenacious character, and too much water used and allowed to stagnate, disease showed itself. There is no evidence in any of the Stational Reports of the production of fever by land under irrigation; and so far as concerns the native population, the advantages of a water-supply for agricultural purposes are so very great and so intimately connected with their well-being, that the question which arises is, not whether the irrigation should be discontinued, but how it can be continued without injury to health.

In Southern India it appears to produce less injury than in Northern India, but wherever water for irrigation is applied in any quantity, subsoil drainage is indispensable both for health and productiveness, and ought always to accompany works of irrigation.

WATER-SUPPLY.

The water-supply of stations, as well as of towns, is derived from three sources,—tanks, wells, and rivers.

DRAINAGE OF STATIONS.

5840.

1032.

Stational Reports.

IRRIGATION.

2044, 2320.

3971.

3967--3992.

WATER-SUPPLY.

WATER-SUPPLY.

Stational Reports.

In low flat districts, and in deltas, tanks are chiefly relied on. The supply at up-country stations is mainly derived from wells of from 20 to 30 feet, or more, in depth.

River-water is used where a river happens to be the most abundant and accessible source. The universal method of distributing the water is as follows:—It is drawn from the tank or well by dipping skins or other convenient vessels, and it is carried by water-carriers (bheesties) from its source to the barrack, and there emptied into such receptacles connected with cook-houses, ablution rooms, &c. as may have been provided for its reception.

At some of the larger stations the water is conveyed by bullocks. For drinking purposes an ordinary wooden barrel or jar is provided; the water is poured from the water-skin into it, and the water is drawn from the barrel by dipping.

It will be seen that the entire method of supply for permanent stations is the same as that usually adopted for armies in the field.

However requisite it may be to adopt it under the pressure of necessity, it is obviously unsafe to trust to such a method of supplying troops with one of the prime necessities of life at all other times.

Somewhat similar methods have always been in use among uncivilized or imperfectly civilized populations. But in proportion as civilization has advanced, such rude and unsafe expedients have been relinquished; and greater attention is now paid both to the source from which water is derived and to the method by which it is distributed for use, especially in towns.

4754, 4796. A considerable amount of useful and valuable evidence has been laid before us on this most important subject by distinguished chemists, two of whom are officers of health in the metropolis, and specially conversant with the whole subject. One of these gentlemen, Dr. R. D. Thomson, who has visited India, describes the state of the Indian tanks as “quite shocking.” He states that he would certainly not be satisfied if the population of his district (Marylebone) had no better water sources than those at the command of the Indian army, that, indeed, he would consider them very dangerous, and that he would expect a “very much higher” rate of mortality in the parish if the water-supply were of a similar kind.

4798.

Dr. Letheby, Officer of Health to the City of London, gives evidence to the same general effect. He is asked:—

“4671. Supposing in an epidemic country you have superficial wells dug in a soil containing a large quantity of organic matter, and suppose the mode of drawing that water is by throwing buckets into the well, drawing the water up, spilling part of it upon the surface, part of the water being washed into the well again, and suppose that the water so drawn up is carried in skins, and distributed to the consumers, what do you think is likely to be the sanitary result of such a proceeding?—That I could hardly speak to, except from an examination of the water, but I should say the mode of distribution is very objectionable, and is likely to give the water organic impurities, and to make it, indeed, worse than it originally was. The soaking of the water from the soil back again into the well, and the redistribution of it in skins, must be a means whereby an additional impurity must be given to the water independently of that which was in it before.

“4672. So that in a country where epidemic diseases prevail you would object, in a sanitary point of view, to that mode of distribution?—Yes, I should object to that.”

In examining the objections against the present system of water-supply more in detail, it appears, that, with very few exceptions, the water from no source in India has been submitted to chemical analysis. In the exceptional cases given in the reports from the stations, the results of analysis, so far as they go, are by no means satisfactory as regards the purity of the supply.

5717. At certain up-country stations, the well water contains a large amount of salts; and a similar excess of saline matter is observed in tanks, rivers, &c., during dry weather.

There is every reason to believe also that many water sources contain a large amount of organic matters, animal and vegetable; but in scarcely an instance is there any qualitative analysis given. The quantitative analysis of water from the wells and tank at Secunderabad, however, gives results of an extraordinary character. This station (which has suffered so severely from bowel diseases) is supplied with water from six sources, containing from 10 grains up to 38, 44, and in one instance 119 grains of solid matter per gallon; and of this amount it appears that organic matter of some kind or other exists to the extent of from above $2\frac{1}{2}$ grains to 8, 11, and apparently, in one instance, up to 30 grains per gallon.

For all practical purposes, as regards the health of troops, the composition of the various water sources in stations may be said to be either unknown or too imperfectly known to be of any real use.

All we can gather from the evidence and the stational returns, is that some waters are considered good, some tolerably good, and some not so good.

But in the selection of sources, it seems not to have been considered necessary to make any special inquiry on the subject.

In some exceptional cases the water-supply is stated to be peculiarly defective as to its purity, and "some very good wells become dangerous from disuse."

Again, it is the result of universal experience that shallow wells, such as those used in India, which receive their water from the rain-fall draining through a soil highly charged with organic matter, always contain a considerable amount of that matter in solution. In ground at a distance from human dwellings the organic matter will be chiefly of vegetable origin. But wherever there is a population on the surface, with neglect of ordinary sanitary precautions as to surface cleansing, drainage, and especially cesspits or other nuisances, the chances are that the wells will contain a considerable amount of animalized matter. Vegetable impurities in water rarely manifest their presence either by taste or smell. In some most fatal instances the presence of decomposing animal matter in wells has rendered the water containing it apparently more agreeable to the taste.

The extent to which these impurities prevail in shallow wells is much greater than the public is at all aware of. Dr. Thomson has given the constituents of 44 wells or street pumps in the parish of St. Marylebone (having a depth of from 12 to 20 ft.) containing from 42 grains to 133 grains of solid impurity per gallon, the organic matter varying from about 5 to 33 grains per gallon. All of these waters are unfit for use. Dr. Letheby says, in regard to these and other similar wells, "there is no shallow well at all in London which contains pure water." As already stated, the cause of this impurity is to be sought for in the existence of organic matter in the soil.

An example of this in India is given by Colonel G. Campbell, in which certain wells at Lucknow became contaminated on account of a number of elephants having been buried near them. The recognized impurity of the water in this case led to its disuse. But generally, as stated by Dr. Letheby, these impure shallow well waters look clear, fresh, and rather inviting, because of the presence of carbonic acid, which gives them a sparkling quality, and because of their temperature and their slightly saline taste caused by the presence of nitrates produced during the process of decomposition of animal matter.

Dr. James Bird states that the waters of Bombay, drawn from wells, contain a considerable amount of organic matter.

The water of open tanks is exposed to similar sources of impurity. They are dug in soils which have been for ages covered by a rich vegetation. They receive the drainage of the whole of the surrounding area, and during heavy falls of rain, whatever impurities there may be on the surface are washed into the tank, which is in fact the drainage outlet.

Some of the tanks are lined with stone, others are banked with more or less care, and kept free of vegetation. Some of them resemble ordinary horse-ponds; in some instances covered with a minute vegetation which, it is considered, rather improves the quality of the water, by assimilating its dead organic matter. It is the custom to set apart tanks for bathing and washing, and tanks for supplying water for domestic use, cooking and drinking. There is a tacit understanding that tanks of the latter class shall not be used for the former purposes, and sometimes they are guarded. Notwithstanding these precautions, the evidence shows that a large amount of organic matter finds its way into them.

The tanks used by Europeans are generally safer in this respect than those used by natives, but still their purity depends to a very great extent on the state of the surrounding surface, and the water is all more or less stagnant. Sometimes the same tanks are used by European and native troops. The use of stagnant water has by itself been known to occasion ague; but besides this the Indian tanks are, many of them, exposed to pollution from filth, on account of the dirty habits of the natives, described in the evidence of Dr. G. C. Wallich, as follows:—

"5855. Independently of that, the habits of the natives, who defecate all over the surface of the country, must necessarily cause the water in the tanks to become impure?—Yes, it is so; in point of fact the natives have no idea of taking sanitary precautions. For instance, a man will eat and drink and perform his evacuations actually on the very same foot of water, standing in it, or close to it; he has no idea of impurity as long as it happens to be Ganges water.

"5856. The European troops and also the native troops drink the water from these tanks?—Yes; there is nothing else for them, and the same causes will operate with Europeans in an increased degree."

After describing the same native habits, Dr. Mouat states that a heavy shower of rain washes down all soluble matter, through the natural percolation of the soil, and it must find its way into the tanks.

WATER-SUPPLY.

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WATER-
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Speaking of the tanks used by the natives, Dr. Falconer says, that the purity of the water in them will depend upon the washing in of the surface, and upon the nature of that surface. If decayed vegetable matter or animal excreta were thrown out on the surface, and the rain drainage took that direction, the water in the tank would become tainted and unwholesome.

Taking into consideration the habits of the natives, and the general state of the surface near stations and towns, it must be evident that considerable danger to health must arise from the use of tank water.

Such a source of supply is not made use of for any military station at home, or indeed for any domestic purpose. Such water, even in this climate, is considered bad and dangerous, and in such a climate as that of India it is more so than at home.

4564. We next come to consider the probable effect of this condition of the water-supply upon the health of the troops; and in doing so we shall have to be guided to a large extent by the experience obtained in sanitary inquiries at home. Dr. Letheby says on this subject:—

“I think I may say that not only myself but all the officers of health of the metropolis are of opinion that bad water is a frequent cause of disease.

“4565. And that it aggravates some of the diseases?—Yes, there is no doubt of that.

“4566. Do you mean that impure water itself produces disease, or merely that it predisposes to disease?—It does both. I believe, in the first place, when there is a natural tendency to disease, the condition into which the water will bring the alimentary canal will tend to establish that disease, or set it on foot; and that decomposing organic matter, in certain conditions of decay, in the alimentary canal is sufficient, without any other agency whatever, to cause disease.

“4567. So that next to impure air you would rank it as one of the most powerful causes of disease?—I am disposed to think it is before impure air, as being one of the most powerful causes of disease.”

This evidence gives the experience up to the present time.

During all great epidemics popular opinion has pointed out the state of the water as one of the chief causes of pestilence, and modern experience has confirmed this by minute statistical inquiry. The diseases to which bad water peculiarly predisposes are mainly epidemic diseases, affecting the intestinal canal, such as cholera, diarrhœa, and dysentery.

4673. To the use of impure water have also been traced fevers of the intermittent type.

The evidence on these points is conclusive, and extends not only to well water but also to impure river water. During the cholera epidemic of 1848–9 several instances occurred in which nearly every person using water from particular wells was affected with diarrhœa or cholera, and of the cholera cases nearly all died.*

4598. During the epidemic of 1854, of 73 persons who died of cholera in a certain street in the metropolis, 61 had drunk water from a pump, polluted by sewage, while the people
4774. who did not use the water were not so severely visited. A vessel of this water was sent
4771. to a lady at Hampstead, and she was attacked and died of cholera. The water, on being analysed, was found to contain 92 grains of solid matter in the gallon, of which 7·8 grains were organic matter. During the same epidemic the population of Southwark and Lambeth suffered severely from cholera, which was attributed to the state of the water-supply. The affected district was supplied by two companies, one of which gave a comparatively pure water, and the other a very impure one, containing sewage matter from the Thames. The deaths from cholera in the houses supplied by the purer water were in the ratio of 37 in 10,000, while the ratio among those supplied with the
4787. impure water was 130 in 10,000. This special case was the subject of elaborate statistical inquiries made by the Registrar-General's department. Referring to these facts, Dr. Thomson says:—“Therefore I conclude that there were destroyed by the Southwark
“and Vauxhall Company (whose water at the time was impure) 2,500 persons.”

4569. In the same manner as the mortality from cholera has been diminished by the use of pure water has the mortality from dysentery also diminished.

In applying this experience to India it is necessary to point out that the diseases which our home experience has proved to be so strikingly under the influence of the quality of the water are the same diseases which bring so much loss and inefficiency in the Indian army. This fact would of itself lead to a strong suspicion that the water is impure. But it must also be borne in mind that the troops drink a large quantity of water, especially during the hot season, and that bowel diseases are generally most prevalent and fatal in the hot dry weather when the water supply is diminishing and becoming daily more impure from evaporation and want of rain. Sir John Lawrence, in his evidence, states:—

3013. “In India one great point upon which good health depends is the water; our people very seldom look to the water, but the natives always look to the water in choosing a locality.

* Report on Cholera, General Board of Health.

"3014. I believe that the troops drink an immense quantity of water mixed or unmixed?—Yes.

"3015. Therefore it is important that the water should be of good quality?—Yes; I think that there is very great scope for improvement in the selection of sites in that way.

"3016. In England we find that the water has a great deal to do with the mortality in cholera?—Yes; I have seen positions which were considered unexceptionably good by Englishmen, but if you asked the natives about one of them, they would say that it was very bad on account of the bad quality of the water."

In a district where there is a strong predisposition to bowel diseases, whenever even the inorganic saline impurities in the water exceed a certain amount, there is danger to health. The production of diarrhœa by such waters even in Europe is perfectly well known, especially at certain seasons; and the same fact has been observed in India. 5717, 5718. Dr. Mouat has no doubt that in a marshy district, impure water has a tendency to produce diarrhœa, especially when, in a very dry season, the wells, and even the tank water, are more or less loaded with salts; diarrhœa is very rife in those cases, and the same thing occurs from water that is drunk from tidal rivers; for even in the hot season, when the tides are very low, the water is to a certain extent brackish. He states that he accompanied a detachment of sailors to Assam during the mutiny, and the water was all taken in alongside from the river: a most frightful outbreak of cholera occurred within 24 hours after embarkation, and the men traced it to the water distinctly.

Dr. Wallich states that there is a great quantity of impurities in tanks, that the water is "completely" "charged with organic matter," and that the animal organic matter (in the tanks) is certainly a cause of fevers, dysentery, and cholera. But we cannot ascertain that there has been any attempt to estimate the nature and amount of the impurities, or their probable influence upon the health of the army. 5838, 5840
5842, 5843.

It is known that water from marshy districts in this country contains from four to five grains per gallon of vegetable matter, and that it would be considered injurious to health to use such water. 4581.

As regards putrescent animalized matter, Dr. Thomson states that he would consider the presence of "any quantity objectionable" in a country like India, where bowel disease prevails. 4849.

Dr. Angus Smith states that, while three grains of peaty matter could hardly be considered bad in a sanitary point of view, half a grain of putrefying matter "might be intolerable," and that water containing from five to six or ten grains of organic matter per gallon could not, he believes, be drunk, and could not be used at all. 2753-4.

The rude and imperfect method of distribution in use has already been adverted to as an additional source of impurity, which would not be submitted to at any home station.

Dr. Sutherland, in reviewing the whole question in its reference to barracks, says, "We should certainly recommend for our home stations the abolition of the entire mode of supply of water mostly used at the Indian stations, both as regards the source and the mode of collection and distribution." "There has," he says, "been no application apparently of any modern improvement, as regards either the examination of water sources or the means of collecting or distributing water for use for stations, bazaars, or towns." He says that "the present condition of the water-supply is one of the cardinal defects in the sanitary arrangements of India, and that it is unquestionably a predisposing cause of disease, especially during the prevailing seasons of cholera, fever, dysentery, and other zymotic diseases." 5490.

The evidence before us goes to show the necessity of making a very careful chemical investigation of all the existing water sources at the stations, with the view of improving them, either by adoption of precautionary measures for diminishing the risk of pollution, or by selecting a purer supply. Any water sources which are found to be irremediably impure should be at once rejected. The purest water is that which is obtained from primary rocks, such as granite, mica slate, and clay slate, or such as is obtained from pastoral districts. Next in order of purity, but by no means so pure, is the water from agricultural districts, represented by rivers. 4835.
4839.

Deep wells afford good water, if care be taken to protect them from surface impurities, whether percolating through the soil or finding an entrance by the well's mouth. The water of shallow wells, as already stated, ought always to be avoided. 2747.

It is highly probable that a careful chemical inquiry would prove the majority of tank waters unfit for use.

In conducting these inquiries, the same method should be adopted as is followed in this country in supplying towns with water. The degree of hardness, by Clark's test, should be ascertained; next, the quantities of organic and inorganic constituents per gallon, their precise nature, and the amount of each. 2743.

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SUPPLY.

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As illustrations of the beneficial results of this method of procedure, it may be stated, that the impure water sources of the metropolis were abandoned and better water provided, with marked improvement in the health of the population; that a proposal to supply the city of Glasgow with well water was rejected after chemical analysis, and at a great expense, the people obtained a supply, the total impurities in which amount to 2·35 grains per gallon, of which only 0·605 grains consist of organic matter. If the chemical constitution of this water be compared with that of the supply of Secunderabad, already mentioned, a clear idea will be obtained of the great importance of chemical inquiry on such subjects.

It may be useful to state briefly the nature of the improved water sources, together with the methods of distribution which have been adopted of late years in this country. The purest waters are those derived from mountain springs or streams, collected and stored either in large artificial reservoirs in upland valleys, such, for example, as those for Manchester and Liverpool, or in natural mountain lakes, such as Loch Katrine, from which Glasgow derives its water. We have already noticed the small amount of impurity in the Glasgow water. Manchester water obtained from a hilly district contains 3·33 grains of impurity per gallon, of which ·680 grains is organic, chiefly peat. It is found highly advantageous in these cases to bring the water a distance of 30 or 40 miles in iron pipes; and as the reservoirs are at a considerable elevation, the water is discharged by head pressure, and can be delivered by gravitation all over the towns for which it is intended. This, though in the first instance a costly method, is the best and cheapest in the end, because it ensures a constant supply of pure water, and delivers it without the cost of machinery.

In many parts of the country such advantages cannot be obtained; and in these cases wells are dug to a great depth, until water-bearing strata are reached affording water of sufficient purity. Engine power is provided to raise the water into iron tanks elevated to a sufficient height above the ground to enable the town to be supplied by gravitation from the tank.

In other instances, such as the metropolis, water is derived from rivers, and distributed in a similar manner; but its purity cannot be so much depended upon. But even the metropolitan waters are pure when compared with those Indian waters, of which we have an analysis. The total impurities in waters supplied by the Thames companies may be taken at about 20 grains per gallon, of which from 1·24 to 1·76 grains consist of organic matter. Water supplied by other London companies contains a little more impurity.

As regards analysis, it is considered necessary not only to ascertain the comparative purity of a water source at the time of its selection, but periodical analyses are made from time to time, to see that no casual impurity has obtained admission.

In all the improved supplies the water is delivered from pipes to the consumers; a method of distribution which experience has shown to be absolutely necessary for health and cleanliness.

Purity, abundance, and facility of use are the three principles which require to be kept in view; and they are, if possible, of far more importance in India than at home.

It may not always be possible at the Indian stations to obtain purer sources of supply; but there can be always at hand the means of reducing the impurities to a minimum; filtration can be adopted everywhere, on any required scale, and the water obtained free of suspended impurities.

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Of late years scientific methods have been applied even to the removal of organic matter held in solution by the water. A filter composed of bone-charcoal, with peroxide of iron, is found to oxidise organic impurities, so that the water passes through without any perceptible remainder.

It might possibly be practicable to obtain water for certain stations by having collecting reservoirs in hilly districts from which water might be laid on after careful filtration.

Whatever be the source, the water should be laid on to every barrack and hospital directly by gravitation, or, if local circumstances prevent this from being done, the water should be raised by mechanical power, and stored in tanks at a sufficient elevation to enable it to be distributed by gravitation. Any way the present method of drawing and distributing by hand labour should be discontinued for all fixed stations, with the least possible delay. As the rain-fall in India is irregularly distributed over the year, special arrangements are required for collecting and storing it up in the rainy season, or for recovering it from the earth and purifying it.

An abundant supply of pure cool water for drinking purposes is an essential requisite for all barracks. Nothing hitherto has been done in this direction; and we strongly recommend that drinking fountains be provided at all necessary points, both in the barracks and over the stations generally.

CONSTRUCTION OF BARRACKS.

With few exceptions, the barracks in India are constructed on one general model, varying in detail, especially in the dimensions of the rooms and in the number of men they are intended to accommodate. As already stated, in some of the older forts the barracks are casemated, or built in more than one floor; but in the other stations, the model is that of a hut with doors on opposite sides, which are protected by verandahs. In the more recent barracks, the detail has been varied by carrying the centre of the hut to some height above the sides, like a gothic church; the elevated part being supported on arches dividing the room into a centre and two side aisles, with verandahs outside. The beds are generally arranged along the side walls, two and two between the doors. In the simpler form of construction there are two rows of beds in the room; but where the room has aisles there are four or even six rows of beds between the opposite doors, the inner rows of beds being placed with their heads to the piers of the arches. In the most recently constructed barrack in India, the Dalhousie barrack, at Fort William, there are six rows of beds between the opposite doors. The dimensions of barrack rooms vary very much. Among the smallest rooms are those at the new station of Mean Meer, 48 feet long by 24 feet wide and 24 feet high; they are intended for 16 men each, and to give 1,703 cubic feet, and 72 superficial feet per man. The temporary barrack rooms at Hazareebaugh, built on the standard plan, are intended for 100 men each, at 1,080 cubic feet and 63 superficial feet per man; these rooms are 300 feet long, 20 feet wide, and 18 feet high.

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The Secunderabad barrack rooms vary in length from 124 feet to 274 feet; they are from 18 to 24 feet in width, and from 16 to 25 feet high; they accommodate from 20 to 104 men per room, giving about 1,000 cubic feet per man, and from 40 to 56 superficial feet. There is a barrack room at Trichinopoly no less than 1,011 feet long by 18 feet wide and 17 feet high. At Allahabad the rooms are 335 feet long by 22 feet wide and 16 feet high, holding 100 men per room. The barrack rooms at Dumdum, intended for from 30 to 38 men, are about 105 feet long by 22 feet wide and 14 feet high; giving about 1,000 cubic feet, and 70 superficial feet per man.

Probably the longest rooms in existence are those in Fort St. George barracks, at Madras; the lower room is 1,483 feet long by 18 feet wide and 15 feet 6 inches high, and holds 400 men; the upper room is 2,124 feet long by 20 feet wide and 14½ feet high, and is intended for above 600 men; the space per man is 1,000 cubic feet, and the superficial area from 64 to 69 feet. The Dalhousie barracks (already alluded to) at Fort William, contain what is virtually one room on each floor, although it is divided by piers and arches into three breadths, exclusive of verandahs: the length of each room is 287 feet 4 inches, the width 64 feet 5 inches, and the height 19 feet; each room holds 306 men at from 1,500 to 1,600 cubic feet, and from 79 to 85 superficial feet per man.

Nothing can be simpler than the hut with its four walls, roof, and verandahs, which is the model on which most of the Indian barracks are constructed; but in the majority of cases it has been so used as not only to lose its advantages, but to become an unhealthy model of a barrack. An essential condition of every barrack room is that the air in it should be as pure during the night as the air outside; but it is impossible to ensure this if the rooms are above a certain size, and contain above a certain number of men. The healthiest of all sleeping rooms are those which, like the huts of the native troops, contain one or two people, simply because they are so easily ventilated. Whenever the number of inmates exceeds 20 or 30 per room it is practically far more difficult to ensure fresh air, and beyond that number it soon becomes impossible. Sad experience has proved that long rooms, like passages, with 100 or more persons sleeping in them, may become highly dangerous during epidemics, and absolutely pestilential if occupied by sick. The reason of course is that the direction which the foul air may take in the room depends on accidental circumstances, not under control, which may lead to its being accumulated at one end of the room, or over one group of beds. This danger may be incurred at any time with long rooms, even if there be no more than two rows of beds; but when other two rows are added, or, as in the case of the Dalhousie barracks, other four rows, a form of construction is introduced only to be kept healthy by the exercise of greater care than is ever likely to be bestowed on the subject, and by very large sacrifice of space per bed.

Defective as the barracks at home stations have been shown to be in some important points, they certainly possess one great advantage over those in India. The rooms rarely hold more than 10, 15, or 20 men. The windows (at least, in the infantry barracks) are generally on opposite sides; but where there are two rooms in the depth of the

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building, with openings through the partition walls, such barrack rooms are by no means so healthy, although they may have a thorough draught, simply because the construction enables four rows of beds to be placed between the opposite sides of the building. If an error in construction such as this, even with a small number of inmates, exercises an appreciable influence on health in this climate, it must, of course, be far more prejudicial in India, especially in rooms containing from a quarter to half a regiment.

The influence exerted on the health of troops by the large size and construction of barrack rooms in India has not passed unobserved. There is a general impression that great constructive improvements are required.

5645. Sir A. Tulloch states, as the result of his experience, that a very great advantage is likely to be obtained by having separate buildings each for a limited number of men, instead of their all being in one barrack; that they would be much more likely to be healthy in small buildings holding 10 men each; that there would be less risk of disturbance and of the spread of disease.

2906-8. Sir John Lawrence, while stating the great improvement recently made in barrack building, says that the only defect he ever saw is, that the barracks are too large, and contain too many men; that, instead of building a barrack for a whole company, it would be better to build it for a half or a quarter of a company. He considers the smaller barracks much safer in the event of an epidemic appearing, and that small barracks are better for the men, both morally and socially.

2380. Deputy Inspector-General Maclean gives the following testimony on this point:—

Are you generally in favour of isolation, and of putting the soldiers in separate dwellings, or in smaller barracks?—I am of opinion that they ought to be all in separate buildings. I think that the system which now prevails in India of erecting costly palaces for troops is one of the most unfortunate mistakes that was ever made, because in the first place, the barracks are so costly that the Government grudges the space required for the men; and I am quite sure that if such barracks were built as Colonel Durand knows were erected at Moulmein, detached bungalows, well raised from the ground, and well ventilated with roof ventilation, the health of the troops would be enormously increased, and the Government would save an immense sum of money.

2385-6. He further states that the natives in India never live together in large dwellings; that epidemic diseases are very apt to run through large barracks; and that in barracks of two floors, the lower floor cannot be ventilated.

5490. Dr. Sutherland (who is a member of the Commission for improving Barracks and Hospitals), states that it is impossible to ventilate efficiently rooms with 100 or more men; and that quarter-company barracks, *i.e.*, separate houses for 20 or 25 men, are about the limit to which we should go in this mode of construction in India.

Many of the newer barracks have double verandahs, a construction which has the two-fold disadvantage of rendering the ventilation more difficult, and of enabling the inner verandah to be appropriated as extra sleeping space. The double verandah is at the same time an unnecessary cost.

One very important point as bearing on the healthiness of barrack construction, is the relative position of the beds with reference to openings through which the outer air comes in. In the ventilation of home barracks, it has been found necessary for the men's health and comfort that the air shall be insensibly diffused through the room without draughts upon the beds. In India, of course, a much freer ventilation can be borne than in colder climates. But the difference between the day and night temperature is often so great that an air-current which might be borne with impunity through the day, becomes at night a serious inconvenience, and may be a dangerous cause of disease. As already stated, in the Indian barracks the beds are placed between the doors, or, if in more than two rows, down the middle of the room; but the space between the doors is so narrow that the wind falls directly upon the side of the bed if the doors are open, and if the

681. doors are shut the ventilation of course is shut out too. Deputy Inspector-General Stewart states, that the space between the doors is generally seven feet, occupied by two beds, each three feet wide, and leaving only one foot between the beds, which, in India, is over-crowding; that the beds project more or less beyond the protection of the wall; that the men occupying them are liable to be injuriously exposed by night and day, and in all seasons, to strong direct currents of air; that in the rains and in the cold season, as well as in the hot months, this exposure may lead to serious results, and that it need not be matter of surprise that rheumatism, pulmonic affections, dysentery, and other serious and fatal diseases should prevail.

It must be obvious that barracks so constructed can never be healthy, and that the ventilation, to be efficient, must be independent of doors and windows, at least during the night.

One cardinal error in barrack construction which prevails throughout India, is placing the barrack rooms at or near the level of the ground. As already stated, the surface of the country is charged with malaria, the action of which extends to a greater or less height above the ground.

Night fogs, which may be considered as indicating the presence of malaria, rise to a certain height above the ground, especially in Lower Bengal.

Mr. Montgomery Martin attributes various native diseases partly to this cause. He says, further, that troops should sleep above the level of the fog; that all the lower stories of barracks or hospitals which he has examined in tropical regions are unhealthy; a result which is caused by a pestiferous gas rising from the earth in regions where vegetation and moisture exist in excess; but that this gas does not rise to any great height, and slowly commingles with the atmosphere.

Mr. Julius Jeffreys corroborates this opinion. He says, that in India all kinds of exhalations are rendered visible by smoke or fog in cool mornings; that it is well known that the density of malaria is in some very high ratio inversely proportionate to the distance from the surface of the ground; that he never saw troops in India quartered above the ground; and that the evidence to his mind was quite conclusive that much disease arose from troops being housed on the ground level.

Deputy Inspector-General Longmore instances the occurrence of these fogs at the very unhealthy station of Dinapore. The barracks are very little raised above the ground. He says that in the morning or after sunset, if there is not much air stirring, a dense vapour may be seen resting over the surface of the ground, while above this vapour or a little below it the air is clear. He states that, in his opinion, this vapour carries malaria with it, and that much of the disease at Dinapore might have been prevented by having a free circulation of air below the rooms.

The barracks, he says, are otherwise badly arranged in close squares.

Major-General Goodwyn states, that he knows only of one instance (at Calcutta) in which the barracks are raised above the ground; and that he considers the absence of arcaded basements as a great fault; he thinks they should be raised at least 12 feet from the ground.

Raising the floors, with free passage of air underneath, is necessary not only to avoid malaria but to avoid damp in flat or low-lying districts, where there are small natural facilities for drainage. The stational returns show that the barracks throughout India have been constructed without reference to this primary condition of health. While it is a native habit to sleep only on upper floors, in order to avoid malaria, the European soldier, who is a much more susceptible subject, has all along slept at or near the level of the ground.

The usual mode of constructing floors has been to raise a plinth a foot or two in height, to fill up the space with earth or some other material, and to lay the floor upon it. The flooring consists of various materials, generally of stone, composition, tile, or brick, but sometimes of rammed earth, painted over periodically with a solution of cow-dung. Referring to the condition of barrack floors, Colonel Campbell states, that if they are in good repair and perfectly smooth, they are always dry; but that if the surface of the plaster becomes broken, the floors absorb wet, and it remains. Dr. James Bird states, that the mud floors are most objectionable, that brick floors are better, but that a wooden floor is the best of all. Washing floors with cow-dung is a native practice, and is used to render the surface more durable and to prevent vermin. Flooring of this description should be forbidden.

The height to which the floors should be raised above the ground will depend on local circumstances. In low, flat, and damp districts, each barrack should consist of two floors, the upper one only to be used as a sleeping room, and the lower floor to be a covered place for exercise and amusement, as suggested by General Goodwyn. In more high and dry districts, four or five feet would be sufficient to raise the floor; and less would suffice at hill stations. The space should be arched to allow of the freest passage of air. Objections have been made to this construction, that filth or dead animals get into the space and create nuisance. But this can be easily prevented.

The best kind of flooring for India is, undoubtedly, that which absorbs the least moisture in cleansing. In this climate a good wooden floor is most wholesome, and there are a number of testimonies in its favour as being the best for India.

The materials chiefly used in the construction of both barracks and hospitals, are burnt brick and mortar; in some instances, burnt bricks set in mud. Sun-dried bricks cemented by mortar or mud, are also used. In a few instances, the walls are of stone and lime, or stone set in mud. Timber is sometimes used as a framing, and more recently iron. The roofs are generally of tile, or thatched, and sometimes tiled over the thatch. In some

recently constructed barracks, the roofs are arched and terraced. Double walls or double roofs, having air passing up between them to keep down the temperature, have not been introduced in India. Thickness of wall and roof has been chiefly depended upon. The materials are stated to be well adapted to the climate, generally. But General Goodwyn states that the bricks are often of bad quality, and admit of great improvement in manufacture.

This is a matter which ought to be considered; for, as he justly observes, there is nothing more destructive to health than an imperfect brick building. Wherever the plaster peels off, the brick absorbs moisture, destroying the permanency of the barrack, injuring the accoutrements, and, above all, the men's health.

One point in the construction of cavalry barracks is much insisted upon by Deputy Inspector-General Stewart, as injurious to ventilation. There are no saddlery rooms belonging to the barracks, and the men carry their saddles saturated with the horse's perspiration into their sleeping room, where they are kept. The practice is both unnecessary and hurtful. Every cavalry barrack should have a dry, well-ventilated saddlery room attached.

VENTILATION OF BARRACKS.

The means of ventilation chiefly trusted to in Indian barracks, are doors and windows. There is very little glass used, and the windows, where they exist, are either venetian, or they consist merely of openings, with solid wooden shutters, which, when closed on account of weather, leave barrack and hospital in darkness. In many cases, the doors are also venetianed.

Many of the hut barracks have louvres in the roof for ventilation. And in barracks with a central raised aisle, there are clerestory windows above the arches, or at the ends, together with ventilators in the ridge.

More attention has been lately paid to this important subject, and many of the newer barracks are better ventilated.

But there is sufficient evidence to show that considerable improvement in this respect is still required.

Sir R. Martin informs us that there has been the same want of strict attention to ventilation in India, as hitherto in England. Colonel Campbell states that the old class of barracks are deficient in upper ventilation, that such openings as exist are, generally speaking, not sufficient for the purpose; that there is frequently much closeness during the night and in the morning. The arrangements in the newer barracks he considers better.

Major-General Goodwyn states that the roof ventilation is at present very spare and scanty.

The ventilation, such as it is, is interfered with by the soldiers; a fact which, of itself, would lead us to suspect that the men are exposed to draughts.

On this subject Brigadier-General Russell states that the men do not object to ventilation, but that they object to any air coming upon their persons. When this is not attended to, the men get chilled and suffer from diarrhoea. The danger of draughts at night is perfectly well known to natives, for Dr. Julius Jeffreys states that, in watching a garden at night, the native places a mat to windward of his bed to cut off the immediate current from his body. He says, this is a matter of really prime importance; for it will often just make the difference whether a man escapes or not an attack of rheumatism or intermittent fever.

In some barracks and hospitals of the Bombay Presidency, an attempt was made to introduce fresh air by air channels under the floor, opening by gratings into the rooms. Refuse of various kinds was thrown down the gratings, and these air channels became the channels for foul air. This is a method of ventilation which ought never to be adopted.

The requirements of good barrack ventilation, in India, are summed up by Lieutenant-Colonel Gall, as follows:—

The ventilation should not depend on doors and windows; it should not cause a thorough draught, to which the men are exposed; there should be sufficient space between door and door, and window and window, to allow the men not to be exposed to draughts; and there should be room for a table between every two beds.

The stational reports adduce instances of what may be considered as structural defects in ventilating arrangements.

Sometimes, *e.g.*, the rain beats through the ventilators. Or the amount of ventilation which is sufficient in one state of the wind becomes too much or too little in other states. Or during dust storms, the dust is driven in. We allude to these defects, because often on such small matters the whole question of fresh air to a barrack or hospital depends. The two first admit of remedy, but it is questionable whether anything short of closing

every crevice would keep out dust during a real dust storm, for the short time during which it lasts.

BARRACK
VENTILATION.
3704.

The following example of an efficient method of ventilation adopted in an unhealthy barrack at Secunderabad, during an alteration in the barrack, and the result on health, is given by Brigadier-General Russell:—

“The opportunity was taken to raise the walls three feet, and to put on what was termed a Bengal roof, by which a current of air was admitted all round, and wire gauze was placed inside and outside the ventilators, beyond the reach of the men. After this was done no serious case of dysentery, the scourge of Secunderabad, occurred among the men quartered in this building, and the medical officer, who visited it before morning gun-fire, found the atmosphere as pure and sweet as in his own bedroom, which he had just left, while it was very offensive in the other portions of the barracks. This dysentery, I therefore conclude, arose more from the construction, overcrowding, and defective ventilation of the barracks than from their site.”

In a climate such as that of India it is impossible to estimate the amount of fresh air required to keep either a barrack-room or hospital ward in a good sanitary state. In England 1,200 cubic feet in rooms, and about three times that amount in sick wards, per man per hour, are required. At certain seasons every breath of air becomes of importance, and there is no test, except that of freshness, to be relied on as indicating the efficiency or inefficiency of the ventilation. Ridge ventilation, together with a free admission of fresh air under the eaves, on some such principle as that adopted at Secunderabad, affords the best solution of the problem for India.

SPACE PER MAN IN BARRACKS.

The greater proportion of European troops in India have, according to regulation, upwards of 1,000 cubic feet per man. In a number of stations the average amount exceeds this, and rises to 1,200, 1,400, and in some instances to 1,600 and 1,700 cubic feet. The average at Secunderabad is 1,000. In about 12 stations the space is less, and varies from 480 to 900. The largest amount at any station is at Rangoon, where the average is 2,200 to each European. The regulation amount on home stations is now 600 cubic feet per man, and at first sight the advantage is very much in favour of the Indian stations. A large cubic space, however, does not necessarily imply absence of overcrowding, for two reasons:—

BARRACK
SPACE.
—

1. The space may be above the head.
2. The beds may be too near to each other.

Both of these unfavourable conditions exist in Indian barracks; *e.g.*, on account of the great height in many of the barracks, the superficial area per bed by no means corresponds with the cubic contents. The average at the majority of stations is between 60 and 70 square feet; in not a few instances it falls below 50. At Secunderabad the men with 1,000 cubic feet have only 40 to 60 square feet. At a few stations the amount is from 70 to 100 square feet, the largest amounts being at Rangoon, where each bed has 120 square feet, and in the bomb proof barracks, Fort William, where the surface area is 140 square feet per bed. But the report states that even with this amount of superficial area, one half the number of men would be too many.

From the construction of the barracks, the beds, as already stated, are too close to each other, every pair having only a foot between them, while at the same time there is a large unoccupied floor surface. Practically, therefore, nearly every barrack-room is overcrowded.

The regulation amount of space by no means represents the degree of crowding which may take place in a barrack. Usually the number of men is the number which may happen to be at the station, be that number more or less; and it has been stated that the lofty barracks recently constructed have been expressly intended to prevent a larger number of men being put into them than the floor surface would accommodate. This is an error. With the intention of preventing overcrowding, it really introduces what in India is the worst form of overcrowding, *viz.*, bringing the beds too close together.

Major-General Cotton advocates a much better course. He says that, in point of fact, it would be well to have the barracks so constructed that, in case of emergency, they might be capable of holding more men than under ordinary circumstances. He advocates lower rooms, and more attention to ventilation.

2026.

Deputy Inspector-General Maclean states that overcrowding and bad ventilation have been the master sins of the old system.

2352.

As regards the amount of cubic space and superficial area required for health, Dr. Sutherland states that this will depend on the position of the barrack, that on high

5508.

BARRACK
SPACE.

ground, with a free circulation of air, 1,000 cubic feet and 80 square feet per man are enough; but that in low, imperfectly ventilated positions, it would be necessary to raise the amount to 1,500 cubic feet and 100 square feet per man.

MEANS OF COOLING AIR IN BARRACK ROOMS AND HOSPITALS.

COOLING OF
BARRACKS.

The usual means of cooling the air, and obtaining a freer movement of it, in barrack rooms and sick wards is by punkahs suspended from the roof and pulled by natives. This, which is an Indian practice, appears to answer, except at the hottest stations, where other means are used. These consist generally of frames filled with mats of kuskus grass fitted into certain of the doors or windows, and kept constantly watered by natives. When the doors and windows are all provided with these "tatties," and the only air which enters the room is that which must pass through the tatties, a considerable reduction of temperature takes place, but it frequently happens that doors are left open, and the cooling effect is reduced.

At some very hot stations "thermantidotes" are used. These are merely a copy of the ordinary winnowing machine, in which the air entering to supply the fan is made to pass through a wetted mat. They are said to answer their object as in hospitals.

Other two plans have been brought before us for cooling the air. One of these by Captain Moorsom is merely a set of tatties moved by machinery and kept moist by water. It is intended to be more constant and efficient, and at the same time more economical, than the present system.

Another method will be found described in the evidence of Mr. Siebe. It is a machine for making ice by steam power, and might be used also for cooling water or air, where the cost was no great object, as in hospitals.

ABLUTION AND BATH ACCOMMODATION.

ABLUTION AND
BATHS.

At home stations ablution rooms are a modern concession to cleanliness, and it is only now that the extent of accommodation provided is becoming sufficient for the soldier's wants. In India, where the means of cleanliness require to be so much more abundant and accessible, they are deficient almost everywhere. At the large station of Peshawur, where there were between 1,600 and 1,700 European troops, there were no ablution rooms in August 1860. At another large station, Deesa, a washing room is attached to each barrack, but there are no conveniences for washing in it. The usual arrangement is to have stone benches along the wall; water is carried by bheesties, and iron basins are used for washing, as at home. None of the ablution rooms are drained. The foul water is simply conveyed to a cesspit, from which it is carried away by hand or allowed to sink into the ground. At some of the larger stations fresh water is conveyed to a cistern, from which it is distributed to the basins by taps. At many stations the ablution rooms are dark and damp; and, with a few exceptions, the ablution accommodation admits of great improvement.

Deputy Inspector-General Stewart states that the means of personal ablution at all stations are more or less deficient; that in some barracks they can scarcely be said to exist, and that the rooms are dark, confined, and inconvenient even for washing the hands and face; that the men do as they best can, and wash themselves perhaps in the open verandah, or in a small room at the end of it.

This is confirmed by Dr. Bird, and by Colonel Greathed, who state that the ablution rooms in barracks are generally imperfect.

At many stations there is more or less bath accommodation. Generally it consists of a plunge bath. In some cases baths of a smaller size are used. There is no bath for the large garrison of Fort William, where baths are urgently required.

Colonel Greathed says that the bath accommodation is sufficient for perhaps two companies, bathing every second day, although it is considered advisable that there should be a bathing parade in India every day during the hot season. The objection to this is the cost of the water-supply, which has to be drawn and carried by men and bullocks. It is indeed the same objection that would exist at home if water had to be provided to any extent as it is in India. But it is found possible to supply extensive bathing establishments with water by improving the method; and hence the present system of Indian water-supply is directly opposed to keeping up a proper system of ablution for cleanliness and health.

It is obvious that the ablution and bath accommodation requires to be placed on a better footing, and that this cannot be done without a better system of water-supply. In situations where the water-supply is limited, shower baths on a large scale might be introduced with advantage.

Dr. Dempster's note,
p. 468.

1320.

5662.

Vide abstract of
stational
reports.

761-2-3.

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COOK-HOUSES.

The means of barrack cooking are of the simplest description. They usually consist of a small detached room or shed, without any chimney, and insufficiently lighted. Along the walls there are low platforms of masonry, with square holes to hold the fire. There is neither water-supply nor drainage. All the water is brought by water-carriers, and the refuse water is either allowed to escape as it best can, or it runs into a cesspit, and is removed by hand labour. The cooking utensils are very simple; but through the ingenuity of the native cooks almost every variety of dish can be prepared. The men like the cooking, but experienced medical officers do not consider it always wholesome. There is a large consumption of fuel, the smoke from which fills the kitchen and blackens its walls. Recently improvements have been introduced in the cook-houses of Fort St. George, Madras, by an army medical officer, who has adapted a set of boilers and oven on Captain Grant's plan, of which it is a modification. The food is said to be better cooked, and at less expense, both for fuel and attendance.

COOK-HOUSES.
Vide abstract of stational reports.

However imperfect the Indian cooking may be, it admits of great variety. And though modern improvements need to be introduced, yet it is by no means in the rude state in which home barrack cooking was found in 1858.

LATRINES AND URINALS.

These conveniences are usually placed in outbuildings at a short distance from barracks, and sometimes connected with them by covered passages for protection against sun and rain. They vary in construction at different stations. Those belonging to the older barracks are cesspits cleansed from the outside. In more recently constructed barracks metal pans have been introduced to facilitate the operation of removal. There is no drainage of any kind, and the arrangements altogether are very offensive. The only object attained is rapid removal of excreta to be buried or otherwise disposed of at a distance. In every other respect the latrines admit of great improvement.

LATRINES, &c.
Abstract of stational reports.

Drainage, and the removal of excreta by water, is now universally considered to be the most economical and least injurious method of disposing of them; but there is some doubt whether these improvements would be applicable to all Indian stations. In certain low, flat districts, where there is little fall for drainage, this might probably be the case; but there are many stations in which drainage might be carried to an available outlet, and iron water latrines and urinals, properly supplied with water introduced.

Many of the buildings require light and ventilation, and none of the latrines have the recent improvements of divisions and doors which have been introduced of late years at home.

Wherever cesspits exist they should be abolished, and movable vessels or water latrines substituted for them.

OFFICERS' QUARTERS.

Officers are generally lodged in detached bungalows, situated within compounds. Their sanitary condition is described in the stational reports as being good. But at some stations complaint is made that sufficiently good accommodation cannot be rented, because it does not exist. The great advantage, as regards health, possessed by officers is living in detached buildings, with free external ventilation. But their quarters partake of the general sanitary disadvantages of the station as to drainage, water supply, &c.

OFFICERS' QUARTERS.

QUARTERS FOR MARRIED NON-COMMISSIONED OFFICERS AND SOLDIERS.

Great improvement has been made in India of late years in providing this class of accommodation. It usually consists of separate huts or bungalows, of two or three rooms, built in the patchery, a court belonging to the barrack. In a few instances there are barracks for the purpose. In about 20 per cent. of the stations no separate quarters have yet been provided; and married people are lodged in barrack rooms divided by mats. There are two or three instances in which married people occupy the same rooms as single men, separated from them by mats. At two-thirds of the stations the married accommodation is said to be sufficient. In some of these cases there are from 80 to 120 separate married quarters. At about one-seventh of the stations where married accommodation has been provided, it is said to be insufficient; and at two or three stations it is described as bad.

MARRIED QUARTERS.
Abstract of stational reports.

MARRIED
QUARTERS.

The general sanitary condition of the married quarters partakes of that of the station. But the men living in patcheries with their families are much more healthy than men living in barracks.

2172-80.

Occasionally, from want of care, considerable over-crowding takes place in these quarters; and in one instance at least it was attended with frightful results. This occurred at Dum Dum, where a large number of women and children were lodged together in barrack rooms, without due care having been exercised as to the amount of space, or ventilation, or as to other sanitary arrangements.

There was an average monthly strength of 554 women, among whom there occurred 64 deaths in 5 months; and there was an average monthly strength of 770 children, out of whom died 166 in the same five months.

The annual ratio of mortality among the women would accordingly have been 276 per 1,000, and among the children 516 per 1,000; the usual proportions for Bengal being, deaths per 1,000, women, 44; children, 84.

The diseases of which so many perished were, dysentery, fever, and cholera. And the causes were intemperance, immorality, reckless exposure, unwholesome food, want of cleanliness, personal and general, and a polluted atmosphere.

2218-19.

The effluvia from the privies were perceptible in the barrack rooms.

This calamity may have been exceptional; but it clearly shows the class of causes which exert the most destructive influence on European constitutions in India; children being there, as elsewhere, the most delicate tests of sanitary condition. The experience admits of application to all barracks where there are European soldiers; and it gives an insight into the causes of high mortality of children in these climates.

TENTS.

Tents for camp or field service are of various forms and dimensions. Some are square, others are oblong or oval formed, some are circular, and others have a pyramidal section. They have some one, others two poles; and they vary in length from 11 to 22½ feet, in breadth from 10 to 14 feet, and in height from 8½ feet to 13 feet, within the inner lining. They consist of three or more layers of cloth, according to its quality, the inner layer being generally of a blue colour.

These tents accommodate a greater or less number of men, 14, 16, or 22 men, according to the arm of the service which has them in use. Their cubic contents vary from 935 to 2,835 feet, the superficial area of the floor varies from 9½ feet to 24½ feet per man, and the space per man varies from 77 to 220 cubic feet. The double poled hospital tents are larger and better than the others. They afford 26 square feet, and 236 cubic feet per man for 12 men.

None of the tents are ventilated, except by opening the doors and raising the walls; but this of itself is not sufficient. Ventilation round the poles at the top is indispensable, to keep the air in the tent sufficiently pure, and the spaces between the different layers of cloth should also be ventilated, to afford a means of escape for the air heated by the sun's rays. Abundant means of admitting fresh air, and allowing of the escape of foul and heated air above, can alone compensate in any degree for the overcrowding to which all tents are liable.

2831.

Objections have been made before us to the whole structure of the present Indian tent, by Mr. Jeffreys, who proposes a totally distinct form, as being much cooler and more healthy, and affording a larger space per man. We refer to his evidence for a description of the tent he proposes.

DIET.

DIET.

At every station in India the British soldier is supplied with a full ration, including the following constituents:—

Meat, 1 lb.	Rice, 4 oz.	Coffee, 1½ oz.
Bread, 1 lb.	Sugar, 2½ oz.	Salt, 1 oz.
Vegetables, 1 lb.	Tea, ⅝ oz. or	Firewood, 3 lbs.

The foundation of the ration is beef and bread. Mutton is issued in lieu of beef twice a week, when procurable. The pound of vegetables consists of potatoes, when procurable, carrots, onions, pumpkins, &c. There are complaints that the issue of mutton is too small, and that vegetables cannot always be procured in sufficient quantity. But generally the ration is considered good. The stoppage is about fivepence (3 annas, 4 pie). The cook generally supplies some trifling articles in addition, such as meat for breakfast, milk, and some times butter, &c., for an anna a day. The large bone is separated from the meat before it is weighed for issue by the Commissariat.

The captains engage the cooks, just as they would engage washermen, and the charge for cooking is 10 to 12 annas per month. Not unfrequently the men, if they have money, will buy bacon and pork, badly and filthily fed; for the bazaar pigs are the bazaar scavengers. And thus, whatever care may be exercised by Government in providing healthy food, the men and the cooks may add meat which is quite the reverse. In addition to all this, the soldier may add 1 quart malt liquor, or 2 drams spirit, per diem.

Diet.

2945.

The first thing that occurs in considering this system of diet is, that it would be amply sufficient for the sustenance of men engaged in out-door toil in a cold climate. Indeed, we very much question whether labouring men at home consume so large an amount of nitrogenous and carboniferous food at any ordinary time. In India it would be enough to supply the requirements of the hardest work the climate would admit of. But, at the same time, there is a certain exhaustion produced by the climate and the manner in which the soldier passes his time, which makes the present ration apparently no more than sufficient.

3521.

The soldier has three meals a day: breakfast at seven or eight in the morning, consisting of tea or coffee, with bread and often meat; dinner at one p.m.; tea about five, sometimes with meat too. The dinner is therefore eaten just before the hottest part of the day; and all the meals are crowded into nine or ten hours of inaction.

In considering the influence of this on health, we must be guided by other facts.

In the first place, the natives who are accustomed to the climate eat very little animal food, particularly in hot weather. This native habit, which is the result of a natural instinct, is in strict conformity with physiological law. Besides providing for the waste of the body by exertion, part of the food goes to supply animal heat. But where there is little or no exertion, and where the climate is hot at the same time, the amount of food necessary for health is much less than it would be in a cold country under hard work. Some useful experience on the effect of overfeeding in tropical climates has been laid before us by Staff Surgeon Dr. Rennie, for several years in medical charge of convicts in Western Australia. In his evidence, and in a note appended to it, he states that overfeeding and the too free use of animal diet produced much disease, including dysentery, among the convicts; that by reducing the amount of both, improved health followed, and that a further reduction in the scale of diet, with other improved sanitary conditions, led to a very remarkable improvement in the general health of the prisoners. He states it as his opinion that what are familiarly known as "the diseases of tropical climates," are in reality diseases resulting from habits and circumstances of life generally unsuited to tropical climates, and that the relation which food (including alcoholic stimulants) bears to temperature is seriously overlooked in the dieting of bodies of men in the public service.

2942.

870.

The soldier in India has not sufficient occupation to keep him in health; and under such a system of dieting, as he at present undergoes, he must suffer, more or less. By overloading the system with useless elements, the digestive and biliary functions become disturbed, and a predisposition to disease is induced. For this state of things, the soldier should either have work or exercise provided, sufficient for his diet; or his diet should be made to accord better with his sedentary habits. No general rule can be laid down in this matter, applicable to all circumstances. But one thing is quite clear, that the soldier should have more exercise, and that the same diet which may be consumed in the cold season with safety cannot be the most suitable for heat. Dr. Dempster tells us that it is certain that the majority of the recruits from Ireland and Scotland eat in the hot weather in India many times the bulk of animal food ever consumed in their native country while working hardest in the coldest season of the year. And that the same quantity of animal food and stimulating drinks taken with advantage by a working man in a cold moist climate is not only unnecessary, but positively injurious to the almost idle European soldier in the burning plains of Hindostan. So little is the importance of the difference of climate recognized that the soldier eats animal food twice or even thrice a day all the year round. Sir John Lawrence says that he does not believe the officer does so, and that if he does, he gets sick too. The evidence before us goes to prove that the present dietary of the soldier considered with reference to the amount of work he has to do is injurious to his health, and we concur entirely in the opinion of Sir John Lawrence that Government might try to induce the men, by varying the ration, with reference to hot and cold weather, to use more vegetable diet and fruit, and less animal food.

Page 466.

2943.

2946.

The regimental medical officer is indeed charged, by the new medical regulations, with the duty of making such representations on this subject to his commanding officer as he may deem necessary for the health of the troops, so that the principle of change is admitted.

DRESS.

DRESS. — Much interesting and valuable information on the subject of the soldier's dress in India will be found in the stational reports and in the evidence, and several important suggestions for improving some of its details have been laid before us, particularly by 2860. Mr. Julius Jeffreys, who has paid much attention to the subject.

The dress of late years has undergone great and beneficial changes, and is now much better adapted to the climate, seasons, and duties, than it was in former times.

3238. The soldier now wears habitually a khakee (dust-coloured cotton) tunic and trousers, and a helmet made of wicker work. The collar is made to fasten with a hook and eye, and no stock is worn except in cold weather.

80-83. As regards under-clothing, the evidence is in favour of wearing light flannel next the skin, especially at stations subject to sudden changes of temperature, and under exposure.

Sir Ranald Martin considers that the evaporation from the surface of the body is so great in India that a slow conducting medium next the skin is absolutely necessary, and that dysentery and liver disease are frequently produced by chills. Flannel moderates the evaporation from the surface of the body, apparently without heating it, for Mr. 2886. Jeffreys states that he has repeatedly ascertained the temperature of the skin in hot and dry weather to be much lower under flannel with a cotton dress over it, than under cotton alone. The value of flannel in preserving health has been long known to army officers, and the main objection to its universal introduction is the difficulty of washing; but on the other hand this objection does not apply with much force to its use in India where labour is so cheap.

2860-2874. The present head-dress is formed for the special purpose of protecting the head from the sun's rays, which it does with considerable efficiency, but several ingenious improvements in it have been laid before us by Mr. Jeffreys, which are worthy of examination. He proposes to make the outer shell of the helmet double, with a ventilated space between the layers, and within the shell there is a lining to fit tight to the head, leaving another ventilated space between the inner surface of the shell and the wearer's head.

The object of the contrivance is to ensure the passage upwards of two distinct currents of heated air between the outer shell of the helmet and the head. In order to diminish the power of the outer shell to absorb the sun's rays, the inventor proposes to cover it with a thin highly-polished metallic surface.

2883. In proof of the great importance of giving every attention to the subject, it is stated that between the years 1830-45 the annual mortality among troops in Bengal was nearly 30 per 10,000 from apoplexy alone; that in particular instances the mortality from this disease has been as high as 500 per 10,000, while the deaths from the same disease in England were less than 2 in 10,000.

2881. Mr. Jeffreys also mentions that excessive heat on the brain produces moral depression, even among the best troops in the service. Sir R. Martin concurs in this opinion.

3243, 3244. Our attention has been called to one other matter of dress,—the boots, which, as at present issued to the soldier, do not fit well. They are made at home on a very few models and sizes, and when sent out to India are found in very many cases not to be wearable. Colonel Greathed states that in his regiment the men never used them, and that they were taken to the shoemaker's shop and made over again at a certain cost.

In the report from Ahmednuggur it is stated that the present system of serving out boots of similar shape to men with differently-shaped feet "cannot be too much reprehended," and that a better system, although somewhat more troublesome and costly, would be amply repaid by increased efficiency. The reporters suggest that "upper leathers" and soles should be sent out to India, all of the largest size, and made up to fit the men by shoemakers attached to each company.

Either this course should be followed or a larger variety of sizes provided. The simple fact mentioned by Colonel Greathed is sufficient to prove that a change of system is required. Foot-lameness from badly fitting boots admits of no excuse. Of all causes of inefficiency in an army it is the most unjustifiable.

INTEMPERANCE.

INTEMPERANCE. — According to existing regulations, every soldier has a right to purchase at his regimental canteen two drams of spirits of good quality, generally rum or arrack, supplied by the Commissariat; or he may substitute malt liquor, wholly or partially, for spirit. Stational Reports. The quantity of malt liquor issued in lieu of spirit varies in different regiments, but

generally it appears to be a quart in lieu of a dram. Formerly spirit used to be issued as part of the ration, and it could be obtained early in the morning; but of late years this practice has been almost, if not altogether, discontinued. No intoxicating drink is issued before dinner, but every soldier has a right to purchase the quantities of spirits or beer stated above. Beer can be removed from the canteen for dinner, but spirits must always be drunk at the bar; and in order to prevent a double issue, a non-commissioned officer attends in the canteen and registers the men's names who have received their allowance. In some regiments no spirit is allowed to be issued until evening.

Two drams of spirit are equal to the twentieth part of a gallon, and hence each soldier who avails himself of his privilege of dram-drinking to the fullest extent, will consume $18\frac{1}{4}$ gallons of raw spirit per annum; but most men content themselves with one dram and an equivalent of malt liquor.

Several very serious questions arise out of this practice of continual dram-drinking, as it affects the health and efficiency of the army in India. In colder climates it is known that there is scarcely a habit to which men are addicted which so surely and steadily undermines their health and predisposes them to organic diseases as the daily use of spirituous liquors. It disorders the digestive functions, irritates the nervous system, occasions structural disease of the liver, brain, and bloodvessels, and is a most potent predisposing cause of cholera and other epidemic diseases. A simple statement of these well-known effects of continued tippling is sufficient to show that of all habits it is about the last which should be indulged in or encouraged in such a climate as that of India; for the diseases which it is observed to cause in this country are diseases from which the soldier suffers severely in India. Liver disease, delirium tremens, sunstroke, and apoplexy, as well as cholera, prevail to a large extent all over India, besides a number of diseases which are indirectly traceable to intemperate habits. A striking illustration of the evil results of even casual acts of intemperance is given by Dr. Bird, who mentions that on one occasion a great mortality took place in the horse artillery. Apoplectic seizures, cerebral symptoms, and fever struck them down. "We marched," he says, "through a great number of date-trees, where the men pulled down the pots that are attached to the trees; they could pull them down, and drink the contents." "Toddy and the sun" killed them; but the deaths were laid to the account of the latter.* Intemperate habits are also the most fruitful causes of indiscipline and crime.

At some stations the proportion of cases received into hospital, directly or indirectly the result of intemperance, appears to be about a tenth part of the total admissions from all diseases; and there is a remarkable concurrence of testimony in the reports of the different stations as to the injury to health generally caused by the use of spirits. Some medical officers go even further, and object to the use of malt liquor in such a climate, and propose to substitute for it light wines, ginger beer, tea, coffee, &c., for the reasons stated by Dr. James Bird that "it is a physiological principle that any hydro-carbonized drinks, whether beer or spirits, are more objectionable to men going to a warm climate" than the less stimulating drinks we have enumerated.

The same evil results of intemperance have been traced among the civil European population. Dr. John MacLennan states, that in one hospital at Bombay the amount of disease admitted from intemperance was "something appalling;" that nearly one-tenth part of all the admissions during a period of 10 years were from delirium tremens and ebrietas; that, with the sole exception of fever, the number of admissions was larger than from any other disease; and that, as to deaths, "alcohol destroyed more than either fever, hepatitis, or diarrhœa, and nearly as many as cholera." About a third part of the victims of intemperance were soldiers and pensioners.

We are glad to say that in some regiments habits of temperance have been introduced, and with marked benefit to health.

Mr. Dempster instances the case of the 2nd troop, 1st brigade, horse artillery, in which

INTEMPERANCE.

3581-2.

Abstracts
of station
reports.

3546.

1229.

Page 466.

* Referring to the effects of drinking ardent spirits, Sir Charles Napier says :—"Drinking does not give the fever, but it so inflames the liver and brain, that the fever takes too firm a grasp to be got rid of. Why! their ration is *two drams* a day, and *eight* of these drams make a *quart bottle!* so the sober soldier swallows *one-fourth of a bottle* of raw spirits every day! You and I know them too well to doubt that the other three-fourths go down after the first. Dr. Robinson, of the 13th, a clever man, supposed to know India better than most others, tells me that at Jellallabad, where no liquor could be had, where they could get only water, he had not a sick man the whole time! The great disease *with officers and men is drink, but the soldiers drink worse liquor, namely, arrack, which is made with anything and everything but rice.* Rice, the wholesomest of all Indian produce, is sadly belied. *This arrack is made chiefly of bhang, a liquor drawn from the date-tree, not by distillation, but incision in the bark.*"—Napier's Conquest of Sind, p. 530.

INTEMPERANCE.

a temperance movement was introduced at Meerut, and only 20 men drew the spirit ration, the remainder either drinking moderately of malt liquor or abstaining altogether. He states the effect to have been excellent, and that he "had never before seen "European troops in India in so good a condition in all respects;" that when the troop arrived at Meerut from Loodiana it had 50 per cent. actually in hospital, and that after a four years' residence in Meerut, under the temperance system, it marched to Sealkote "with a clean bill of health, no death having occurred among the men for a "period of two years." It is however but fair to state that Meerut is a comparatively healthy station.

2390, 2391.

The 26th Cameronians, while under the command of the late Colonel Oglander, is cited by Dr. Maclean as a temperance regiment, whose health was "admirable" up to the time of their landing at Chusan, where they were destroyed by bad food and bad locality, until at the end of two months they could not muster 20 men. While they were at Fort William they had only about a third of the sickness under temperance which they suffered from under dram-drinking. They landed in China 900 strong, and there was not a single man in the regiment, except the old soldiers, who drew his spirit ration.

Appendix
2nd, to
Kurrachee
Report, vol. 2.
2390.

Dr. Maclean also mentions a remarkable illustration of the beneficial effect of temperance in the 84th regiment, under the command of Colonel Russell, while it was stationed at Secunderabad, which has been hitherto one of the most unhealthy spots in India. The Irish Roman Catholic priests in the regiment promoted the temperance movement so effectually that there was scarcely a man in the regiment who drew the spirit ration; and he says, "as might be expected, it was one of the healthiest regiments "I ever saw in Secunderabad."

1355, 1356.

Another similar fact is mentioned by Dr. Colvin Smith as having occurred at this station. He says that the 3rd Madras European regiment was remarkably healthy at Secunderabad in 1856; and when his attention is called to the fact that this healthiness is an exception to the rule, he states that it is to be accounted for in this way, "that "they got rid of all the grog shops about the lines, and that improved the health of the "regiment immensely."

Vide also
Stational
Reports.

The whole tenor of the evidence, then, goes to prove that the consumption of ardent spirits by the troops is a very potent cause of disease in India, and that much benefit to the efficiency of the army would accrue from discontinuing its use, if it were practicable to do so.

It is upon the practicability of effecting this great reform that the whole question turns.

The use of spirits habitually is an acquired taste, which after a time becomes confirmed. The habit exists throughout the British army, and is carried with it to every station at which it serves, whatever may be the climate or its dangers. It is this depraved taste which lies at the root of the whole matter, and which renders it so difficult to deal with the question.

Throughout the army, drunkenness is punished as an offence, and at all home stations the sale of spirits is forbidden in the canteens. So far, the habit meets with discouragement.

The introduction of libraries, reading rooms, schools, good conduct badges, amusements of various kinds, and savings' banks are encouragements to temperance which have been introduced of late years.

It is considered to be unnecessary at home stations to permit the sale of ardent spirits in canteens, because no danger can accrue from the prohibition, while, at the same time, their use is, to a certain extent, discouraged.

But at most foreign stations, and throughout the whole of India, it has been considered advisable to permit the sale of ardent spirits, under restrictions as to quality and amount, in all canteens; because bad, adulterated, and, in some cases, poisonous spirits only could be otherwise obtained by the soldier.

The permissive, authorized sale of spirits, the use of which by the troops we have shown to be an indirect cause of a large amount of disease and mortality, thus becomes a direct encouragement to intemperance and disease, while its avowed object is to prevent disease by supplying men with a less injurious spirit than they could otherwise obtain.

There are also certain financial advantages derived from this monopoly of sale, which are thus described by Colonel Greathed:—

"3185. You say that the soldier derives a certain pecuniary benefit from the canteen fund, will you explain to the Commissioners how that arises?—It is from the enhanced price at which the spirits are sold,—8 annas or 1s. is imposed upon every gallon of spirits, and that in a very short time creates a fund which supplies the wants of the soldier without any expense to himself; for instance, the canteen fund, under the regulations of the Government, pays for the cap covers of

the men, which are very necessary, and a constant expense; it also pays for all his amusements,—the fives court and the theatre, the skittle ground and the gardens, and in fact any reasonable request which the commanding officer makes is always granted. INTEMPERANCE.

"3186. When we speak of the Government providing soldiers with a fives court, or other means of amusement, we mean that, in point of fact, the soldier provides these for himself by the tax which is levied on spirits, and which is levied on spirits exclusively?—The fives courts are always parts of the barracks; the theatres are certainly maintained by the soldiers, or by the regiment; the men subscribe to them. The theatre at Jullundur was bought; we paid 300% for it, and that money was paid out of the canteen fund entirely; that the Government did not give at all: and, in fact, everything connected with the amusements and comfort of the men is paid for out of the canteen fund."

In the appropriation of this fund, Colonel Greathed states that the fund accumulates in "a wonderful way," and that the great difficulty is to keep it down. After 3,000 rupees are accumulated, the Government may lay its hands on the fund; and it is the object of the officer commanding the regiment to spend it as quickly as he can. 3190.

It appears then that there is a tax on spirits which is applied in India to purposes and objects which are met in a totally different way at home, and that there is a direct pecuniary interest in the soldier consuming spirits up to the full extent of the regulation allowance. There is, as it were, a tacit encouragement for the soldier to drink that which is admitted to be injurious to health, in order that he may be benefited in other ways, which may be conducive to health. So long as this pecuniary interest is recognized, it will be impossible to deal effectually with the evil. Government in India should cease to have anything to do with such a source of revenue, in the same manner as it has done at home; and whatever is necessary for the soldier's health and recreation should be otherwise provided for.

Colonel Greathed says, "I cannot defend it. Let the Government give the money, and the thing might be done. It is a question of money." 3194.

As regards the danger of bad or adulterated spirits being obtained by the men, there is an all but universal belief that if the supply at the canteen were discontinued, the men would be injured by drinking bazaar spirits.

Distillation appears to be carried on to a large extent all over India, and in every bazaar there are places where spirits of some kind can be openly bought or otherwise obtained at a very small price. This spirit is stated to be very unwholesome, and often adulterated with poisonous drugs, such as stramonium, &c., to increase its intoxicating power. It is not very strong, but it is so cheap that a man may intoxicate himself for three halfpence, or less. It is allowed to be sold in the bazaars, but not to soldiers, under severe penalties both as regards the vender and the man himself.

One of the most difficult and important duties of the bazaar magistrate is to keep the soldiers from obtaining this bad cheap liquor, which he does manage to procure notwithstanding the facilities afforded by the canteen and the penalties to which he subjects himself.

Sir R. Martin says, "restrictions are always attempted, but then the evil of open cantonments throughout India, is the difficulty of maintaining a proper system of medical police, especially in regard to the use of the pernicious bazaar spirits." Testimony to the same effect is given by other witnesses, and, indeed, the difficulty of preventing the sale of bazaar spirits to soldiers, is the only reason alleged in the stational returns for the continuance of the present canteen system. From nearly every station, and from all classes of officers, there is the same expression of opinion, that the use of spirits by the troops is neither conducive to health nor discipline, and that it ought to be abolished were it possible to prevent the consumption of bazaar spirits. 65.

Notwithstanding every effort, it is to be feared that the cheap spirit will always cope successfully with the dear spirit; and the whole evidence leaves it very doubtful whether, considering the encouragement given to men to drink spirits in the canteen, confirming their bad habits, and the cheapness of the bazaar spirit which they manage to procure, the present canteen system is of any use in protecting the soldier's health.

The testimony in favour of the use of malt liquor is nearly as unanimous as the testimony against the use of spirits. Some medical officers, indeed, consider that it would hardly be safe even in India to deprive old spirit-drinkers of a long-accustomed stimulus; but admitting that such cases exist, they in no way detract from the weight of testimony on the other side, because the cases put forward are exceptional, and are indeed those in which a medical officer would in all probability prescribe alcoholic stimulants as medicines. Indeed it would not be advisable to exclude the use of spirits altogether from the army. There are cases, such as those alluded to, and there are particular kinds of service, as, for instance, field service, or duties exposing men to wet or damp, or very great fatigue, where a temporary stimulus would be of use, and where an issue of spirit Stational Reports.

INTEMPERANCE. under the advice of the medical officer might be permitted. But it is now known that many of these temporary uses to which spirits can be advantageously applied are much better met by tea or coffee, both of which have the special virtue of preventing waste under exertion, which spirit has not. Indeed there can be no doubt that a more systematic use of these beverages during times of fatigue and exposure would conduce more to the health of troops than any temporary issue of spirits.

Admitting, however, the existence of these exceptional cases, the weight of evidence is strongly in favour of malt liquor when compared with spirits.

803. Speaking of the comparative effect in India on health of the use of these drinks, Deputy Inspector-General Stewart says—

“I believe the majority of soldiers would greatly prefer malt liquor to spirits, and the only reason for their not using beer almost exclusively is, their means being insufficient to procure it. I also feel assured that the use of malt liquor is far more conducive to health than that of spirits: I believe it would also lead to less crime and irregularity. I have further observed, that the consequences of prolonged over-indulgence in malt liquor are more manageable and less fatal in their result than when produced by a similar abuse of spirits.”

Page 465. Deputy Inspector-General Dempster in his paper says—

“Although I am of opinion that the freshly arrived European does best to confine himself to pure cold water or slightly acidulated drinks, yet if good malt liquor is only to be considered a substitute for rum, I would advocate its use from the very first.”

These opinions of experienced medical officers give the substance of most of the evidence on the subject which will be found in the stational reports; but it must not be considered that malt liquor is advocated as a drink which it is indispensable for the soldier to use; the evidence only goes to prove that malt liquor is very greatly less injurious to health in a warm climate than spirits.

3546. We have already quoted what Dr. James Bird says on the subject. His evidence is against malt liquor and in favour of lighter drinks, and other witnesses give equally guarded opinions: thus, Dr. John McLennan says, “I apprehend that beer or porter ought to be taken with considerable moderation if health is to be retained in India”; and when he is asked, “But do you not think that a comparatively liberal use of beer or porter would be far less injurious than an unlimited use of ardent spirits?” he replies, “I think it would produce a different class of disease. I believe that great beer-drinkers and great porter-drinkers do suffer.”

1205, 1206.

Light wines, and temperance drinks of various kinds, tea, and coffee are certainly those which would meet the case as regards health most effectually, were it possible to secure their use by the troops; and perhaps as great an inducement to sobriety as any of them, would be a plentiful supply of pure filtered cold water, obtained from fountains or water-taps at convenient places all over the stations.

5650. The Indian Government has been put to an expense of nearly 200,000*l.* a year in supplying malt liquor from home for the troops in India, in order to place it within the reach of the men. And as the daily use of malt liquor is not necessary to health, this large sacrifice of revenue can be considered in no other light than as a tax to encourage men not to drink spirits, and is a striking evidence of the cost incurred by the intemperate habits of the British soldier. If the loss to the service from diseases occasioned by intemperance were added to this premium on the consumption of the less deleterious drink, it would amount to a very large item in the whole cost of the army.

5651, 5652. One of the advantages of hill stations is stated to be that, on account of the lower temperature of the climate, beer could be brewed at them, and a great public saving effected thereby.

Page 482. This has already been tried by Lieut.-Colonel Ouchterlony and others. But the nature of the materials at their disposal and other circumstances rendered their success only partial. He, however, thinks the question of establishing breweries in India worthy of consideration by capitalists.

5654, 5657. Sir A. M. Tulloch is strongly of the view that beer should be brewed at all the higher stations, and the great cost of carriage saved.

The whole subject, indeed, is of most serious importance, and every inducement to temperance should be held out. Any change would have to be gradually introduced, beginning with young soldiers, and discouraging to the utmost the use of spirits, until the stigma of spirit-drinking be wiped off from the British army. The present inactive weary life which the soldier leads in warm climates powerfully fosters the habit of intemperance; and every facility for useful work and for rational instruction and recreation should be afforded him.

VENEREAL DISEASE.

Venereal Disease, a frequent concomitant of intemperate habits, and, like these, fostered by want of occupation, is another of the causes enumerated as laying the foundation for ill health in India. It prevails to a very great extent in the army, and at almost every station. The proportion of venereal cases constantly in hospital is usually from 20 to 25 per cent. of the total sick. At some of the larger stations it very much exceeds this amount. At Bangalore and Roorkee the proportion at the time the return was made up was 50 per cent.; at Dinapore it was as high as 53 per cent.; and its influence on efficiency may be judged of from the fact stated by Dr. Maclean, that in the 1st Madras Fusiliers, a few years ago, the amount of syphilis was equivalent to the withdrawal from duty of one-fourth of a company daily. Many of the cases are of course of a slight character, but a considerable number become very serious in their progress, and render the men unfit for service. Many invalids are sent home from this cause, and in numerous other cases the constitution is undermined, and the patient becomes liable to other diseases.

VENEREAL
DISEASE.

2393.

There is no subject so difficult to deal with as this; and almost every plan for lessening the evil has been tried and found to fail. They all resolve themselves into two classes, namely, repressive measures of police, or marriage and moral restraint.

Many of the stational returns contain recommendations for the establishment of lock hospitals, and several witnesses have also strongly recommended them. They were introduced many years ago into India, but their use was after awhile discontinued. The amount of venereal affections among the troops in all three Presidencies is so large (in 1860 it was 345 cases per 1,000 of the strength in Bengal, 249 in Madras, and 314 in Bombay) that there is an urgent need of some remedial measures. After considering the various plans which have been adopted in different countries, we have arrived at the conclusion that none are so likely to diminish this great scourge of the soldier in India as the re-organization of the measures formerly adopted in the three Presidencies, with any improvements which subsequent experience and consideration may point out as being required to meet the necessities of each locality.

Additional means of cleanliness, such as have been recommended by Mr. Acton, ought to be provided in all barrack lavatories. They would materially diminish the liability of the troops to this class of diseases.

4010.

It is observed that among native regiments, where marriage is not restricted, this disease is much less frequent than in European regiments, in which marriage is restricted.

There are no means of knowing precisely to what extent these facts stand to each other in the relation of cause and effect, but they have led to certain proposals for increasing the proportion of marriages in the army. The present proportion of married soldiers in Her Majesty's regiments who have a claim for accommodation in barracks is 6 per cent. of the force (exclusive of serjeants) at home, and 12 per cent. in India. Since the amalgamation of the two services any augmentation in the number of marriages specially to meet the case of India would probably involve a change in the regulation throughout the army. Even at present, and with the existing per-centage, the number of women and children in a regiment is a very serious affair, and leads to much expense as well as suffering. It is beyond our province to decide what should be the proportion of marriages "with leave" for the whole army. Men of great experience consider that the proportion should be increased. Married men are generally the most healthy; they are the best soldiers, and a certain number of them are an example in a regiment; but when the regiment goes on foreign service a certain proportion of women only can be taken with it: and thus, so far as India is concerned, any large increase in the proportion of marriages would lead to wives and children being left behind, and exposed to much temptation and possibly to distress, while the domestic tie cannot fail to be weakened by long protracted absence. Some excellent remarks on the subject will be found in Miss Nightingale's paper.

p. 368.

There is one means of reducing the temptation resulting in sexual disease, which ought to be encouraged, and that is to improve the soldier's condition in the way of occupation, instruction, and recreation,—in fact, to occupy his wasted time beneficially and rationally. The late General Jacob was fully aware of this, when he stated that "moral forces alone are of any value."

Vide Ap-
pendix 2,
Kurrachee
Report.

So far as we can deal with this question, occupation appears to us to afford the most reasonable hope of diminishing this great scourge, by leading men away from the canteen and from vice.

MEANS OF RECREATION AND INSTRUCTION.

RECREATION,
&c.

There is no period of military service in which the soldier is thrown more upon his own resources, and has fewer opportunities of employing them advantageously, than during his service in India. He rises at gun-fire, attends his parade or drill, over soon after sunrise. He then returns to his barrack, and during the hot season he is not allowed to leave it till late in the afternoon. At one o'clock he consumes a large amount of both animal food and vegetables, porter (perhaps a quart), and spirits. He has few or no means of occupying himself rationally. He lies on his bed and perhaps sleeps most of the day. He has his evening parade or drill, and his turn of guard duty once every five, seven, or ten days. Even at home this kind of regimen would be far from conducive to health. In India, both physically and morally, it helps to destroy it in men in the prime of life, with abundance of nervous power to dispose of.

The whole of this unwholesome proceeding is considered necessary for preserving the soldier; but it is not considered necessary to subject the officer to the same ordeal. He goes about, and even goes shooting, not only without detriment, but with great advantage to health; for the officers are much more healthy than the men.

Some means of passing the time are provided for the soldiers at all stations.

The usual games are long bullets, quoits, fives, and cricket; and almost every station has a ball-court and skittle-alley.

There are also libraries, and sometimes a theatre.

Soldiers' gardens and workshops have been tried at a few stations; but there are no covered places for exercise or for gymnastics.

The scale on which the existing means have been provided is the same as the very imperfect provision at home, without reference to the climate or to the much greater need of inducements to exercise, which require to be held out in India.

The men's amusements, such as they are, are always connected, more or less, with drink; and they are everywhere most deficient in amount. The men suffer much from ennui. For all practical purposes they are entirely idle; and they complain of what they feel everywhere, the "weary idleness" of their lives, and that there has been so little done in the way of giving them occupation.

The want of exercise, and a coincident high rate of sickness and mortality, falls most heavily on the infantry. The cavalry regiments and artillery, who have, one way or other, much more physical exertion to undergo, are much more healthy.

From every station there are requirements for increased means of occupation, which we shall briefly notice in detail.

Foremost amongst the proposals is that for—

WORKSHOPS.

WORKSHOPS.

At most of the stations there are none at present; while it is admitted that everywhere they would be most useful. The only difference of opinion is as to the kind of work to be done, and how the workshops and tools are to be provided. All agree, however, that the trades should be useful, and that the soldiers should make money by them. The opinion at some stations is that the work done should be of such a kind as is required by natives, and should be sold to them. Colonel Campbell suggests cabinet-making, shoe-making especially, and printing.

He states that he used to print all his own returns in this way, as well as papers for the civil authorities at Lucknow, and that at Meerut he was able to supply 100 pairs of boots to the 81st regiment, who could not otherwise have obtained them.

Sir J. Lawrence proposes that the men should make "anything connected with their regiment," such as clothes, shoes, ironwork, &c.

As regards tools it is considered that Government should provide them in the first instance, and that they should be afterwards kept up by the regiment. It is satisfactory to know that every barrack in the Punjab has a workshop attached to it, and that the subject has already attracted considerable attention on the part of the Indian Government.

Sir Proby Cautley puts in three letters from soldiers themselves, in proof of the advantage of occupying their spare time.

And the experience of the 3rd Bombay Fusiliers, extending over seven years, affords remarkable instances of improvement in the men's moral character from indoor occupations. Courts-martial and crimes diminished in proportion as the men were occupied for their own benefit. It has indeed been the opinion of some of the greatest army

3206.
Stational
Reports.

1464, 1465.

479.

4470.

Vide Sta-
tional Re-
ports. +

4122, 1479.

4130.

4134.

2955.

3960.
Addenda,
1, 2, 3, p.238.

74.

surgeons that the soldier should be permitted to do for himself whatever he can do, without injury to his health or discipline. WORKSHOPS.

It has been proposed by Sir Alexander Tulloch and Colonel Durand to extend the soldier's occupation beyond the workshops, and to make him useful in outdoor work, such as in building barracks, or in magazines, or even in farm work; but the objection to such proposals is that, in a country where labour is so cheap, it would cost much more to have it done by the soldier than by the native worker. The gain would be in the health, comfort, and contentment of the men. 5650, 5102.
5110.

Sir C. Trevelyan has also stated that soldiers would not come forward for public works, unless they were entirely excused from military duty for the time. Addendum to evidence, p. 301.

In the present state of the question, we propose that the existing means for carrying on indoor trades should be extended, or provided where they do not exist, under such regulations as would make it, as far as practicable, the interest of the men to occupy themselves profitably.

Sir Charles Trevelyan has laid before us an important suggestion for improving the soldier's condition, by holding out to him the prospect of bettering himself by his own exertions and good conduct. He proposes to select from regiments men of good character, trustworthy, with competent knowledge of reading, writing, and arithmetic, and an elementary knowledge of native languages, such as may now be obtained in schools; to submit these men to some suitable test, and then to train them for subordinate offices in the administrative departments. He states the plan to have been adopted successfully at Madras, and it is in our opinion well worthy of further consideration. It is, however, liable to the objection that it withdraws from the army the most trustworthy men, and thus tends to limit the supply of competent non-commissioned officers. 5357.

SOLDIERS' GARDENS.

Attempts have been made to establish soldiers' gardens at several stations, chiefly with the view of occupying the men and providing vegetables. They have been mainly connected with regiments, an arrangement which no doubt has militated against their success. At some stations they have been very useful, and the men have taken great pleasure in them. At other stations they have not been so successful, apparently from the reason mentioned. The regiment may be called away at any time, irrespective of the state of the crop, so that the men may lose the result of their labour. But Sir A. Tulloch is of opinion that, if the gardens were attached to the station, and if an arrangement could be made by which the men were paid for their work the gardens would succeed; for the men, he says, are fond of gardening, and a very great proportion of them, after they are pensioned, become successful cultivators. GARDENS.
Stational reports.
966-7.
2952.
5554.

We are of opinion that every encouragement should be given to these gardens. They have often succeeded in other services, and are worthy of a fair trial in India; and an arrangement could easily be made by which the interests of the outgoing regiment could be protected. There is a proposal from one station to establish farms. #

GYMNASTICS.

It is scarcely necessary to advocate the introduction of gymnastic exercises. They have been extensively used in foreign armies, and a beginning has recently been made at home stations, and also at one or two foreign stations; but up to the present time there are no gymnasia in India, although the evidence from the stations proves that it would be most advantageous to provide them. GYMNASTICS.
Stational reports.

The evidence given before us shows that gymnastics would be "the best thing ever introduced into the service in India," provided they were made "a parade," and the soldiers "dressed loosely" for the purpose. 3220-3224.

The gymnasia should of course be covered, and provided with the usual fittings. According to the new medical regulations, the medical officer is required to see that the exercises are conducted in such a manner as not to be injurious to health; so that nothing further will be necessary than to provide the accommodation requisite.

The gymnastic sheds, if made sufficiently large, would afford another kind of accommodation very much required in India, viz., covered places where the men could walk and take exercise during the heat of the day, and in the rainy season, apart from the barrack rooms, where they are at present literally confined at these times. 1013, 4135.
5247, 3229.

On this subject of exercise, another most important question presents itself; viz., whether it is really necessary to confine the soldier so rigidly to his barracks during the heat of the day. The assumption seems to be that if allowed to go out he will expose himself and get sunstroke or some other disease, and so the health of the regiment would suffer. No evidence of this result has been adduced before us; and indeed it

GYMNASTICS.

- would, at first sight, appear doubtful whether confining a number of men all day in the same crowded room where they eat and sleep, in a state of absolute inaction, is not, in such a climate, productive of more injury than allowing the men legitimate liberty. The very idea of confinement is in itself injurious, and is very likely indeed to make the soldier miserable. Tell him, however, that he may go out, and, at all events, the idea of unnecessary restriction will be removed. We have evidence before us of men being allowed to go out shooting by their commanding officer in the hot season; and they were all the better for it. At all events they did not suffer in consequence. It is stated that the men liked shooting better than any other amusement: that the effect on their health and spirits is good: that the liberty given has never been, in any single instance, abused; and that it was quite a point of honour with them to behave well.
- At malarious stations, and during dangerous seasons, the same amount of liberty cannot, of course, be given with safety.
- But Colonel Greathed has cited a remarkable instance of the benefit derived from this liberty in one of the hottest stations in India.

In the hottest station, Deesa, where we were for three years, the mortality in the regiment was extremely small, and the general health of the men was excessively good. I mean to say that they were able to take the most active exercise there without suffering from the heat. We allowed them to go out shooting as much as they liked all over the country, and a man would go and walk 14 miles on foot from the barrack, and be back at night; their health and spirits were excellent, and there never was a single case of a difference between the soldiers and the natives in the whole of the three years during which time we gave them unbounded liberty; I mean, of course, to the good men.

In this, as in every other matter bearing on the soldier's health, no precise rule can be laid down. The present evil is, that there *is* a precise rule, viz., to confine the soldiers to barracks; while the nature of the case and the evidence both indicate, that the men should, on the contrary, have every facility given them for exercise, under such local restrictions as common sense points out.

LIBRARIES AND READING ROOMS.

LIBRARIES, &c.

Stational
reports.

- At every station there is a library of some sort; but these libraries resemble closely the libraries at home stations. They are not a whit more comfortable in general; with a few exceptions, not so well lighted. This last defect they have in common with all the barrack rooms; for in India "deficiency of light" is a "universal fault." The supply of books is bad, and a "constant influx of new works" of light literature is as much required as in England. There are very few proper reading rooms, fewer still of day rooms. There are no means of getting refreshment, such as tea, coffee, &c., connected with any of these rooms; although it is obviously most desirable to extend this class of accommodation to India, as is now being done at home stations. The men in India are in more need than they would be at home, of some place out of their bed rooms, where they can smoke, talk, and have harmless refreshment, without being exposed to the temptation of canteens.
- The men are always willing to take advantage of any rational means of recreation; and we have on evidence a very satisfactory instance of a successful coffee room, given by Brigadier-General Russell. It was supported by voluntary contributions from officers and men. The library contained 1,000 volumes, and received a quarterly supply of books, newspapers, and periodicals from London. In the coffee room the men could have ginger beer, soda water, tea and coffee, biscuits, preserves, &c. It was at a distance from the canteen, expressly to keep the men out of the way of temptation; "the very smell of the liquor being a temptation." All amusements near the canteen were discouraged, and only encouraged near the coffee room.
- This is very much what is to be carried out at home. And having succeeded at one station in India, it ought to succeed at all with similar care.
- Much improvement is required in lighting barracks and reading rooms in the long evenings. Small oil lamps, such as are at present used, give a very inefficient light. Wherever gas can be obtained it should be introduced at the Indian stations, as has been done at home. But there are very many stations in India where gas is not available, and it is worthy of consideration whether at these stations gas apparatus should not be provided. Of late years great improvements have been introduced in the manufacture of gas for single establishments by means of simple portable apparatus, which might be tried in India. Coal is not everywhere to be had, but there is at all barracks a certain amount of refuse matter which might be used for the purpose. Lieut.-Colonel Ouchterlony has directed our attention particularly to the importance of the subject as regards

the comfort of Indian barracks, and he shows that it would be economical even to convert the present allowance of oil into oil gas instead of burning it imperfectly in the defective lamps in use. We concur entirely in the importance of these suggestions for the comfort of the soldier.

LIBRARIES, &c.

THEATRES.

There are theatres at many stations, generally in large unoccupied barrack rooms; and sometimes there are rooms erected on purpose, which are also used for music, lectures, glee-singing, dancing, &c. The theatre is a great source of amusement, and occupies many men who have no other interest. To the actual performers it is "rather lucrative."

THEATRES.

3778.

Stational reports.

HOSPITALS.

The European hospitals are constructed on the same general plan as the barracks at the station. The soils, sub-soils, and means of external ventilation are of the same character, except that the hospitals are more isolated than the barrack buildings. The materials and construction are the same. The wards are on the ground floor, elevated at most a foot or two above the level, but without any passage of air beneath the floor. The better class of hospitals are those which consist of detached wards, with a single verandah, because they admit of easier ventilation. The worst are those which have a number of wards in the same building, or double aisles with more than two rows of beds between the opposite doors and windows.

HOSPITALS.

Abstract of stational reports.

Although more constant care is exercised over the general sanitary state of hospitals than over that of barracks, it cannot be said that the great majority of them are well adapted for the treatment of sick.

The plans bear evidence of not having been subjected to any intelligent medical or sanitary revision; and they carry out the description of Sir R. Martin, that the buildings are generally defective, and the latrines and drains generally deficient.

175, 176.

The wards vary to an extraordinary degree in their dimensions and number of beds. Besides the usual "small wards" containing one or two beds, the numbers vary from 16 beds per ward, as in Fort St. George, to 20, 30, 40, 166, 100, as at Dumdum and Kurrachee, 150, as at Dinapore, while at Trimulgherry (Secunderabad) there are two wards for 228 beds each.

Abstracts of Stational reports.

The dimensions of course vary. The smallest class of wards are about 25 feet in length, and from that to 60, 70, 120 to 140, 334 feet, as at Dumdum, 349, as at Poona; and perhaps the longest hospital ward in existence is at Dinapore, no less than 633 feet in length. This ward is 21 feet wide and 18 feet high, being, in fact, nothing but a very long narrow passage, like the Scutari corridors, memorable in history for their immense fatality to the sick in them, owing in part to this long narrow construction.

The usual width of Indian hospital wards is from 20 to 25 feet, with windows and doors on opposite sides. In a few they are 40 feet wide; at least 10 feet more than they ought to be for health.

The wards generally are of considerable and unnecessary height; 18 feet is a common height, as at Poona and Kurrachee. The height is, however, often from 20 to 30 feet, and even 42 feet, as at Trimulgherry. The question of height is a very important one, as indicating the extent of surface over-crowding; for, as in the barracks, excessive height crowds the hospital even with an apparently large cubic space per bed. At Trimulgherry *e.g.*, where the cubic space per bed is 1,000 feet, the superficial area is in some instances as small as 24 feet, and varies to 45 and 75. At Poona the beds have 1,300 cubic feet, but only 70 and 72 square feet. At Dinapore they have 1,000 and 1,500 cubic feet, but only from 52 to 88 square feet. At Dumdum, with 1,500 cubic feet, the superficial area is 78 feet. There are wards with from 1,800 to 2,000 cubic feet, in which the superficial area per bed is from 76 to 84 feet. In some better proportioned wards, 1,400 cubic feet give above 100 square feet. The largest superficial area given in any Indian hospital is at Deesa, in which the ward proportions are such that, with 2,000 cubic feet, they afford 114 square feet per bed.

The usual cubic space per bed is from 1,000 to 1,200 feet, rising occasionally to 1,500 and 1,800, and in certain exceptional cases to 1,900 and 2,000. There are hospitals, however, in which the amount falls far short of this. There is a ward at Surat which gives only 760. Above two-thirds of the sick at Fort William have 927 to 977 cubic feet each. There are a number of wards in which the space varies from 660 to 960 feet. The smallest amount is at Ahmedabad, where it is between 456 and 1,050 feet. The superficial area in the great majority of cases is between 50 and 80 feet per bed. And hence in that element which is of the most importance in an unhealthy climate, *viz.*, surface over-crowding, the hospitals as well as the barracks must be condemned.

HOSPITALS.

It would be very advisable to reduce this great diversity in practice to one common rule, applying the rule to suit local circumstances.

The Royal Commission on the Sanitary State of the Army recommends, for the comparatively small stations in warm climates occupied by Her Majesty's troops, an allotment of 1,500 cubic feet per bed. The Indian stations vary so much in their topographical position and local climates, that it would be better to fix a minimum and maximum space between which the allotment at each station should be made. In all the more elevated, better ventilated, and healthier stations, we suggest the minimum of 1,500 cubic feet; and in all the low-lying, damp, and less healthy positions a larger space and superficial area are required. The beds should be arranged along the walls, with not less than 8 feet of wall space per bed in any case, and with the larger amount of cubic space, more wall space should be given. The superficial area per bed should never be less than 100 square feet with 1,500 cubic feet, and from 130 to 140 square feet with 2,000 cubic feet per bed.

VENTILATION OF HOSPITALS.

HOSPITAL
VENTILATION.Stational
reports.165.
1585, 1589,
1590.

692.

724, 725.

The ventilation of hospitals is effected by opposite doors and windows, aided in many cases by a ventilator in the roof. The evidence before us shows that it varies very much in efficiency. From Sir R. Martin's experience it appears that there is a want of strict attention to ventilation. The old European hospitals are very badly ventilated, while the newer ones are described as very good indeed. The atmosphere in the older hospitals is often very bad and impure from over-crowding.

All that has been said with reference to the draughts produced in barracks, applies with greater force to hospitals. As the ventilation is principally by the doors, and as there is insufficient control over it, it is very often extremely uncomfortable, especially to men with rheumatism, chronic dysentery, &c. in the cold months.

Some hospitals are complained of as being dark, and wherever this is the case they must be close too. In one instance, at Meerut, there is so little light that operations have actually to be performed in the verandah outside. In some instances there appears to be no well-lighted room in which surgical operations can be performed.

Dark hospitals are unsuitable for sick.

A sufficiency of light is as necessary as a sufficiency of fresh air; and it is quite possible to supply both without too much sunlight or too many draughts.

What we have said respecting the ventilation of barracks applies to hospitals. It should be provided for along the ridge and under the eaves; and the patients should on no account be exposed to draughts, either from doors or windows.

Unless the wards be raised a sufficient distance from the ground, it is impossible to supply them with fresh air. As at present constructed, malaria from the ground must necessarily permeate the whole building. The only way to avoid this evil as far as practicable, is to construct hospitals always of two floors, placing the sick only on the upper floor, and providing for a free ventilation between the ward and the ground.

HOSPITAL ABLUTION AND BATH ACCOMMODATION.

HOSPITAL
ABLUTION.Stational
reports.

3508.

The ablution and bath accommodation consists occasionally of a "tin pot" with which "the sick generally pour the water over themselves," as at Bombay. Very frequently there is no ablution room, and the patients wash themselves if at all in the open verandahs in all weathers. Generally there are no basin-stands: and the sick have often to sit on the ground to wash their faces. The only bathing is done in wooden tubs, to which water is carried by bheesties; and it is usually poured over the patients. There are no warm baths, and indeed no baths at all in the sense in which they are understood in all the hospitals of Europe, and even in the military hospitals at home. The means of cleanliness for sick as sick, are, to sum them up, *nil*.

Every sick ward should have its basin stand with fixed basins, and a bath, both with hot and cold water constantly laid on, in a separate small room attached.

HOSPITAL DRAINAGE.—WATER-CLOSETS.

HOSPITAL
DRAINAGE.Stational
reports.

Hospitals are no more drained than the barracks to which they belong. There is surface drainage; but the roof water is allowed to sink into the ground. There is no subsoil drainage; and all fluid refuse has to be removed either by hand, or, by escaping as it best may, to remove itself. No hospital can long continue healthy under such circumstances. All hospitals must be drained together with the barracks to which they belong.

There are no water-closets in any hospital in India. The usual arrangement is to have

night-chairs placed in a small room adjacent to the ward, or to have privies at a distance of from 30 to 80 feet, connected with the hospital (by a covered way), and of the same construction as the barrack privies, often placed over cesspits cleansed once a day, and sometimes provided with pans which are removed daily. The arrangements are those of a camp hospital, and have long since been condemned in Europe.

HOSPITAL
DRAINAGE.
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Every ward should have a water-closet, if practicable, with one or two seats according to its size, having a separate ventilation. It is the only healthy arrangement for sick; every other is liable to danger, especially in the event of cholera or dysentery prevailing, as nothing but immediate removal can prevent the risk of dangerous emanations. In stations where from the want of water no water-closets can be provided, provision for such immediate removal ought to be made.

DIET TABLES AND COOK-HOUSES.

The diet tables now in use in the Indian army are similar to those formerly in use in the British army. They lay down a certain number of fixed diets for every day use, to which the medical officer may add extra articles at his discretion. This practice was attended with many disadvantages in Queen's regiments, to avoid which, a new scale of diets containing sufficient variety for all hospital purposes, and rendering extra articles unnecessary was made matter of regulation. For the sake of uniformity, the new diet table should be adopted for all regimental and general hospitals in India, so far as the supplies will admit of it.

HOSPITAL
DIET.
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Hospital cook-houses are similar to barrack ones; they are in small detached buildings, and are provided with the usual small fire-places and utensils. There is not sufficient variety in the cooking, and sometimes it is complained of as being bad. The cooks are chiefly natives, and have no training in the specialties of hospital cooking; or they are equally untrained men taken from the ranks and liable to be withdrawn at any time. On home stations arrangements are in progress to supply every hospital with a trained cook from the purveyor's branch of the army hospital corps. The cook will be responsible to the head of his department for the state of the hospital cooking; and any cause of complaint will be removable. It would be very desirable that some such responsible system should be extended to hospitals for Her Majesty's troops, while serving in India.

Stational
reports.

HOSPITAL BEDDING.

Hospital bedsteads are generally of wood, sometimes of iron. Wooden bedsteads are at all times, but especially in warm climates, subject to vermin; and complaint is made of the expense incurred by the men breaking the bedsteads in their efforts to get the vermin out. The bedding is of mattresses and pillows stuffed with a variety of materials, chiefly straw and country hemp. By far the best form of bedstead is the iron hospital bedstead in use at home; it should be supplied at all Indian stations. The best material for hospital bedding is hair, now supplied by regulation for mattresses, bolsters, and pillows, in all hospitals of the British army.

HOSPITAL
BEDDING.
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Stational
reports.

HOSPITAL ATTENDANCE.

Attendance on the sick is mainly provided for by a subordinate medical department, with native assistants. The number is fixed by regulation; but the numbers actually employed appear to differ at different stations. They consist of apothecaries, steward, apprentices, dressers, cooks, washermen, water-carriers, tailors, barber, ward coolies, nurses, bearers, sweepers, &c.

HOSPITAL
ATTENDANCE.
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Stational
reports.

The regular establishment for an European corps contains 79 of these officials. In the hot season there are added 34 water-carriers, 23 coolies for throwing water on tatties, 104 coolies for moving the punkahs, making the total establishment 240.

Besides these, there is the regimental hospital serjeant, and orderlies taken from the regiment, who are supplied in all serious cases or at the request of the sick.

So far as numbers are concerned, the supply of attendants is no doubt on the most liberal scale, when contrasted with that which is found in practice to be sufficient for regimental hospital service at home.

Generally we may consider that wherever "a comrade can be told off from the ranks" to attend "upon any case which desires it," there can be no discipline, nothing which can be called efficient nursing of the sick, in such a hospital.

The hospital establishment for a battalion of infantry at home, according to the recent warrant, consists of 1 serjeant for discipline and for attendance on the sick, with 5 privates; also one serjeant, with two or three privates, belonging to the purveyor's department, for providing the supplies, cooking, and care of stores.

HOSPITAL
ATTENDANCE.

The regular establishment of a battalion at home would therefore consist of 2 serjeants and 7 or 8 privates, while in India the same battalion would have a regular establishment of 79, capable of being extended to 240 in hot weather.

The hospital serjeant receives 1s. per day additional pay for compounding, if he qualifies himself for that office; and the cost of a compounder is saved. In India the dispensing is done by six officers of the subordinate medical establishment.

Even in temperate climates, and in civilized countries, where the water is brought to the door, the laying on hot and cold water all over a hospital and the use of lifts, makes the difference of one attendant to every 30 patients. While the most objectionable system of water-carrying, instead of water-laying-on, lasts in India, where not only has every drop of water to be carried to the hospital before it can be carried over it, but to be carried away again when foul, the cost of this kind of arrangement cannot be far short of two-thirds of the whole; and the expense of a civilized system of water-supply and of drainage, may prove to be actually less than keeping up this enormous staff.

As regards the quality of attendance, there can be no doubt that natives, however kind they may be, if untrained, are not the class of attendants the sick want. The same applies to "comrades from the ranks." The hospital corps men at home, under the new warrant, are, it is true, taken from the ranks; but when they are trained they cannot be returned to the ranks, except for misconduct or inefficiency.

As in future each battalion will carry with it its quota to India, it is worthy of consideration whether the Indian hospital system might not be revised, with advantage and economy.

The stational returns contain a great number of complaints as to the untrained character of the hospital nursing.

The hospital establishments throughout India are generally regimental. There are very few general hospitals. The superior advantages of these for the sick, as regards their care and comfort, are admitted; and several are being organized at home and on foreign stations, in terms of the new medical regulations. Female nurses have already been introduced into one of these; and the system is to be extended to others. The only instance of the kind in India appears to be the general dépôt hospital at Allahabad, consisting of 400 beds. Six European nurses have been attached to this hospital since 1858, and are stated to be a great comfort to the sick.

Female nurses are not suited to, nor are they used for regimental hospitals; but wherever, on large stations, general hospitals are organized, they should be introduced; and in these, as well as in the instance of Allahabad, the nursing should be organized according to the regulations in use for Her Majesty's service. Miss Nightingale, in her Observations, has made some excellent remarks on the present state of Indian military hospitals, and on their want of adaptation for the care and speedy recovery of sick. She considers them rather as being like camp hospitals than as establishments adapted for permanent barracks or stations, and consequently deficient in many of the most important requisites for efficient nursing and treatment. She points out many defects which might be remedied, and considers the hospital arrangements generally as of a makeshift character, requiring great improvement to make them at all comparable with those of the recently improved military hospitals at home.

From the evidence it appears that every station for British troops in India has one or more female hospitals for the sick of soldiers' families, generally under the same management as the regimental hospitals at the station, and that they are in most cases supplied with matrons, native nurses, and midwives. The attendance and nursing is generally considered sufficient, but the buildings not so in all cases.

We have now completed our analysis of the information laid before us regarding the various influences affecting the soldier's health and efficiency in India. In weighing the evidence, especially that referring to the sanitary condition of stations, it is impossible to evade the conclusion that a great part of the sickness and premature mortality in the Indian army is due to preventible causes. In times past climate has been popularly blamed for results which would follow in their degree similar causes anywhere. Our inquiry has shown that the causes must be sought in defective sanitary condition and in bad habits, and it is in the correction of these that we must look for diminished mortality and increased efficiency. In the words of Miss Nightingale "it would require very strong evidence indeed to convince the people of this country that the epidemics which have devastated India arise from any other causes than those which the stational returns and the evidence prove to exist in what one may call a state of absolute perfection in the Indian towns, but which have been removed with entire success in this country."

Miss Night-
ingale's pa-
per, p. 363.

Vide Alla-
habad sta-
tional report.

Observa-
tions.

HILL STATIONS.

For some years past the conviction has been gaining ground in India that, in order to diminish the high rate of sickness and mortality, it will be necessary to remove a considerable proportion of the troops from low malarious plains and river-banks, and to station them on high table-lands or isolated mountains. It has been assumed that by simply removing the troops from the influence of heat, moisture, and malaria, which conjointly are admitted to sap the constitution, and predispose the men to disease, troops would be kept in a state of efficiency similar to that of colder climates. This proposition has two aspects; 1, as regards health; 2, as regards the military occupation of the country; and we must consider it with reference to both of these, in order to estimate its exact value, and the extent to which it can be carried into effect.

So far as health is concerned, the evidence in the station returns is, with a trifling exception, decidedly in favour of mountain climates, especially during the earlier years of service; and the evidence of witnesses tends to the same result. Hitherto, however, there has been no experience on any large scale of the sanitary influence of hill climates on healthy troops. For it has been the practice to send to the hills men either absolutely diseased or convalescing from severe diseases, or sickly regiments; and, so far as these classes are concerned, hill climates have been found beneficial in certain descriptions of cases only, but in all others either of doubtful efficacy or positively injurious.

We are indebted to Sir Ranald Martin for having brought this subject prominently before us, and also for having directed the attention of the Indian Government to its importance. The *primâ facie* evidence derived from the superior healthiness of the inhabitants of elevated plains and mountain regions generally, would alone warrant a careful local inquiry into the adaptation of such Indian climates to European constitutions. But, besides this, a large amount of experience has already been obtained in the case of civilians and military officers, who for many years past have been in the habit of resorting to the hills, in order to recover from the exhaustion produced by service on the plains.

Similar evidence is afforded by the Lawrence asylums, one of which, containing 500 children, is at Sunnawur, and the other at Mount Aboo. Children are taken in at four or five years; and during their residence they look like English children, while those in the plains below are "pale, pasty, and wasted."

There is a convent at Darjeeling, with 11 adults and 28 children sent up from the plains; during 13 years there had been no death among the children, while the mortality among the children in Bengal is 84 per 1,000 per annum.

As, of all subjects, children are the most susceptible to sanitary defects of any kind, this experience proves that these hill stations are not necessarily unhealthy, and that, if found so for grown men in health, the cause lies elsewhere than in the climate.

It may fairly be taken for granted, that properly selected hill stations, under proper sanitary management, would be of great advantage to the health of the army; and we propose, therefore, to confine our attention chiefly to those points in the selection which have been brought before us in evidence. Indeed Sir Ranald Martin, while strongly advocating the adoption of hill stations, states that the whole subject has to be investigated *ab initio*, both as regards "the mountain ranges" and "the climates most suited to the occupation of European troops."

The stations which have hitherto been selected as hill sanatoria are of two classes; those on the spurs of the Himalayas, chiefly occupying elevated and narrow mountain crests, and those on the table-lands of southern India. There is another class, of which there are only one or two examples, viz., isolated mountains, such as Mount Aboo and Ramandroog. The least elevated of the Himalaya stations is Subathoo, 4,000 feet above the level of the sea, and the highest are Darjeeling and Simla, 8,000 feet above the sea. The southern Indian stations vary from 5,000 to upwards of 7,000 feet in height. Mount Aboo has an elevation of upwards of 4,000 feet, and Ramandroog of 3,400 feet.

The majority of the stations being on the outer face of the mountain ranges, and at an elevation where the heaviest rains occur, receive the first impact of the monsoon; and the consequence is that they are all wet, and subject to cold fogs. The annual rain-fall in the Himalaya stations varies from 70 inches to 132 inches, as at Darjeeling. The rainfall at Mahableschwur, in Bombay, is actually 240 inches per annum. In the Neilgherry group, which are not exposed to the monsoon, the rain fall is from 50 to 60 inches a year. The mean temperature varies, of course, with the latitude and elevation. In the Himalaya group, the highest mean is from 64° to 78°; in the Neilgherries, from

HILL
STATIONS.

215.

3047, 3050.

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HILL
STATIONS.
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63° to 70°. The lowest mean in the Himalayas is from 35° to 42°; the lowest in the Neilgherries is from 53° to 60°.

140.

The great objection to the Himalaya group is that already stated, viz., the damp climate and excessive rain-fall, the only way of avoiding which would be to select stations at a lower elevation, or more in the heart of the mountains. In this way the force of the monsoon would be avoided; but, on the other hand, the difficulty and cost of transit, and the long distance to be traversed by troops in descending to the plains, present serious obstacles.

2372.

The present stations are described as having clouds continually hanging about them, dispersing and reforming very quickly; at one moment in sunshine, with inconvenient warmth; at another, in cloud, with considerable chill.

Stational
reports.

An elevation of from 6,000 to 8,000 feet is also prejudicial, because, although malaria is to a great extent absent at such a height, troops proceeding from the hot moist plains, where the function of perspiration has been so active, are suddenly exposed to lower temperature, to cold damp air; the result of which is that they become liable to other diseases, chiefly of the bowels and chest.

The diseases of a colder climate are substituted for those of a warmer one. Much has depended on want of care in moving the men: no sufficient attention has been paid to change of clothing, diet, or exercise. The men have been usually left to wander down into the ravines and valleys, filled with jungle, where the sun is intensely hot; and, as we shall presently show, the sanitary condition of the stations has been much neglected.

We have the mortality returns for hill stations for a few years only, and they throw but imperfect light on their influence on health.

The mortality at Murree, 7,000 feet above the level of the sea, was for five years at the rate of 92 in 1,000. It was an invalid dépôt, and several sick men died there, who had been attacked at other stations. Of 39 deaths in Murree, 12 were by dysentery; of 964 attacks, 644 were by zymotic diseases.

3035.

These elevated regions are not even exempt from epidemics, of which a remarkable illustration occurred at Murree. Sir John Lawrence informs us that he saw cholera raging there "in a magnificent climate, a beautiful site and fine barracks, and there was "nobody else sick but the soldiers." Out of 254 men in barracks, 42 were attacked, and 31 died, of cholera. Not one officer suffered, a clear proof that the men were exposed to some specially unfavourable condition.

4520.

The important military position in front of Simla is occupied by Kussowlie, Subathoo, and Dugshai, at which regiments or detachments have been stationed for some years. The mortality at Kussowlie (440 men, 8 years) was at the rate of 37 in 1,000; at Dugshai (717 men, 6 years) 36; at Subathoo (209 men, 3 years) 68 in 1,000. The excess of the mortality was chiefly due to dysentery, diarrhœa, apoplexy, hepatitis, fever; and upon subtracting zymotic diseases, the mortality is reduced to the same rate as prevails in the districts of the higher plains in India. In Subathoo the mortality was at the rate of 15, in Dugshai of 28 per 1,000 in 1860.

Nynsee Tâl near Almorah, 7,609 feet above the sea, is now occupied by a regiment, but supplies no returns. Landour (7,000 feet) is a small invalid and sanitary dépôt; the mortality was, for 10 years, after excluding the invalids, at the rate of 61 in 1,000. Of 67 deaths, 17 were by dysentery. Darjeeling, in Sikkim, is the hill station nearest to Calcutta. It was a convalescent dépôt; and for 9 years the mortality was at the rate of 39 in 1,000. Of 25 deaths 8 were by dysentery.

It must be borne in mind that all the Himalayan hill stations are of comparatively recent formation, and that the mortality is in every case augmented by the deaths of men who were attacked at other stations. The supply of fruit and vegetables is often defective. The water is sometimes polluted, and the men suffer from descending into the close ravines.

Stational
reports.
1109, 1560.

Notwithstanding these objections, merely local, the evidence is in favour of carefully selected positions on ridges or mountain ranges, as being decidedly advantageous to European health, although experience has proved that they are so only within certain limits.

2963.

Sir J. Lawrence, while admitting that men would be healthier on hills than on plains, states that there are constitutions which do not benefit by hill residence. And Colonel Greathed states that, though the men look better on the hills, the returns show no great difference as regards health; but he admits, at the same time, that the sanitary condition of the stations was very bad.

3261.

This last point is one of primary importance, for it is clear that, if hill stations are supplied with bad barracks and hospitals, deficient water-supply, no drainage, and if the vicinity is allowed to become a reservoir of filth, troops leaving the plains for the hills will leave behind them malaria, to find in its stead foul air (and perhaps more intensely foul air) from other causes.

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STATIONS.
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The stations being generally on ridges and near ravines, afford great facilities for perpetrating all kinds of nuisance. There is a large native population, over whom very little sanitary inspection is exercised. At Simla, the "conservancy" is described as having been as bad as could be, the ravines full of dead animals, together with the ordure of many thousand natives. There are no public conveniences. The water-supply was scanty, and liable to pollution. The effluvia from the ravines were "as strong as on going into a sewer." A large amount of hill diarrhœa prevailed among the residents, which Surgeon Major Grant attributed mainly to want of sanitary precautions, and neither to the elevation nor to the damp atmosphere. He states that the disease had gradually increased with the increase of population, and that "the authorities seemed to think that, because the climate was cold, the men might be crowded together, and all "sanitary arrangements neglected with impunity." The men were crowded together at Kußowlie with fatal results. Colonel Greathed informs us that, when the rains begin, the nuisance produced by the washing down of the filth is intolerable.

4484, 4487.

4486-4487-
4492.

3267.

The reports on the stations give the evidence of a number of officers on this same subject. We learn from them that the barracks at several stations in the Simla group, such as Subathoo and Kussowlie, are bad in structure and plan; that at Mount Aboo the barracks are erected in a malarious gully; that at Nynee Tâl, 6,400 feet above the sea, the huts have been built in a narrow defile, where the earth is damp, and a perfect marsh during rains, and where the huts are exposed to violent gusts of wind. The bazaars are filthy and crowded. There are neither drains nor latrines, and "the "stench is at times overpowering," causing nuisance in the barracks. At Darjeeling the medical officer reports the sanitary condition of the hospital for convalescents as "bad," and he states that he had been making representations for five years as to a privy under a verandah connected with the hospital, before he could get the nuisance abated, which rendered the ward so offensive that the sick had to be moved out of it. The drainage is defective, and "the inducements for the sick to remain dirty are," he thinks, "greater "than those to be clean."

Vide Ab-
stracts and
Stational
Reports.

The hill stations on the Neilgherries are not exposed to the same objection as regards climate; the rain-fall is much less, and the air is drier; there are fewer fogs, and altogether this group of stations is perhaps the best yet occupied. But even here the usual fatality followed neglect of very obvious sanitary measures. When the station at Jackatalla, now called Wellington, was first occupied, much disappointment was experienced on account of the high rate of sickness and mortality.

The mortality of the 74th Highlanders, during three years at Jackatalla, was at the rate of 39 per 1,000. Of the 68 deaths in the regiment, 19 deaths were by dysentery, 6 by diarrhœa, 8 by cholera, 6 by apoplexy, 9 by hepatitis. The barrack square "was "frequently an immense swamp." In 1860 the mortality of the 60th Rifles, third battalion, was at the rate of 24 in 1,000 at Jackatalla; the mortality of the 66th Foot at Cannanore was 11 in 1,000 during the same year. Cannanore is on the coast, and 20 feet above the sea level.

On inquiry into the causes of this sickness, it was discovered that, besides want of attention to drainage, the large body of from 2,000 to 3,000 workmen employed on the buildings had been under no sanitary control, so that the ground for miles about was "one immense privy," and the troops suffered to a great extent from bowel disease in consequence; but since sanitary arrangements were thoroughly carried out, the sickness has been under one per cent. of the strength.

2336.

One thing is quite clear, that it will never do to trust simply to elevation above the plains to keep the army in health.

Malaria has been blown up ravines in India far above the fever range, over sites otherwise perfectly healthy; and those who slept within its influence have been attacked with fever and died.

4258.

We have shown that epidemic disease originates at hill stations just as it would do at unhealthy stations at home. Hence, in selecting sites on hills, all the precautions necessary for selecting sites on plains are just as necessary. The climate, exposure, subsoils, drainage, water-supply, local diseases, and the relation to distant sources of malaria, require careful examination; and all buildings, whether for European troops or

HILL
STATIONS.

natives, must be subjected to the sanitary conditions as to structure and supervision which are everywhere required.

It is always desirable, as suggested by several witnesses, to test new hill stations by a residence at them of a certain number of Europeans and natives, before they are occupied. The preponderance of evidence is rather in favour of heights of moderate elevation than of those so high as Darjeeling. Sir R. Martin states that the best elevations have yet to be determined, and that probably heights of from 2,000 to 4,000 feet, if otherwise suitable, would be best in practice.

We are of the same opinion, and would suggest that stations of intermediate height should be carefully sought for, and their sanitary relations investigated.

It is objected to stations on narrow mountain ridges that there is not sufficient space for healthy exercise; that the men can scarcely leave the immediate vicinity, and suffer from confinement. The men complain of their forced inaction, and dislike these stations. But this admits of remedy. Sites very defective in this respect should not be chosen, or, if already chosen, it is always possible to find space for gardens by terracing the slopes; and occupation may be given to the men in this way. Abundant means of exercise are indispensable to health on the hills.

The men find the hill stations dull also, it is to be feared, from their being cut off from the debauchery and excitement of the plains. But on the other hand, this isolation from the plains is considered to be a great advantage as regards health, by enabling a more strict police to be exercised, whereby the sources of debauchery are cut off.

We next proceed to consider the extent to which hill stations can be occupied consistently with military and political considerations. There is some diversity of opinion on this point, as there is also on the precise manner in which hill stations should be used. On one point, however, all are agreed, viz., that sickly regiments should not be sent to the hills; for such regiments invariably suffer in health.

As regards disease, the mountains of India are but partially curative.

There is also a general concurrence of opinion that healthy regiments, or parts of regiments, should be stationed on the hills, and that men who are beginning to suffer in health from service on the plains should be sent to the hills. Of this latter class there is a considerable proportion in all regiments. If left in the plains, many of these would become subjects of actual disease; and from the nature of the case they should be sent to the hills for restoration to health. As regards the others, it has been proposed to locate most of the effective force on hill stations, at such a distance from the plains as would enable them, either by roads or railroads, to be thrown on any point where their services might be required.

But it is very soundly objected to this by Col. Durand, that any large proportion of the troops cannot be permanently quartered on the hills without detriment to the military occupation of the country; that to do so would be practically to evacuate the country; that it would be most dangerous not to occupy the great strategical points, upon which the security of the country depends; that there are many posts which must be held, healthy or unhealthy. Several illustrations of these dangers occurred during the mutiny, where important points were lost from deficiency of force before regiments could be brought down from the hills. It is clear that all necessary points in the plains must be held by a sufficient force; and hence, whatever proportion of troops is placed on the hills, must be considered as "a reserve." Both Sir John Lawrence and Sir Charles Trevelyan concur in this, that not more than one-third of the force should be disposed of in this manner. Such a proportion would enable the remaining two-thirds of the force to take their turn on the hills. But here another question presents itself, viz., what are the points in the plains which must be held? This all important element in the question has not yet been settled. It depends upon the military authorities to do so; and as soon as it has been done, we recommend that hill stations conveniently situated for the strategical points should be provided wherever it is possible.

Possibly some of the more unhealthy stations in Lower Bengal could be abandoned without risk to the military occupation of the country, and with great advantage to the health of the army; but, at the same time, it is necessary to bear in mind that the stations in worst repute are in such a bad sanitary condition, that it is not easy to say to what extent the health of the troops might not be improved by suitable works and precautions. It is said of even some of the worst of them that they have never had "fair play" on account of this want of sanitary care.

The hill stations must, of course, be at the shortest possible distance from those on the plains; but the introduction of railroads will facilitate their occupation, and enable more distant stations to be used.

Vide Kher-
warrah Re-
port.

As regards the Madras Presidency, there would be no difficulty in locating the requisite number of troops on the hills. The Neilgherry range is one great hill station, sufficient for nearly every purpose, and which will shortly be connected, more or less, with every station by railway. Other stations have also been proposed at Ramanmullay, Shevaroy, and the Pulney hills. In the Bengal Presidency the spurs of the Himalaya have been chiefly used; but there are many hill districts besides these worthy of careful examination. The chief hill stations in the Bombay Presidency are at Mahableshwur and Mount Aboo. The former from its local position, as already stated, is very wet; but many other more available points might be discovered.

The result of our inquiry into the important subject of hill stations may be given in a very few words, as follows:—

1. To reduce to a minimum the strategic points on the alluvial plains, and to hold in force as few unhealthy stations as possible.

2. To locate a third part of the force required to hold these points on the nearest convenient hill station or elevated plain, including in this third, by preference, men whose constitutions are becoming enfeebled, and recruits on their first arrival; and to give the other two-thirds their turn.

3. Never to trust to simple elevation as a means of protecting health; but, while occupying the best available elevated stations, to place these (for they want it just as much as the stations in the plains), in the very best sanitary condition.

SANITARIA.

Besides the hill stations, there are several places along the sea-coast of India which have been found very useful in restoring health after certain diseases. The most successful of these is Waltair, on the Madras coast, which occupies a range of sand hills close to the sea, fully exposed to the sea breeze. Others have been proposed in India, at the Cape, and especially in Western Australia. The object which these places is intended to serve is not the prevention of disease so much as restoration to health after disease.

The Cape of Good Hope has at various times been strongly recommended for this object; but its distance is so great as to render it of doubtful utility, and besides it is alleged that the climate of the Cape is not very suitable for Indian diseases.

Western Australia, though not much nearer, appears to possess many advantages as a locality for a sanitarium.

We have taken evidence on this point from Vice-Admiral Sir James Stirling, K.C.B., late Governor of the Colony; from Staff-Surgeon Rennie, who has been stationed at Fremantle for 6½ years; and from Mr. Roe, Surveyor-General.

It appears from the evidence of these gentlemen, that the climate, although possessing a temperature ranging between 45° and 100° Fahr. is dry, fine, healthy, and invigorating. That the mortality rate is low, and that there are no particular local diseases. That water and supplies are abundant and good, and that the most favourable parts of the colony could be reached from Calcutta and Bombay in about 20 days by sailing vessel, and in from 14 to 16 days by steam.

The evidence on the subject is not so conclusive as to enable us to recommend the adoption of Western Australia as a position for a sanitarium; but it is sufficient to justify a recommendation that its claims be further inquired into.

We have seen that hill stations are not curative, and that in fact diseased men had better be removed out of India. The only question is whether a complete sanitary system for the Indian army should include a foreign sanitarium, or whether it would not be better to send diseased men home at once. There is much to be said on both sides, but there is no direct evidence of a decisive character either way. It is highly probable that certain cases of disease would so far recover as to enable the sufferers to resume duty after a short residence out of the country, and for this class of cases Australia would be useful. It is on this ground that we would advise further inquiry.

But for cases in which return to comparative health would probably not be accompanied by the likelihood of return to efficient service, the best way would be to send the sufferers home.

As the veterans of the army advance in years the warm climate of India out of the region of malaria appears to suit them. Bangalore is a striking example.

NATIVE LINES.

Native troops generally hut themselves; but at a few stations there are barracks. Hutting is the rule, and each man receives a small sum from Government for the purpose.

HILL
STATIONS.
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4269, 427
5342.

SANITARIA.
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868-872.
864, 3382
3335.

NATIVE LINE
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Stational
reports.

NATIVE LINES. The huts are made of very light materials, bamboo and matting, and cost about two rupees. The men generally sleep outside, except in the rains. The huts differ in dimensions, and are not constructed on any general rule. Those for single men are, say 10 feet long by $7\frac{1}{2}$ wide, and 7 feet high, containing about 525 cubic feet.

5826.

A married soldier builds a hut of from 12 to 18 feet long, 12 to 8 feet wide, and 8 to 10 feet high.

The huts are put up without any order or regularity. Nobody interferes; the outline only of the native lines is marked out.

5695.

The huts are huddled together, without drainage or attention to ventilation.

5700.

Officers sometimes induce the men to arrange the huts in line, with a space between. But of sanitary supervision there is none.

5818.

5729.

Natives generally raise the floor of their huts with earth taken from a hole close to the door, in which hole all manner of filth is deposited.

A native cantonment is nothing but a very bad camp, in which every sanitary precaution is ignored, and the water is often very impure.

5899.

The only advantage the native possesses is that of having a separate hut.

Native troops, as might be expected, suffer much in efficiency from epidemic disease. According to the returns their mortality is less than that of European soldiers; but many men are sent home from their regiments to die from disease contracted in the regiment. Such cases are not entered on the death list. The condition of the native lines undoubtedly exerts a very injurious influence upon the troops.

5746-5748.

It is usually considered that little or no sanitary improvement can be carried out among natives on account of caste prejudices, but it may be doubted whether such is really the case. Natives, it is stated, would make no objection to clearing and levelling ground, drainage, and cleanliness, if it were properly explained to them that it was done only for the protection of their health; they object solely on the ground of cost and trouble; but if the requisite improvements were made without additional cost to themselves, and with full explanations of their nature, it is not likely that any serious difficulty would arise. It is, however, superfluous to observe on the necessity of caution in dealing with this part of the question.

5728, 5730.

Apart from any consideration of humanity, there would be a saving in improving the condition of native lines. There may be plenty of raw material for soldiers in India, but it requires training and drilling. An efficient native soldier costs money; and when he gets into hospital, or is invalided, or dies, Government incurs great expense in loss of service, medical assistance, &c. Any system of improvement required for stations should therefore include native lines.

NATIVE HOSPITALS.

Native hospitals have very few, if any, of the conveniences of hospitals in Europe. They generally consist of a simply-constructed hut, with a pent roof supported on pillars so as to form a verandah. There are numerous doors, and unglazed windows with wooden shutters, which are the usual means of ventilation. Two or three small rooms are generally cut off from the end of the hut or the corners of the verandah, and there is a court behind containing privies, cook-house, dead-house, &c. The hospital construction and administration appear to have been framed on the habits of natives, rather than on what is necessary for the recovery of sick. There seems to be no regulation as to the amount of bed space. The allowance per bed in different hospitals is 294, 386, 570, 620, 840, 1,000, 1,500, up to 1,700 or 1,800 cubic feet. There are no lavatories and no proper baths. The sick wash according to their own habits, and there are tubs in which they can sit to have water poured over them. Ablution is generally performed in the open air in the verandah, or the patients are allowed to go home to wash. In one native hospital the sick are allowed to wash and bathe in a tank in front of it. The means of cleanliness for sick are admitted to be altogether insufficient for medical purposes. The medical officer has no control over diet or cooking, and hence patients often make themselves ill by errors in quantity or quality. The cook-houses have only native fireplaces; they are sometimes close to the privies and dead-houses, and the smell pervades them. The privy is merely a walled off space kept clean by sweepers. In the ordinary sense of hospital offices there are none. Sometimes the surgery is used for all purposes. The attendance on the sick is insufficient. In one hospital of 30 beds the only attendant is the assistant apothecary; but in this, as in other similar cases, native orderlies may be obtained from the regiment. Bedsteads are usually of wood; the natives appear in some cases to supply their own bedding, and in others beds are given out on the requisition of the surgeon. Hospital washing is done by washermen, occasionally by comrades.

NATIVE
HOSPITALS.

Vide Abstracts of
Stational
Reports.

5881.

Miss Nightingale's observations,
p. 364-7.

In practice the sole function of the medical officer in these native hospitals is to order drugs. The only thing done to promote the recovery or comfort of the sick is to supply drugs. In everything else, in diets, baths, &c., the medical officer has no power.

NATIVE
HOSPITALS.

The system seems to be the growth of circumstances, and of an indifferent deference to supposed caste prejudices.

Little attempt seems to have been made to conciliate with such native prejudices or habits the use of means which are essential to the recovery of the native, quite as much as, or more so than to that of the European.

This wise conciliation would effect great improvement in the stations among healthy native soldiers. Could it not be extended also, by considerate inquiry, to the sick?

SANITARY ADMINISTRATION.

At the three seats of government, Calcutta, Madras, and Bombay, sanitary powers are vested in local commissioners appointed by Government. But there appears to be no one on these commissions specially conversant with sanitary works. For in each city the sanitary state of the population, as regards drainage, water-supply, cleansing, construction of buildings, and general sanitary arrangements, is as bad as it can well be. It is hardly an exception to this, that Bombay has recently obtained, for the first time since it came under British rule, a water-supply; or that Calcutta is about to be drained, for drainage and water-supply are only two portions of one system, and not two separate systems. Nothing has yet been done in Madras. And as sanitary measures, to be effectual, must be carried out as a whole, and not partially, it cannot be said that even the seats of Government have, up to the present time, made any efficient progress in sanitary improvement.

SANITARY
ADMINISTRATION.

Sir C. Trevelyan states that, before he left Madras, he prepared a scheme for the reconstruction of the municipality on a sufficiently popular basis to interest the inhabitants; and through this to lay the foundation of sound sanitary improvement, by the introduction of a conjoined system of drainage and water-supply. But up to this present time nothing further has been done.

5305.

So far as the evidence before us relates to other large cities and towns, there is no sanitary administration whatever; so that, to all intents and purposes, this important administrative department has to be created for India.

The sanitary police of bazaars is, with few exceptions, of a most inefficient character. The administration seems to vary at different places, and to be confined chiefly to surface cleansing. The power is exercised by the cantonment magistrate, but on no definite system; sometimes carts and sweepers are allowed, in other cases the people are held responsible for their own cleanliness. Certain bazaars and cantonments are described as being "clean." But the majority bear no evidence of any consistent sanitary authority being in existence.

Vide abstract of
Stational
Reports.

The sanitary state of the lines is under the military authorities and medical officers. But hitherto this part of the administration has been far from efficient, on account of its not being special enough. Referring to this subject, Sir R. Martin states that, although generally throughout India the arrangements are admirable for the cure of disease, they are not at all so for the prevention of disease, that, for this great purpose, they are almost universally wanting; that there are no proper sanitary officers; that no knowledge whatever, either of military hygiene or of preventive science, has been exacted from medical officers; that indeed a sanitary department is altogether wanting; that any knowledge obtained by medical officers has been too often obtained at the expense of the soldier.

200.

216-218.

An examination of the stational returns shows that the proper functions of officers of health are not even recognized, and that there is neither order nor system in the administration.

5498, 5499.

Very important improvements have been recently introduced into Her Majesty's service, which will in time remove some of the evils so far as stations are concerned. A practical school, in which hygiene is taught, is now in operation at Netley, and all candidates for commissions in the army medical service are required to undergo this course of instruction. In the present transition state of the Indian service all Indian medical officers must also attend this school. In a few years therefore the army will be supplied with a considerable number of men competent for ordinary regimental sanitary work. According to the new medical regulations, in force in Queen's regiments, medical officers have now certain defined sanitary powers in inspecting and reporting to their commanding officers, who are required to carry out their recommendations, or else to state their reasons for non-compliance to the superior military authority. Special sanitary officers

can be appointed to this work in garrisons, camps, and stations, or, if such officers are not appointed, the principal medical officer is required to do the duty. Reports are made to commanding officers, and are dealt with as already mentioned.

This procedure was in operation in India during the mutiny, and "was leading to an immense amount of good," when the service was discontinued. We are of opinion that, if the regulations were enforced at every station, they would effect all the good they are capable of, so far as the stations are concerned. These regulations, of course, are applicable only to the removal of easily-removed causes of disease. They can effect no improvement as regards drainage, water-supply, the laying out of stations and bazaars, and works generally requiring a large outlay, such as are executed under the Public Works Department.

This department at present has no special sanitary direction, and as we have shown, even the latest constructed barrack errs in the most important particulars.

Much of this evil might be avoided in time to come by requiring all cadets of engineers at Brompton to attend a special course of hygiene, which they have a right to do (by the army medical school regulations).

It follows from what has been said that, except for regimental and certain stational purposes, there is no sanitary authority or administration in India, and no means of bringing the large experience acquired in dealing with sanitary questions, as regards towns, stations, and barracks, including the description of works which have been successfully introduced at home, to bear on the Indian question. The time has now arrived to supply this deficiency in each presidency.

There are no doubt considerable difficulties in the way of organizing an efficient sanitary service for India, and in adapting it to the various exigencies of the country, but there are nevertheless certain leading principles which should be kept in view in any administrative arrangements to be introduced for the purpose. It is, for example, of great importance that the procedure should be as far as possible uniform in each presidency, and this could be best secured by appointing commissions of health, one at each seat of Government, representing the various elements, civil, military, engineering, sanitary, and medical, on the co-operation of which depends the solution of many health questions. We are of opinion that such commissions are necessary also to give a practical direction to sanitary improvements and works.

Their functions would be chiefly consultative and advising on all questions relating to the selection and laying out of stations, proper construction of barracks, hospitals, and other buildings, drainage, water supply, cleansing, and general sanitary supervision in stations, cities, and towns, and on the prevention and mitigation of epidemic diseases.

To fulfil the other object of taking advantage of home experience, it would be necessary to afford these commissions every needful information on the most approved and economical methods of laying out sanitary works, and in those healthy principles of construction and improvement of barracks and hospitals which have been successfully carried out in England, but which have still to be introduced into India, and adapted to the circumstances of the country. The sanitary improvements which have been recently introduced at home military stations, and which are about to be carried into effect at certain foreign stations by the War Office, as well as the improved principles of construction in barracks and hospitals now in use, were adopted on the advice of a Commission specially appointed by the War Office to inquire into the subject. The questions which arise out of the evidence from the Indian stations, are of the same nature as those which have come under the examination of, and have been dealt with by, the War Office Commission, and it would be highly advisable to make their experience available for India by adding to the existing commission an engineer and a medical officer conversant with Indian sanitary questions, or to form a similar commission in England for this object. Such a commission, if considered preferable, should include members specially conversant with recent improvements, military and civil, an engineer of Indian experience who has given attention to sanitary works, and a medical member acquainted with the sanitary question as it presents itself in India. The function of such a commission could of course be consultative only. It would simply be the medium of advising and informing the Indian Government and the presidency commissions on the latest improvements and on the best principles of sanitary construction. For this purpose, it might give its advice on the healthiness or otherwise of plans, and as to the sanitary details of buildings to be occupied by troops; on the best and most economical methods of water supply and drainage: it might collect and publish useful information and instructive matter regarding improvements, and it might possibly be able to give a more practical direction to the education of cadets of engineers

destined for service in India, to enable them to devise works and improvements on healthy principles.

It would in no way interfere with perfect freedom of action. It would place at the disposal of the Indian Government and presidency commissions the latest experience, classify and generalise the results of their several publications in a summary form, and thus enable all to arrive at a more satisfactory decision as regards measures to be carried out for protecting the health of troops than would otherwise be possible.

As to the executive authorities by whom sanitary measures will have to be carried into effect, we apprehend that, as regards military buildings and stations, the powers should remain as at present with the department of Public Works, whose plans and proposals would have to be submitted to the presidency commissions for opinion on points affecting health.

All plans of sanitary works and improvements, which might be proposed for native towns connected with stations, should also be submitted for advice and opinion to the presidency commissions.

It would be very advisable to begin this great work with the seats of Government, and to select a few of the more important stations to be thoroughly improved as examples. This course would at once afford the necessary administrative experience, and a basis would be laid for future progress.

Much time must necessarily elapse before much progress is made, but we fear this is inevitable.

RECAPITULATION.

Our inquiry has shown—

1. That by far the larger proportion of the mortality and inefficiency in the Indian army has arisen from endemic diseases, and notably from fevers, diarrhœa, dysentery, cholera, and from diseases of the liver.

2. That the predisposition to these diseases is in part attributable to malaria, in conjunction with extremes of temperature, moisture, and variability.

3. But that there are other causes of a very active kind in India connected with stations, barracks, hospitals, and the habits of the men, of the same nature as those which are known in colder climates to occasion attacks of these very diseases, from which the Indian army suffers so severely.

In examining into these causes, we find that the stations generally have been selected without reference to health, and mainly from accidental circumstances, or for political and military reasons. Many of them are situated in low, damp, unhealthy positions, deficient in means of natural drainage, or on river banks, close to unwholesome native cities or towns.

Bad selection of stations.

The towns and bazaars in the vicinity of lines are in the worst possible sanitary state, undrained, unpaved, badly cleansed, often teeming with offensive and dangerous nuisances; with tanks, pools, and badly-made surface gutters, containing filth and foul water; the area overcrowded with houses, put up without order or regularity; the external ventilation obstructed, and the houses overcrowded with people; no public latrines, and every spare plot of ground covered with filth in consequence; no water-supply, except what is obtained from bad shallow wells and unwholesome or doubtful tanks. These towns and bazaars are the earliest seats of epidemics, especially of cholera, before their ravages extend to the European troops in the vicinity.

Bad sanitary state of native towns and bazaars.

None of the stations have any subsoil drainage; and there are no other means of removing the rainfall except surface gutters. The ground about the lines is often broken up in pits and hollows, filled with stagnant water, or it is traversed by unwholesome ravines or nullahs. In certain states of the weather and wind nuisance is experienced in the lines from these causes, and from the foul state of neighbouring native dwellings. Many of the older stations are irregularly built; and the buildings are arranged so as to interfere with each other's ventilation.

Sanitary defects of stations.

Both barracks and hospitals are built at or close to the level of the ground, without any thorough draught between the floors and the ground. And the men, both in barrack rooms and sick wards, are exposed to damp and malaria from this cause, as well as from want of drainage. The ventilation is generally imperfect; and from the arrangement of doors and windows, men are exposed to hurtful draughts. Many of the rooms are too high, and as a consequence there is much surface over-crowding, both in barracks and hospitals, although with large cubic space. In a number of instances both the space and area per bed are much too small.

Defects in construction of barracks and hospitals. Over-crowding.

Barracks and hospitals have frequently no glazed windows, and only wooden shutters. Both barrack rooms and sick wards are, as a rule, dark.

Want of light.

RECAPITULATION.	There are often four, or even six, rows of beds between the opposite doors or windows, increasing greatly the already existing difficulty of ventilation and exposing the inmates to foul air.
Bad position of beds.	The greater proportion of the force is lodged in barracks in such large numbers per room as to be very injurious to health; many of these rooms being several hundreds of feet in length, and some of them containing from a quarter to half of a regiment each!
Barrack rooms hold too many men.	Water sources have been, with one or two exceptions, selected without analysis, although it is always hazardous to omit this precaution. The supply is taken from shallow wells and tanks, both of which are very liable to pollution. In a few cases, the water is derived from rivers. It is drawn by dipping, and carried in skins, thereby increasing its impurity. No precautions are taken for purifying drinking water, and the whole arrangement results in a supply of water (for drinking and culinary purposes) of a bad or doubtful quality, and such as would be rejected in any improved sanitary district in this country. This unsatisfactory condition of the water supply is one of the cardinal defects at Indian stations.
Defects in water-supply.	
Deficient means of cleanliness.	Ablution and bath accommodation is often very deficient and sometimes there is none. Very often there are no baths, and where baths exist there are not enough.
Cooking.	Means of cooking are primitive and imperfect, hardly suitable for permanent barracks, although the cooking is considered sufficiently varied.
Latrines and urinals.	Privies and urinals are generally of a bad or defective construction. The contents are removed by hand, often producing great nuisance. No drainage for either privies, ablution rooms, or cook-houses: the foul water is received into cesspits or carried away by hand.
Hospital defects.	Hospitals are constructed on the same general plan as barracks. They have no proper ablution or bath accommodation; no water-closets, only open privies situated at a distance; no drainage, no water supply, except what is drawn and carried by hand labour. The bedsteads are often of wood, instead of iron, and mattresses and pillows of various materials, instead of hair, as they ought to be.
	No trained attendants are provided for the sick.
Ration.	The soldier has a complete ration of good quality; but the ration is not varied to provide against the effects of the soldier's sedentary habits; and no difference is made for the cold and hot season. For the hot season the ration contains too much animal food and too little vegetable. Mutton is not issued often enough.
Clothing.	Flannel underclothing would be very advantageous, and a better system of supplying boots for troops is required.
Drink.	The use of spirituous liquors is highly detrimental to the soldier's health in India, and is one of the chief personal habits which injure him physically and morally. Abstinence from spirits has always been attended by greatly improved health, even under circumstances otherwise unfavourable, and by diminution of crime. The only advantage of the issue of spirits in canteens is stated to be that it prevents the soldier from obtaining more unwholesome spirits in the bazaar. The moderate use of malt liquor or light wines is much less injurious to health than spirits.
Intemperance.	Connected with habits of intemperance and want of occupation, is the prevalence of syphilis, a disease which occasions a large amount of inefficiency and invaliding.
Deficient means of instruction and recreation.	Means of recreation are few, of exercise none, of instruction limited. The soldier's habits are sedentary where they ought to be active. He is led into vice and intemperance. He has no means of occupying his time profitably. He complains of the weary sameness and ennui of his life. This, together with his diet, and allowance of spirit and malt liquor, is bad for his health—physical as well as moral health.
Results of removable causes of disease.	Making every allowance for the influence of climate, which, however, is altogether secondary, except as increasing the effect of removable causes of disease, the whole tenor of the evidence proves that the bad sanitary conditions enumerated, together with unfavourable habits as to diet, intemperance, and want of occupation, on the part of the men, are causes sufficient to account for a large part of the sickness, mortality, and invaliding occasioned by those diseases from which the army in India mainly suffers.
State of sanitary administration.	The arrangements for the prevention of disease are either non-existent or most deficient. There are no proper sanitary authorities in towns, no trained officers of health in any town or cantonment, and no means whereby the experience obtained in dealing with sanitary questions at home can be rendered available for India. Until recently, no means on the part of medical officers of receiving education in military hygiene and sanitary knowledge existed; there was no recognition of the sanitary element in the army medical service. At present there are no means of bringing trained sanitary knowledge or experience to bear on the selection of sites for stations, or on the laying out of stations

or bazaars with the requisite sanitary works, or on the planning or construction of barracks and hospitals on sanitary principles. RECAPITULATION.

Under the new medical regulations, medical officers are empowered to make representations regarding removable causes of disease to commanding officers, which will so far meet the requirements of regiments; but otherwise there is neither order nor system in sanitary administration.

Hill stations are proposed as a means of being able at once to remove the troops from the influence of climate, malaria, and sanitary defects of stations and barracks into a healthy region. The evidence proves that these stations are useful chiefly for prevention, but not always for cure of disease; that they are suitable for children, and for healthy or ailing men, but not for unhealthy regiments, especially those suffering from bowel complaints; that about a third part of the troops might be located on hill stations, or on other high and healthy positions in rotation, with advantage to health; that although the number of stations in malarious regions should be diminished as far as practicable, and the troops removed to healthier localities, there are certain strategical points (yet undecided) which must be held, whether healthy or unhealthy, and the force on the hills must be considered as a reserve for the purposes of health. Hill stations.

Although several excellent hill stations are in use, they are not sufficiently convenient for many stations; and an increased number is required. Very careful examination and trial of the climates of new sites should be undertaken. The evidence farther shows that there has been great neglect of sanitary measures at existing hill stations, giving rise to serious disease and mortality.

Stations on the plains and slopes of India up to 1,500 feet, and on the raised coasts of the sea, are comparatively salubrious. They only require adequate sanitary arrangements. Elevated plain stations.

Stations on low inundated lands are hotbeds of malaria.

Native lines are laid out, and huts built, without sufficient reference to health. Lowland stations.

There is no drainage, clearing, or levelling, and little attention to cleanliness or ventilation. Native lines.

Native hospitals are almost altogether wanting in means of personal cleanliness or bathing, in drainage or water-supply, in everything in short except medicine. The medical officer has no control over the patient's diet. There are no trained attendants on the sick. The evidence shows that, by management and conciliation, much might be done to improve the sanitary condition of native lines, as well as the state of native hospitals.

We have, in the course of our inquiries, endeavoured to ascertain the probable excess of mortality in the Indian army occasioned by the sanitary defects we have described, as well as the reduction of mortality which would follow on the adoption of improvements in existing stations, combined with the use of hill stations, and the abandonment of as many unhealthy localities as may be practicable. The statistical evidence shows that the mortality varies from $11\frac{1}{2}$ per cent. in the most unhealthy, to about 2 per cent. in the most healthy places, even in their present unimproved state. It has been estimated that the lowest of these rates, or 2 per cent., (double the rate at home stations since the introduction of sanitary improvements,) may be taken as the possible mortality under improved sanitary conditions. 4543, 5569.

The annual death rate for the whole of India has hitherto been about 69 per 1,000. The proposed European establishment is 73,000 men, and will, at the present rate of mortality, require 5,037 recruits per annum to fill up the vacancies caused by death alone.

A death rate of 20 per 1000 would require only 1460 recruits per annum, so that the excess of mortality is 3570 lives per annum.

Estimating the cost of recruiting, training, and landing men in India at no more than 100% per man, the excess of mortality will be equivalent in cost to a tax of nearly 1,000% per diem, irrespective of the cost of the extra sickness indicated by a high death rate.

A careful examination of the causes of disease and of the character of the diseases prevalent at the more healthy stations, would lead us to hope eventually for a greater saving of life than we have here estimated. Causes of disease, such as exist at these stations, would, even at home, be sufficient to account for one-half of the 20 per 1,000; and if the time should ever arrive when, under the influence of improved culture, drainage, and sanitary works, India should be freed from the local malaria which exists everywhere there now, as it once did in some form or other over Europe, we may cherish the hope of realizing what statistical inquiries appear to point to, namely, that

RECAPITULA-
TION.
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the natural death rate in times of peace of men of the soldiers' ages in India, will be no more than 10 per 1,000 per annum.

But a reduction of mortality also indicates increased physical strength and greater fitness for duty in the army generally, as well as a smaller proportion of "constantly sick" in hospital; and hence a greater effective numerical strength.

5569. Fewer recruits would be required to supply the losses from disease, a point of very great importance, in regard to which Sir A. Tulloch states that he very much questions whether, with the mortality rate of the last 40 years, it would be possible to keep up an army of 70,000 men in India. And he says that from what he knows of recruiting, this country would not be able to fill up the gaps occasioned by death, and at the same time supply the vacancies occasioned by invaliding, and by the return of time-expired men.

Apart therefore from the question of humanity, the introduction of an efficient system of hygiene in India is of essential importance to the interests of the empire.

The following recommendations are founded on the practical conclusions at which we have arrived.

RECOMMENDATIONS.

RECOMMENDA-
TIONS.
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1. That no recruit be sent to India under 21 years of age, nor until he has completed his drill at home, and that recruits be sent direct from home to India, so as to land there early in November.

2. That no spirits be issued to troops on board ship, except on the recommendation of the medical officer in charge.

3. That the sale of spirits at canteens be discontinued, except in specific cases on the recommendation of the medical officer, and only malt liquor or light wines allowed. That the sale of spirits in military bazaars be made illegal, and, as far as practicable, suppressed.

4. That the ration be modified to suit the season; that flannel be introduced as under-clothing, and a better system of supplying boots introduced.

5. That the means of instruction and recreation be extended to meet the requirements of each station. That covered sheds for exercise and gymnastics be provided, and that gymnastic exercises be made a parade. That libraries be improved, a better supply of books and periodicals provided, together with reading rooms, well lighted at night. That only coffee, tea, and other non-intoxicating drinks be sold to the men at these rooms. That workshops be established, and also soldiers' gardens, in connexion with the station, wherever practicable. That the proposal made by Sir C. Trevelyan of selecting and educating soldiers of good character for subordinate offices in the administrative departments be tried.

6. That until the mortality be reduced, the period of service in India be limited to 10 years.

7. That provision be made for passing invalids at the port of embarkation without delay, and for their immediate shipment home.

8. That works of drainage and water-supply be carried out at all stations. That all existing water sources be subjected to analysis, and those rejected which contain matters injurious to health. That the present method of drawing and distributing water be discontinued wherever practicable. That all water used for drinking purposes be filtered, or otherwise purified.

9. That all future barracks and hospitals be erected on raised basements, with the air circulating under the floors, and that, in all existing barracks and hospitals, the floors be raised as much as possible, and a free current of air allowed to pass beneath them.

10. That all new barracks be constructed to hold no more than a quarter company in each building, or at most half a company in one building in two separate rooms having no direct communication with each other. That hospitals be constructed in detached pavilions containing no more than from 20 to 24 beds. That future barracks and hospitals be arranged en echelon to receive the benefit of prevailing winds. And that detached cottages be erected for married soldiers.

11. That barracks and hospitals be in future constructed with single verandahs only; and for no more than two rows of beds between the opposite windows.

12. That the cubic space per man in future barracks be from 1,000 to 1,500 feet, and the superficial area from 80 to 100 square feet, varying according to the airiness of the position. The same space and area to be allotted in existing barracks.

13. That the beds be so arranged, with respect to windows, doors, and wall spaces as to ensure the benefit of free ventilation, without exposing the men to draughts.

That, in existing barracks, where the space between the doors is too small to admit of this, precautions be taken to shelter the beds from draughts. That, in all future barracks, the wall space be made sufficient to keep the beds at the least three feet apart, and at the same time out of the door draught.

14. That the ventilation of barracks and hospitals be sufficiently provided for independently of doors and windows.

15. That in all cavalry barracks, saddlery rooms be provided, and saddles removed out of the barrack rooms.

16. That all barracks and hospitals be provided with sufficient glazed window space to light them, and that they be better lighted at night. Gas to be introduced where practicable.

17. That all barracks be provided with sufficient ablution and bath accommodation, with a constant water-supply. That drinking-fountains supplied with filtered water be provided.

18. That barrack cook-houses be improved and better ventilated.

19. That wherever practicable iron or earthenware water latrines, supplied with water, and drained to an outlet, be introduced instead of the present system; that, where this is impracticable, all cesspits be abolished, and metal or earthenware vessels, to be removed twice a day, substituted. That improved urinals, supplied with a jet for lavatory purposes, as well as with a free supply of water for the cleansing and drainage of the urinals, be provided.

20. On the subject of venereal disease, and the means to be employed for its diminution, we refer to the suggestions made by us under that head in the body of the report.

21. That wherever there is a deficiency of married quarters, the same be supplied.

22. That the cubic space in hospitals be fixed at 1,500 feet and upwards, and the superficial area at from 100 to 120 and 130 square feet per bed, according to the healthiness of the position; and that the wall space per bed be never less than eight feet. In existing hospitals the same space and area to be allowed.

23. That every hospital be provided with a constant supply of pure filtered water, and with drainage.

24. That every hospital be provided with ablution accommodation, with fixed basins, and with baths, having hot and cold water laid on, conveniently accessible from the wards.

25. That, wherever practicable, water-closets, with drainage and water-supply, be introduced for hospital wards, and privies converted into water latrines.

26. That the hospital diet tables in use at home stations be adopted in India as far as practicable, and the hospitals supplied with properly trained cooks.

27. That trained hospital attendants be introduced into all hospitals, and that female nurses, under the new medical regulations, be introduced into large general hospitals.

28. That in future every regiment in India shall have an adequate number of hospital orderlies from its own ranks to provide personal attendance for the sick.

29. That the number of general hospitals in India be increased by the organization of such hospitals, under the new medical regulations, at the largest European stations.

30. That the strategical points of the country, which must be occupied, be now fixed, with special reference to reducing as far as possible the number of unhealthy stations to be occupied.

31. That a sufficient number of hill stations, or of stations on elevated ground, be provided; and that a third part of the force be located on these stations in rotation.

32. That the sanitary duties of regimental, garrison and inspecting medical officers, prescribed in the new medical regulations of October 7, 1859, be applied or adapted to all stations in India. And that properly trained army medical officers of health be appointed to this service at the larger stations.

33. The Commission entirely approves of medical candidates being required to undergo the course of instruction, including military hygiene, at the army medical school, and are of opinion that practical training in sanitary science is of the greatest importance to the public service.

34. Considering also the constant reference to sanitary subjects necessary in carrying out public works in India, they consider it requisite that every cadet of engineers should attend a course of sanitary instruction at Chatham.

RECOMMENDATIONS.

35. In order to the gradual introduction of sanitary improvements for barracks, hospitals, and stations, as well as in the seats of Government and throughout towns in proximity to military stations, they recommend the appointment of commissions of public health, one for each presidency, so constituted as to represent the various elements, civil, military, engineering, sanitary, and medical; to give advice and assistance in all matters relating to the public health, such as selection of new stations and the sanitary improvement of existing stations and bazaars; to examine new plans for barracks and hospitals; to advise on the laying out of stations and bazaars, the sanitary improvement of native towns, prevention and mitigation of epidemic diseases, and generally to exercise a constant oversight on the sanitary condition of the population, European and native; to report on the prevalence, causes, and means of preventing sickness and disease; and further, that administrative measures be adopted to give effect to the advice of the presidency commissions. That trained medical officers of health be appointed, to act in peace as in war, in connexion with these commissions.

36. That in order to render available for India the experience obtained in dealing with all classes of sanitary questions in England, two officers of the Indian Government be appointed in England to be associated with the War Office Commission for this special purpose: unless it should be thought preferable to appoint a similar commission specially for the Indian Department.

37. That a code of regulations, embodying the duties and adapted to the specialties of the Indian sanitary service, be drawn up and issued under authority.

38. That the system of army medical statistics at present in use at home stations, be extended to all stations in India.

39. That a system of registering deaths and the causes of death be established in the large cities of India, and be gradually extended, so as to determine the effects of local causes on the mortality of the native as well as of the European population; the results to be tabulated and published annually by the Commissions.

All which we humbly certify to Your Majesty.

(Signed)	STANLEY.	(L.S.)
	PROBY T. CAUTLEY.	(L.S.)
	J. R. MARTIN.	(L.S.)
	J. B. GIBSON.	(L.S.)
	E. H. GREATHED.	(L.S.)
	W. FARR.	(L.S.)
	JOHN SUTHERLAND.	(L.S.)

T. BAKER, *Secretary.*

Dated 19th May 1863.

TABLES REFERRED TO IN THE FOREGOING REPORT.

TABLE 1.—MILITARY FORCE employed in INDIA in 1856 and 1861.

—	Total.		European				Native Troops.		India Office return.
			Officers.		Non-commissioned Officers and Men.				
	1856.	1861.	1856.	1861.	1856.	1861.	1856.	1861.	
ALL ARMS - -	280,325	221,887	5,996	8,324	39,108	75,759	235,221	137,804	
Engineers and Sappers	3,360	3,378	237	286	161	300	2,962	2,792	
Artillery - - -	16,390	16,502	473	804	6,729	11,816	9,188	3,882	
Cavalry - - -	32,540	26,757	431	811	1,442	6,713	30,667	19,233	
Infantry - - -	225,772	172,201	4,053	5,573	30,400	56,310	191,319	110,318	
Medical Establishment	1,887	2,429	802	850	—	—	1,085	1,579	
European Warrant Officers - - -	376	620	—	—	376	620	—	—	

TABLE 2.—MILITARY FORCE employed in INDIA in 1856 and 1861.

—	Number of Regiments or Corps.		European Officers.		European Non- commissioned Officers and Men.		Native Troops.		Total.		Idem.
	1856.	1861.	1856.	1861.	1856.	1861.	1856.	1861.	1856.	1861.	
ALL ARMS - -	—	—	5,996	8,324	39,108	75,759	235,221	137,804	280,325	221,887	
Royal army - -	—	—	713	2,719	22,867	58,922	—	—	23,580	61,641	
Company's army -	—	—	5,283	5,605	16,241	16,837	235,221	137,804	256,745	160,246	
Royal troops :—											
Artillery - -	—	22 Battalions.	—	127	—	3,958	—	—	—	4,085	
Dragoons - -	2	8 Regiments.	47	313	1,382	5,359	—	—	1,429	5,672	
Infantry - -	22	49 do.	666	2,279	21,485	49,605	—	—	22,151	51,884	
Company's troops :—											
1. Engineers and Sappers.	—	—	237	286	161	300	2,962	2,792	3,360	3,378	
2. Horse Artillery	5 Brigades.	5 Brigades.	118	196	1,974	2,396	1,120*	499†	3,212	3,091	
2a. European Foot Artillery.	12 Battalions.	13 Battalions.	225	427	4,725	5,452	3,265‡	1,956‡	8,215	7,835	
2b. Native Foot Artillery.	6 do.	2 do.	130	54	30	10	4,803‡	1,427‡	4,963	1,491	
3. European Cavalry	—	5 Regiments.	—	220	—	1,340	—	—	—	1,560	
4. Native Regular Cavalry.	21	26 do.	284	220	60	14	9,597	11,767	9,941	12,001	
4a. Native Irregu- lar Cavalry.	33	16 Corps.	100	58	—	—	21,070	7,466	21,170	7,524	
5. European In- fantry.	9	11 Regiments.	321	539	8,115	6,046	—	—	8,436	6,585	
5a. Native Regular Infantry.	155	126 do.	2,771	2,471	252	167	152,538	93,370	155,561	96,008	
5b. Native Irregu- lar Infantry.	45	22 do.	129	115	72	22	35,312	16,948	35,513	17,085	
6. Veterans -	—	—	166	169	476	470	3,469	—	4,111	639	
7. Medical Estab- lishment.	—	—	802	850	—	—	1,085§	1,579§	1,887	2,429	
8. European War- rant Officers.	—	—	—	—	376	620	—	—	376	620	

* Includes 451 gun lascars.

† Includes 158 gun lascars.

‡ Includes gun lascars and ordnance drivers.

§ These are described as “apothecaries and stewards” and “native doctors.”

TABLE 3.—ANNUAL COST in £ of 1,000 of the QUEEN'S TROOPS in INDIA.
Exclusive of COST of Staff Charges, Camp Equipage, Ammunition, Arms, Stores, Punkahs, Bedding,
Hospital Attendants, Medicines, and Transport in India.

					Infantry.	Cavalry.	Artillery.
Strength	{	All ranks	-	-	1,000	1,000	1,000
		Officers	-	-	37	58	32
		Non-commissioned Officers and Men	-	-	963	942	968
					£	£	£
ALL RANKS					81,633	102,400	83,700
I. Officers					20,637	39,368	16,684
II. Non-commissioned Officers and Men					60,996	63,032	67,016
I. Officers :—							
Pay and allowances					17,366	34,362	13,912
Passage money					1,500	2,230	1,240
Non-effective charge					1,771	2,776	1,532
II. Non-commissioned Officers and Men :—							
1. Pay, clothing, and maintenance					43,329	45,420	48,480
2. Passage money					5,569	5,440	5,599
3. Levy money, depôt, and recruiting expenses.					4,716	4,951	5,516
4. Non-effective charge					7,382	7,221	7,421
1. Pay, clothing, and maintenance of Non-commissioned Officers and Men :—							
Pay and allowances					15,150	17,780	20,180
Victuals					8,672	8,480	8,710
Clothing					2,617	2,560	2,630
Barracks					13,150	12,900	13,200
Wives and children of soldiers, good-conduct pay, head money, lascars, &c. &c.					3,740	3,700	3,760
2. Passage money of Non-commissioned Officers and Men :—							
Passages <i>outwards</i> of relief regiments					1,509	1,477	1,518
„ <i>homewards</i> of regiments recalled					1,348	1,318	1,355
„ <i>outwards</i> of drafts					1,512	1,470	1,526
„ <i>homewards</i> of invalids					1,200	1,175	1,200
3. Levy money, depôt, and recruiting expenses :—							
Levy money					869	1,493	1,963
Depôt and recruiting expenses for depôt of one company.					3,847	3,458	3,553
4. Non-effective charge of Non-commissioned Officers and Men					7,382	7,221	7,421

NOTE.—The Table may be read thus :—The cost of maintaining an infantry regiment in India of 1,000 strong is 81,633*l.* ; each soldier costs 81*l.* 6*s.* 33 florins, or 81*l.* 12*s.* 8*d.* This is exclusive of the cost of the staff, of arms, ammunition, hospital supplies, &c.

TABLE 4.—AVERAGE ANNUAL MORTALITY at certain Periods of Service in the Three Presidencies of the EFFECTIVES of the European Forces of the late East India Company.

Years of Service.		Average Annual Rate of Mortality per 1,000 in 10 Years.*			
		INDIA.	Bengal.	Madras.	Bombay.
0—1 years	-	65·2	78·1	73·9	31·4
1—2 „	-	53·6	74·0	40·7	33·4
2—3 „	-	56·2	61·7	73·3	37·4
3—4 „	-	49·3	54·2	28·9	66·6
4—5 „	-	44·1	71·5	20·5	39·9
0—5 „	-	54·6	68·7	42·9	38·4
5—10 „	-	47·0	64·0	35·2	36·0
10—15 „	-	52·8	69·1	43·2	45·3
15—20 „	-	43·0	62·2	33·1	31·9
20 and upwards	-	62·5	76·9	43·3	102·0
Total	-	51·2	67·2	39·5	38·4

* NOTE.—The average annual rate of mortality in the Table is for the 10 years 1847–1856 in the Bengal and Madras presidencies, and for the 10 years 1846–49 and 1851–56 in the presidency of Bombay. The rate of mortality for this period was considerably below the previous average in Madras and Bombay.

TABLE 5.—INDIA. The CASUALTIES in the EFFECTIVE NON-COMMISSIONED OFFICERS and MEN of the Local European Forces during the Years 1847–56.

Year of Service.	Strength. (Years of Life.)	Casualties.				Rate per Cent.			
		Deaths. (D.)	Invaliding. (I.)	D. + I.	All Causes.	Deaths. (D.)	Invaliding. (I.)	D. + I.	All Causes.
0—1 - -	14,390	938	45	983	1,547	6·52	·31	6·83	10·75
1—2 - -	11,630	623	88	711	1,085	5·36	·75	6·11	9·32
2—3 - -	9,220	518	83	601	872	5·62	·90	6·52	9·45
3—4 - -	9,530	470	121	591	907	4·93	1·27	6·20	9·51
4—5 - -	10,120	446	128	574	871	4·41	1·26	5·67	8·60
5—10 - -	41,860	1,968	468	2,436	4,048	4·70	1·12	5·82	9·67
10—15 - -	21,440	1,131	597	1,728	2,949	5·28	2·78	8·06	13·75
15—20 - -	9,976	429	598	1,027	1,424	4·30	6·00	10·30	14·28
20 and upwards	3,090	193	779	972	1,207	6·25	25·21	31·46	39·06

This Table is compiled from the Tables of Casualties of Effectives in the Presidencies. Under “invalided” are included here, besides the true invalids, the following casualties :—(1.) Discharged by purchase ; (2.) Discharged on account of term expired or otherwise ; (3.) Promoted ; (4.) Transferred to town major’s list ; (5.) Transferred to other corps ; (6.) Deserted ; (7.) Missing, &c. ; (8.) Other causes. Those on the town major’s list of Bengal are included among the effectives.

TABLE 6.—INDIAN LIFE and SERVICE TABLES for NON-COMMISSIONED OFFICERS and MEN.

(Constructed on the Returns of the European Troops of the late Company during the 10 Years 1847–56.)

Years of Service. (x)	Living and Serving.	Decrements in the Five Years following. (x)	Decrements by various Causes.								
			Died in the Service.	In- valided.	Discharged.		Pro- moted.	Transferred.		Deserted.	Missing and other Causes.
					By Pur- chase.	Time expired.		to Town Major’s List.	to other Corps.		
0 - - -	100,000	37,915	21,499	3,338	1,543	2,749	93	1,314	5,979	1,242	158
5 - - -	62,085	23,543	7,988	3,500	1,458	3,074	284	2,692	4,039	441	67
10 - - -	38,542	19,045	7,980	3,634	529	2,496	237	1,211	2,763	128	67
15 - - -	19,497	9,893	2,980	4,155	28	653	354	507	1,195	7	14
20 - - -	9,604	—	—	—	—	—	—	—	—	—	—
Totals -	- - -	90,396	40,447	14,627	3,558	8,972	968	5,724	13,976	1,818	306

TABLE 7., showing the Reduction of the CORPS of the EUROPEAN ARMY in INDIA, from ALL CAUSES, in each Year of Service from 0 to 20 :—

Year of Service. (x)	Serving. (L _x)	Annual Decrement. (d _x)	Pro- bable Age.
0	100,000	10,202	21
1	89,798	7,996	22
2	81,802	7,382	23
3	74,420	6,756	24
4	67,664	5,579	25
5	62,085	4,222	26
6	57,863	4,679	27
7	53,184	4,906	28
8	48,278	4,934	29
9	43,344	4,802	30
10	38,542	4,550	31
11	33,992	4,215	32
12	29,777	3,831	33
13	25,946	3,426	34
14	22,520	3,023	35
15	19,497	2,634	36
16	16,863	2,274	37
17	14,589	1,944	38
18	12,645	1,651	39
19	10,944	1,390	40
20	9,604	1,163	41

TABLE 8., showing the Reduction of the CORPS of the EUROPEAN ARMY in INDIA, by DEATH and INVALIDING ALONE, in each Year of Service :—

Year of Service.	Serving.	DIED OR INVALIDED Annually.	Pro- bable Age.
0	100,000	6,606	21
1	93,394	5,541	22
2	87,853	5,546	23
3	82,307	4,951	24
4	77,356	4,266	25
5	73,090	4,032	26
6	69,058	3,809	27
7	65,249	3,689	28
8	61,560	3,741	29
9	57,819	3,757	30
10	54,062	3,740	31
11	50,322	3,690	32
12	46,632	3,613	33
13	43,019	3,510	34
14	39,509	3,386	35
15	36,123	3,242	36
16	32,881	3,084	37
17	29,797	2,915	38
18	26,882	2,737	39
19	24,145	2,555	40
20	21,590	2,369	41

TABLE 9., showing the Reduction of the CORPS of the EUROPEAN ARMY in INDIA, from DEATHS ALONE, in each Year of Service from 0 to 20 :—

Year of Service.	Serving.	Annual DEATHS.	Pro- bable Age.
0	100,000	6,312	21
1	93,688	4,888	22
2	88,800	4,853	23
3	83,947	4,040	24
4	79,907	3,445	25
5	76,462	3,366	26
6	73,096	3,286	27
7	69,810	3,206	28
8	66,604	3,127	29
9	63,477	3,047	30
10	60,430	2,967	31
11	57,463	2,886	32
12	54,577	2,805	33
13	51,772	2,723	34
14	49,049	2,641	35
15	46,408	2,559	36
16	43,849	2,476	37
17	41,373	2,392	38
18	38,981	2,308	39
19	36,673	2,224	40
20	34,449	2,140	41

TABLE 10.—ANNUAL RATE OF MORTALITY, in Groups of Years, from 1770 to 1856, in each of the PRESIDENCIES.

Years.	Deaths annually to 100 of Strength.			
	INDIA.	Bengal.	Bombay.	Madras.
1770-1800	5·47	7·06	7·82	3·75
1800-1810	7·37	9·15	8·45	5·48
1810-1820	8·48	6·87	9·96	9·70
1820-1830	9·07	8·45	9·79	9·52
1830-1840	5·57	6·01	4·63	5·55
1840-1850	6·54	7·95	6·83	4·35
1850-1856	5·07	6·78	3·11	4·43
1770-1800	5·47	7·06	7·82	3·75
1800-1856	6·86	7·41	6·60	6·35
1800-1830	8·46	8·06	9·54	8·43
1830-1856	5·77	6·96	5·04	4·73

TABLE 11.—INDIA.—Average ANNUAL MORTALITY per 1,000 amongst the EFFECTIVE and NON-EFFECTIVE Troops of the late East India Company (Non-commissioned Officers and Men) in 10 Years (1847-56).

Ages.	Years of Life.	Deaths.	Annual Rate of Mortality per 1000.		Excess of the Rate of Mortality in India.
			Non-commissioned Officers and Men in India.	Males in England.	
Total - -	146,405	7,597	51·9	—	—
10— - -	3,147	83	26·4	5·2	21·2
20— - -	33,813	1,908	56·4	8·7	47·7
25— - -	46,586	2,274	48·8	9·6	39·2
30— - -	30,397	1,509	49·6	10·6	39·0
35— - -	15,953	820	51·4	11·9	39·5
40— - -	7,683	473	61·6	13·9	47·7
45— - -	3,830	220	57·4	16·8	40·6
50— - -	2,140	120	56·1	21·5	34·6
55— - -	1,225	67	54·7	27·6	27·1
60— - -	733	40	54·6	37·8	16·8
65— - -	468	44	94·0	54·8	35·2
70— - -	247	20	81·0	81·8	—
75 and upwards	183	19	103·8	121·6	—

The Table may be read thus :—In 33,813 years of life, 1,908 died of the age 20 and under 25, so the mortality was at the rate of 56·4 per 1,000 ; and as the mortality of men of the corresponding age in England is at the rate of 8·7, the excess of the mortality in India is 47·7 per 1,000.

TABLE 12.—LIFE TABLE for the ENGLISH SOLDIER in INDIA.

AGE.	DYING in each Year of Age.	LIVING at each Age.	SUM of the NUMBERS LIVING at each Age (x), and from x to the last Age in the Table.	LOGARITHMS of the PROBABILITY of LIVING ONE YEAR after the Age x .	LOGARITHMS of the NUMBERS LIVING at each Age.	AGE.	DYING in each Year of Age.	LIVING at each Age.	SUM of the NUMBERS LIVING at each Age (x), and from x to the last Age in the Table.	LOGARITHMS of the PROBABILITY of LIVING ONE YEAR after the Age x .	LOGARITHMS of the NUMBERS LIVING at each Age.
x	d_x	l_x	L_x	λp_x	λl_x	x	d_x	l_x	L_x	λp_x	λl_x
20	2,052	33,361	607,084	$\bar{T} \cdot 9724347$	$4 \cdot 5232361$	60	189	3,710	44,993	$\bar{T} \cdot 9773783$	$3 \cdot 5693278$
21	1,811	31,309	573,723	$\bar{T} \cdot 9741177$	$4 \cdot 4956708$	61	180	3,521	41,283	$\bar{T} \cdot 9771076$	$3 \cdot 5467061$
22	1,618	29,498	542,414	$\bar{T} \cdot 9754993$	$4 \cdot 4697885$	62	178	3,341	37,762	$\bar{T} \cdot 9762816$	$3 \cdot 5238137$
23	1,462	27,880	512,916	$\bar{T} \cdot 9766063$	$4 \cdot 4452878$	63	179	3,163	34,421	$\bar{T} \cdot 9747667$	$3 \cdot 5000953$
24	1,336	26,418	485,036	$\bar{T} \cdot 9774643$	$4 \cdot 4218941$	64	183	2,984	31,258	$\bar{T} \cdot 9724294$	$3 \cdot 4748620$
25	1,234	25,082	458,618	$\bar{T} \cdot 9780992$	$4 \cdot 3993584$	65	192	2,801	28,274	$\bar{T} \cdot 9691359$	$3 \cdot 4472914$
26	1,150	23,848	433,536	$\bar{T} \cdot 9785366$	$4 \cdot 3774576$	66	204	2,609	25,473	$\bar{T} \cdot 9647527$	$3 \cdot 4164273$
27	1,081	22,698	409,688	$\bar{T} \cdot 9788022$	$4 \cdot 3559942$	67	216	2,405	22,864	$\bar{T} \cdot 9591462$	$3 \cdot 3811800$
28	1,024	21,617	386,990	$\bar{T} \cdot 9789218$	$4 \cdot 3347964$	68	185	2,189	20,459	$\bar{T} \cdot 9615239$	$3 \cdot 3403262$
29	976	20,593	365,373	$\bar{T} \cdot 9789211$	$4 \cdot 3137182$	69	163	2,004	18,270	$\bar{T} \cdot 9632785$	$3 \cdot 3018501$
30	933	19,617	344,780	$\bar{T} \cdot 9788259$	$4 \cdot 2926393$	70	145	1,841	16,266	$\bar{T} \cdot 9644098$	$3 \cdot 2651286$
31	896	18,684	325,163	$\bar{T} \cdot 9786618$	$4 \cdot 2714652$	71	131	1,696	14,425	$\bar{T} \cdot 9649180$	$3 \cdot 2295384$
32	861	17,788	306,479	$\bar{T} \cdot 9784546$	$4 \cdot 2501270$	72	122	1,565	12,729	$\bar{T} \cdot 9648029$	$3 \cdot 1944564$
33	828	16,927	288,691	$\bar{T} \cdot 9782300$	$4 \cdot 2285816$	73	122	1,443	11,164	$\bar{T} \cdot 9614970$	$3 \cdot 1592593$
34	794	16,099	271,764	$\bar{T} \cdot 9780138$	$4 \cdot 2068116$	74	121	1,321	9,721	$\bar{T} \cdot 9582913$	$3 \cdot 1207563$
35	762	15,305	255,665	$\bar{T} \cdot 9778316$	$4 \cdot 1848254$	75	119	1,200	8,400	$\bar{T} \cdot 9548413$	$3 \cdot 0790476$
36	728	14,543	240,360	$\bar{T} \cdot 9777092$	$4 \cdot 1626570$	76	115	1,081	7,200	$\bar{T} \cdot 9511367$	$3 \cdot 0338889$
37	692	13,815	225,817	$\bar{T} \cdot 9776723$	$4 \cdot 1403662$	77	111	966	6,119	$\bar{T} \cdot 9471672$	$2 \cdot 9850256$
38	708	13,123	212,002	$\bar{T} \cdot 9759219$	$4 \cdot 1180385$	78	105	855	5,153	$\bar{T} \cdot 9429225$	$2 \cdot 9321928$
39	703	12,415	198,879	$\bar{T} \cdot 9746639$	$4 \cdot 0939604$	79	99	750	4,298	$\bar{T} \cdot 9383922$	$2 \cdot 8751153$
40	685	11,712	186,464	$\bar{T} \cdot 9738377$	$4 \cdot 0686243$	80	92	651	3,548	$\bar{T} \cdot 9335660$	$2 \cdot 8135075$
41	655	11,027	174,752	$\bar{T} \cdot 9733829$	$4 \cdot 0424620$	81	85	559	2,897	$\bar{T} \cdot 9284336$	$2 \cdot 7470735$
42	620	10,372	163,725	$\bar{T} \cdot 9732390$	$4 \cdot 0158449$	82	77	474	2,338	$\bar{T} \cdot 9229846$	$2 \cdot 6755071$
43	581	9,752	153,353	$\bar{T} \cdot 9733454$	$3 \cdot 9890839$	83	69	397	1,864	$\bar{T} \cdot 9172088$	$2 \cdot 5984917$
44	540	9,171	143,601	$\bar{T} \cdot 9736417$	$3 \cdot 9624293$	84	61	328	1,467	$\bar{T} \cdot 9110958$	$2 \cdot 5157005$
45	500	8,631	134,430	$\bar{T} \cdot 9740674$	$3 \cdot 9360710$	85	52	267	1,139	$\bar{T} \cdot 9046352$	$2 \cdot 4267963$
46	463	8,131	125,799	$\bar{T} \cdot 9745619$	$3 \cdot 9101384$	86	45	215	872	$\bar{T} \cdot 8978169$	$2 \cdot 3314315$
47	428	7,668	117,668	$\bar{T} \cdot 9750647$	$3 \cdot 8847003$	87	38	170	657	$\bar{T} \cdot 8906302$	$2 \cdot 2292484$
48	396	7,240	110,000	$\bar{T} \cdot 9755154$	$3 \cdot 8597650$	88	31	132	487	$\bar{T} \cdot 8830651$	$2 \cdot 1198786$
49	371	6,844	102,760	$\bar{T} \cdot 9758533$	$3 \cdot 8352804$	89	25	101	355	$\bar{T} \cdot 8751113$	$2 \cdot 0029437$
50	347	6,473	95,916	$\bar{T} \cdot 9760181$	$3 \cdot 8111337$	90	20	76	254	$\bar{T} \cdot 8667581$	$1 \cdot 8780550$
51	330	6,126	89,443	$\bar{T} \cdot 9759493$	$3 \cdot 7871518$	91	16	56	178	$\bar{T} \cdot 8579955$	$1 \cdot 7448131$
52	317	5,796	83,317	$\bar{T} \cdot 9755862$	$3 \cdot 7631011$	92	12	40	122	$\bar{T} \cdot 8488131$	$1 \cdot 6028086$
53	307	5,479	77,521	$\bar{T} \cdot 9749480$	$3 \cdot 7386873$	93	8	28	82	$\bar{T} \cdot 8392005$	$1 \cdot 4516217$
54	292	5,172	72,042	$\bar{T} \cdot 9748233$	$3 \cdot 7136353$	94	7	20	54	$\bar{T} \cdot 8291475$	$1 \cdot 2908222$
55	272	4,880	66,870	$\bar{T} \cdot 9750787$	$3 \cdot 6884586$	95	4	13	34	$\bar{T} \cdot 8186437$	$1 \cdot 1199697$
56	252	4,608	61,990	$\bar{T} \cdot 9755803$	$3 \cdot 6635373$	96	3	9	21	$\bar{T} \cdot 8076787$	$0 \cdot 9386134$
57	232	4,356	57,382	$\bar{T} \cdot 9761947$	$3 \cdot 6391176$	97	3	6	12	$\bar{T} \cdot 7962424$	$0 \cdot 7462921$
58	215	4,124	53,026	$\bar{T} \cdot 9767882$	$3 \cdot 6153123$	98	1	3	6	$\bar{T} \cdot 7843241$	$0 \cdot 5425345$
59	199	3,909	48,902	$\bar{T} \cdot 9772273$	$3 \cdot 5921005$	99	1	2	3	$\bar{T} \cdot 7719138$	$0 \cdot 3268586$
						100	—	1	1	$\bar{T} \cdot 7590011$	$0 \cdot 0987724$

FORMULAS. x = age ; and ω (omega) the last age of life.

$$d_x = l_x - l_{x+1}$$

$$L_x = l_x + l_{x+1} + l_{x+2} \dots \dots \dots l_{\omega}.$$

$$\frac{l_{x+n}}{l_x} = \text{the probability that the soldier will live } n \text{ years after the age } x.$$

$$\frac{l_x}{2} = l_{x+n}; \text{ where } n \text{ is the probable duration of life after the age } x.$$

$$p_x = \frac{l_{x+1}}{l_x} = \text{the probability that a soldier will live 1 year after the age } x.$$

$$\mu_x = 1 - p_x = \frac{l_x - l_{x+1}}{l_x} = \frac{d'_x}{l_x} = \text{probability of dying in the year after } x; \text{ incorrectly called, in several of the Reports on the Indian Funds, the "rate of mortality."}$$

$$m_x = \frac{2d_x}{l_x + l_{x+1}} = \text{rate of mortality in the year of age after } x.$$

By the following two formulas the mortality can be deduced from the probability of dying (μ), and conversely the probability of dying can be deduced from the mortality (m).

$$m = \frac{2\mu}{2 - \mu}; \text{ and } \mu = \frac{2m}{2 + m}$$

NOTE.—This Life Table from age 20 to 72 has been constructed upon the basis of the rate of mortality obtained from the tables relating to the non-commissioned officers and men (effective and non-effective) of the European troops of the late East India Company. It was found that at age 72 the λp_x of the Indian army corresponded nearly exactly with that of the English Life Table No. 3, and as the Indian facts did not extend beyond that age, the table was completed by means of the λp_x as given in the English Life Table No. 3. The col. L_x starts from the same base as the English Life Table No. 3,—at age 20,—but reduced on the assumption that 100,000 instead of 1,000,000 formed the starting point at age 0.

This Table differs from any life tables relating to Indian officers in this respect, that whereas they deal with officers residing in India, say from age 20 to 40 or 45, and then returning to live in England, this Table refers exclusively to soldiers in India at the later as well as at the earlier period of life.

TABLE 13.—LIFE ANNUITY TABLE for the ENGLISH SOLDIER in INDIA.

Age. <i>x</i>	3 PER CENT.			5 PER CENT.			Age. <i>x</i>	3 PER CENT.			5 PER CENT.		
	<i>D_x</i>	<i>N_x</i>	λD_x	<i>D_x</i>	<i>N_x</i>	λD_x		<i>D_x</i>	<i>N_x</i>	λD_x	<i>D_x</i>	<i>N_x</i>	λD_x
20	18,471	228,458	4·2664916	12,573	128,231	4·0994501	60	630	6,097	2·7990943	199	1,692	2·2979699
21	16,830	209,987	4·2260891	11,238	115,658	4·0506955	61	580	5,467	2·7636354	180	1,493	2·2541589
22	15,395	193,157	4·1873696	10,084	104,420	4·0036239	62	534	4,887	2·7279058	162	1,313	2·2100772
23	14,126	177,762	4·1500316	9,077	94,336	3·9579339	63	491	4,353	2·6913501	146	1,151	2·1651695
24	12,996	163,636	4·1138007	8,191	85,259	3·9133509	64	450	3,862	2·6532796	131	1,005	2·1187469
25	11,979	150,640	4·0784278	7,407	77,068	3·8696259	65	410	3,412	2·6128718	117	874	2·0699870
26	11,058	138,661	4·0436898	6,707	69,661	3·8265358	66	371	3,002	2·5691705	104	757	2·0179336
27	10,219	127,603	4·0093891	6,080	62,954	3·7838831	67	332	2,631	2·5210859	92	653	1·9614970
28	9,448	117,384	3·9753541	5,514	56,874	3·7414960	68	293	2,299	2·4673949	79	561	1·8994539
29	8,739	107,936	3·9414387	5,003	51,360	3·6992285	69	261	2,006	2·4160816	69	482	1·8397885
30	8,082	99,197	3·9075226	4,539	46,357	3·6569603	70	233	1,745	2·3665229	61	413	1·7818777
31	7,473	91,115	3·8735112	4,117	41,818	3·6145969	71	208	1,512	2·3180954	53	352	1·7250982
32	6,908	83,642	3·8393358	3,733	37,701	3·5720694	72	186	1,304	2·2701762	47	299	1·6688269
33	6,382	76,734	3·8049532	3,383	33,968	3·5293347	73	167	1,118	2·2221419	41	252	1·6124405
34	5,893	70,352	3·7703460	3,065	30,585	3·4863754	74	148	951	2·1708017	36	211	1·5527482
35	5,439	64,459	3·7355225	2,775	27,520	3·4431999	75	131	803	2·1162557	31	175	1·4898502
36	5,018	59,020	3·7005169	2,511	24,745	3·3998422	76	114	672	2·0582598	27	144	1·4235022
37	4,628	54,002	3·6653889	2,272	22,234	3·3563621	77	99	558	1·9965593	23	117	1·3534496
38	4,268	49,374	3·6302240	2,055	19,962	3·3128451	79	85	459	1·9308893	19	94	1·2794275
39	3,920	45,106	3·5933086	1,852	17,907	3·2675777	80	73	374	1·8609745	16	75	1·2011607
40	3,590	41,186	3·5551353	1,664	16,055	3·2210523	81	61	301	1·7865295	13	59	1·1183636
41	3,282	37,596	3·5161358	1,492	14,391	3·1737007	82	51	240	1·7072583	11	46	1·0307403
42	2,997	34,314	3·4766815	1,336	12,899	3·1258943	83	42	189	1·6228547	9	35	0·9379846
43	2,736	31,317	3·4370832	1,197	11,563	3·0779440	84	34	147	1·5330020	7	26	0·8397799
44	2,498	28,581	3·3975914	1,072	10,366	3·0301001	85	27	113	1·4373736	5	19	0·7358094
45	2,282	26,083	3·3583959	961	9,294	2·9825525	86	22	86	1·3356322	4	14	0·6257059
46	2,087	23,801	3·3196261	862	8,333	2·9354306	87	17	64	1·2274302	3	10	0·5091518
47	1,911	21,714	3·2813507	774	7,471	2·8888032	88	13	47	1·1124099	2	7	0·3857794
48	1,752	19,803	3·2435782	696	6,697	2·8426786	89	10	34	0·9902028	2	5	0·2552203
49	1,608	18,051	3·2062564	627	6,001	2·7970047	90	7	24	0·8604307	1	3	0·1170961
50	1,477	16,443	3·1692725	565	5,374	2·7516687	91	5	17	0·7227048	1	2	—
51	1,357	14,966	3·1324633	509	4,809	2·7064975	92	4	12	0·5766257	1	1	—
52	1,246	13,609	3·0955654	458	4,300	2·6612575	93	3	8	0·4217839	—	—	—
53	1,144	12,363	3·0583144	413	3,842	2·6156544	94	2	5	0·2577598	—	—	—
54	1,048	11,219	3·0204252	371	3,429	2·5694132	95	1	3	0·0841231	—	—	—
55	960	10,171	2·9824112	333	3,058	2·5230472	96	1	1	—	—	—	—
56	880	9,211	2·9446527	300	2,725	2·4769366							
57	808	8,331	2·9073958	270	2,425	2·4313276							
58	743	7,523	2·8707533	243	2,155	2·3863330							
59	683	6,780	2·8347042	220	1,912	2·3419319							

FORMULAS. i = interest of 1*l.* in one year.
 $\frac{1}{1+i} = v$; and $d = 1 - v$.
 v^x = the value of 1*l.* payable at the end of x years.
 $D_x = v^x l_x$
 $N_x = D_x + D_{x+1} + \dots$
 $\frac{N_x}{D_x} = A_x$ = the value of an annuity of 1*l.* payable at the beginning of every year of life.
 $\frac{D_x}{N_x} = \frac{1}{A_x} = a_x$ = life annuity which 1*l.* will purchase.

NOTE.—This Table was formed from the col. *l_x* of the Life Table for the English soldier in India.

TABLE 14.—COMPARATIVE NUMBERS LIVING and DYING in each Year of Age amongst ENGLISHMEN remaining at Home, and ENGLISHMEN going to INDIA, as Soldiers and Civilians, at the Age of 20.

AGE <i>x</i> .	Englishmen remaining at Home.		Englishmen going to Madras as Civilians at the Age of 20.		Officers serving in India after the Age of 20.		Englishmen going to India at the Age of 20 as Soldiers.	
	Living.	Dying in the next Year.	Living.	Dying in the next Year.	Living.	Dying in the next Year.	Living.	Dying in the next Year.
15	34,429	178	34,429	178	34,429	178	34,429	178
16	34,251	193	34,251	193	34,251	193	34,251	193
17	34,058	211	34,058	211	34,058	211	34,058	211
18	33,847	232	33,847	232	33,847	232	33,847	232
19	33,615	254	33,615	254	33,615	254	33,615	254
	At Home.		Civilians in Madras.		Officers in India.		Soldiers in India.	
20	33,361	276	33,361	353	33,361	865	33,361	2,052
21	33,085	281	33,008	412	32,496	840	31,309	1,811
22	32,804	283	32,596	452	31,656	819	29,498	1,618
23	32,521	287	32,144	472	30,837	950	27,880	1,462
24	32,234	290	31,672	476	29,887	921	26,418	1,336
25	31,944	292	31,196	469	28,966	893	25,082	1,234
26	31,652	296	30,727	462	28,073	865	23,848	1,150
27	31,356	298	30,265	456	27,208	836	22,698	1,081
28	31,058	301	29,809	449	26,372	897	21,617	1,024
29	30,757	304	29,360	444	25,475	865	20,593	976
30	30,453	307	28,916	438	24,610	836	19,617	933

TABLE 15.—LIFE TABLE for PENSIONERS who have served in EAST and WEST INDIES.

AGE.	DYING in each Year of Age.	LIVING at each Age.	Sum of the NUMBERS LIVING at each Age (<i>x</i>), and from <i>x</i> to the last Age in the Table.	LOGARITHMS of the PROBABILITY of LIVING One Year after the Age <i>x</i> .	LOGARITHMS of the NUMBERS LIVING at each Age.	AGE.	DYING in each Year of Age.	LIVING at each Age.	Sum of the NUMBERS LIVING at each Age (<i>x</i>), and from <i>x</i> to the last Age in the Table.	LOGARITHMS of the PROBABILITY of LIVING One Year after the Age <i>x</i> .	LOGARITHMS of the NUMBERS LIVING at each Age.
<i>x</i>	<i>d_x</i>	<i>l_x</i>	<i>L_x</i>	<i>λp_x</i>	<i>λl_x</i>	<i>x</i>	<i>d_x</i>	<i>l_x</i>	<i>L_x</i>	<i>λp_x</i>	<i>λl^c</i>
40	269	11,712	266,931	᠓·9899345	4·0686243	73	271	2,936	22,165	᠓·9580155	3·4676943
41	285	11,443	255,219	᠓·9890168	4·0585588	74	263	2,665	19,229	᠓·9547860	3·4257098
42	296	11,158	243,776	᠓·9883312	4·0475756						
43	300	10,862	232,618	᠓·9878462	4·0359068	75	255	2,402	16,564	᠓·9513794	3·3804958
44	299	10,562	221,756	᠓·9875305	4·0237530	76	243	2,147	14,162	᠓·9477988	3·3318752
						77	230	1,904	12,015	᠓·9440478	3·2796740
45	294	10,263	211,194	᠓·9873525	4·0112835	78	216	1,674	10,111	᠓·9401294	3·2237218
46	288	9,969	200,931	᠓·9872809	3·9986360	79	199	1,458	8,437	᠓·9360471	3·1638512
47	279	9,681	190,962	᠓·9872840	3·9859169						
48	271	9,402	181,281	᠓·9873306	3·9732009	80	183	1,259	6,979	᠓·9318041	3·0998983
49	261	9,131	171,879	᠓·9873890	3·9605315	81	166	1,076	5,720	᠓·9274037	3·0317024
						82	148	910	4,644	᠓·9228493	2·9591061
50	253	8,870	162,748	᠓·9874280	3·9479205	83	131	762	3,734	᠓·9181442	2·8819554
51	246	8,617	153,878	᠓·9874159	3·9353485	84	114	631	2,972	᠓·9132916	2·8000996
52	241	8,371	145,261	᠓·9873214	3·9227644						
53	238	8,130	136,890	᠓·9871130	3·9100858	85	99	517	2,341	᠓·9082948	2·7133912
54	237	7,892	128,760	᠓·9867592	3·8971988	86	83	418	1,824	᠓·9031572	2·6216860
						87	70	335	1,406	᠓·8978820	2·5248432
55	239	7,655	120,868	᠓·9862286	3·8839580	88	58	265	1,071	᠓·8924726	2·4227252
56	243	7,416	113,213	᠓·9854897	3·8701866	89	48	207	806	᠓·8869322	2·3151978
57	252	7,173	105,797	᠓·9845111	3·8556763						
58	261	6,921	98,624	᠓·9832613	3·8401874	90	38	159	599	᠓·8812641	2·2021300
59	259	6,660	91,703	᠓·9827775	3·8234487	91	30	121	440	᠓·8754718	2·0833941
						92	24	91	319	᠓·8695583	1·9588659
60	255	6,401	85,043	᠓·9823750	3·8062262	93	18	67	228	᠓·8635271	1·8284242
61	253	6,146	78,642	᠓·9817490	3·7886012	94	14	49	161	᠓·8573815	1·6919513
62	253	5,893	72,496	᠓·9809030	3·7703502						
63	256	5,640	66,603	᠓·9798402	3·7512532	95	10	35	112	᠓·8511247	1·5493328
64	259	5,384	60,963	᠓·9785639	3·7310934	96	7	25	77	᠓·8447601	1·4004575
						97	6	18	52	᠓·8382910	1·2452176
65	264	5,125	55,579	᠓·9770774	3·7096573	98	4	12	34	᠓·8317266	1·0835086
66	268	4,861	50,454	᠓·9753841	3·6867347	99	3	8	22	᠓·8250522	0·9152292
67	272	4,593	45,593	᠓·9734872	3·6621188						
68	275	4,321	41,000	᠓·9713900	3·6356060	100	1	5	14	᠓·8182892	0·7402814
69	278	4,046	36,679	᠓·9690959	3·6069960	101	2	4	9	᠓·8114349	0·5585706
						102	1	2	5	᠓·8044926	0·3700055
70	279	3,768	32,633	᠓·9666080	3·5760919	103	0	1	3	᠓·7974655	0·1744981
71	278	3,489	28,865	᠓·9639298	3·5426999	104	0	1	2	᠓·7903569	᠓·9719636
72	275	3,211	25,376	᠓·9610646	3·5066297	105	1	1	1	᠓·7831702	᠓·7623205

NOTE.—This Table was formed from the column “Logarithms of the Value of Chance of Surviving,” given in a Table relating to Pensioners who have served in East and West Indies, on pages 6 and 7 of Appendix to Report on “Charge for Non-effective Services of Troops of the Line in India.”

TABLE 16.—ANNUAL RATE of MORTALITY amongst MALES of the Age *x* in ENGLAND and in INDIA.

Age. (<i>x</i>)	Deaths annually to 1,000 living.					
	Males in Healthy Districts of England.	Males in England and Wales.	Soldiers in India.	Pensioners who have served in East and West Indies.	Madras Civil Service (1760–1853).*	Officers retired from the Indian Army.
22	7·3	8·7	56·4	—	14·0	10·8
27	8·0	9·6	48·8	—	15·2	11·3
32	8·4	10·6	49·6	—	15·5	12·2
37	8·9	11·9	51·4	—	16·3	13·6
42	9·9	13·9	61·6	26·9	17·9	15·8
47	11·6	16·8	57·4	29·2	20·4	19·6
52	14·4	21·5	56·1	29·2	25·2	24·9
57	18·5	27·6	54·7	35·8	28·4	32·0
62	28·9	37·8	54·6	43·9	29·7	41·2
67	44·4	54·8	94·0	61·0	35·7	53·5
72	67·9	81·8	81·0	89·5	50·5	79·7
77	103·7	121·6	103·8	128·6	85·0	116·0

* NOTE.—The mortality in the Healthy Districts, and amongst the Pensioners and Madras Civil Service has been deduced from the respective Life Tables by the formula $m_x = \frac{2 d_x}{l_x + l_{x+1}}$ The

mortality of England and Wales is taken from the English Life Table, No. 3, and for Soldiers in India from the Tables published in the Appendix to this Report. The mortality of Officers retired from Indian army has been obtained from a Table in the Statistical Journal for 1838 (vol. i. p. 280), by the formula

$$m = \frac{2 \mu}{2 - \mu}$$

(a) EXTRACT from the Registrar-General's Annual Summary of the London Tables of Mortality, 1859, referred to in section 12.

It may be instructive to compare the fatality by some of the diseases of London now (1859) and in the seventeenth century. In the twenty years, 1660–79, the mortality in Southwark and in the City within and without the walls was at the rate of 7 or 8 per cent. ; so the mortality within the bills may be set down at the rate of 7,000 annually in every 100,000 living, of which 3,400 were by zymotic diseases.

The diseases are not always distinguished accurately. But by putting them in groups, any fallacy from this source will be obviated, and the decrease of some of the worst forms of mortal disease will be placed beyond doubt. To render the comparison easy, the number living is taken to be the same in the two periods, 100,000 in 1660–79 and in 1859. The annual deaths by small-pox were 357 in the first period, 42 in the second period ; by measles 40 and 47 in the two periods. Medical science was imperfect, and the science existing in that century was very imperfectly applied. Croup and scarlatina were not generally recognized, but were confounded with measles and fever. The mortality by fever, continued or remittent, and ague was at the rate of 749 and 59 in the two periods ; or including scarlatina, quinsy, and croup, the mortality was 759 and 227. Thus a person was in four times as much danger of dying of these diseases at the Restoration as a person living in London now. Women are not yet entirely exempt from peril in child-bearing ; the mortality by that disease is now 17, it was then 86. Again a few (8) in 100,000 die now of dysentery ; then, out of the same number, 763 died annually of that disease. By diarrhœa, a milder form of disease, 11 died then, 120 die now ; cholera was fatal in 1859

to 7, and in the 20 years (1660–79) to 130 annually. Syphilis was twice as fatal as it is, the numbers being 21 and 12. Scurvy and purpura bear testimony to the imperfect nutrition of the population ; the annual deaths were then 142 and are now 2. Vegetables, fruit, and fresh meat could with difficulty be procured in winter. Worms and all parasitic creatures that crawl over, bite, and prey on the body of man, were prevalent ; 10 deaths were ascribed to worms.

Dropsy, a frequent result and sign of scurvy and fever, was exceedingly fatal ; 298 died of that disease then, and 26 now. Apoplexy, paralysis, epilepsy, affections of the brain, and suicide, are more fatal now, according to the returns, than they were in the proportion of 57 then to 151 now.

Consumption and diseases of the breathing organs were uncommonly fatal ; 1,079 then and 611 now are the figures of the mortality. Diseases of the digestive organs were fatal then and now in the proportion of 146 and 95. Stone and diseases of the urinary organs are now as fatal as they were then ; the deaths being 21 and 30. Children were rapidly cut down ; of convulsions and teething, 1,175 died then, 136, too many, now.

Of the violent deaths, some are now more frequent, as the forces by which they are occasioned are greater ; of fractures and wounds 19 died then, 25 now ; of poison, more accessible, 2 now and then only 1 ; of burns, as fires are probably more common, and dresses more inflammable, now 13, then 3 ; drowning and suffocation were then twice as fatal (23 and 20) as they are (10 and 10) in the present day.

Five in 100,000 of the people were executed then annually ; now one in the whole population.

In addition, the inhabitants of London were then destroyed by the terrible plague ; which, upon an average of the 20 years, carried off 1,132 lives.

In 1665 nearly a third of the population perished by plague. It is difficult to conceive this frightful destruction of human life ; the imagination, the wailing notes of writers, the details of Defoe in a work which would have immortalized any writer, fail to bring all the horrors before our minds.

The mortality was at the rate of *seven* per cent. on an average during the 20 years. If the mortality of London had been at the same rate in the last year, instead of 61,617 about 194,204 deaths would have been registered.

The plague was the more appalling as the mortality overwhelmed the people in particular years ; thus the burials from 15,356 in 1663, rose to 97,306, “whereof 68,596 were by plague,” in 1665 ; and this was equivalent to more than 600,000 deaths by plague in the present population of London. In the third week of September 8,297 deaths were registered, which represents a rate of mortality equivalent to about 85,000 deaths in a week on the actual population of London.

In these recurring plagues vast numbers of people fled in panic terror from the fatal city ; servants and workpeople were discharged in great numbers ; commerce was paralyzed ; few ships ventured up the river, and merchant vessels were occupied by their owners as asylums on the water. Sextons, grave-diggers, bearers, bellmen, and drivers of death-carts were in demand. The dead were buried indiscriminately ; some bodies lay in forsaken houses, others across the paths in the streets, no longer traversed by carts or coaches. At the end of the summer, grass was growing in Bishopsgate-street and Cornhill, where the people thronged no longer. The loud voices, shrieks, and sobs of the delirious, the desolate, and the dying were heard in the streets ; at times too disturbed by reckless revellers, and by raving patients, who had escaped from their dwellings, converted into prisons. For according to the regulations “infected houses” were shut up ; a red cross and

“Lord have mercy upon us!” were inscribed on their portals; while watchmen jealously guarded the doors. These quarantine regulations were at first rigidly carried out, and were only gradually abandoned when they were found useless, pernicious, and impracticable.

It is of some use to ask whether these past occurrences possess merely a historical interest for the inhabitants of London. Are the diseases of those times ever likely to recur? The answer must be:—undoubtedly they will recur, if their causes come again into action; and not otherwise. If a comet—if the stars—if volcanic action—if some mystical telluric influence destroyed the population of London at the rate of 7 per cent. annually, and at times in paroxysms at the rate of 20 and 30 per cent. in a single year, such powers are evidently beyond the reach of the will, and of all human effort. The population must resign itself to its fate. Vesuvius may perhaps be extinguished artificially; but the cause of the volcanic action which pervades the world is inaccessible (a).

All the evidence, however, goes to show that comets, stars, and volcanic action had as much to do with the mortality of the population of London in the seventeenth century as with the mortality of the British troops in the Crimea; and no more. The supply of food, and particularly of vegetable and fresh animal food, in certain seasons of the year, was defective, so that a large portion of the population became scorbutic. The houses were nearly as close and dirty as the houses now are in Constantinople and Cairo; the water supply was imperfect, as London Bridge works and Hugh Middleton's New River were for many years unappreciated. Water has in itself little attraction for people unaccustomed to ablution. Parasitic insects and diseases of the skin betrayed its impurities. The dirt of the houses

struck foreigners. The sewers were imperfect; and the soil gave off marsh malaria in some parts, and in others was saturated with the filth of successive generations.

The high rates of mortality which then prevailed still attend cholera and current epidemics in certain localities. The nature of disease and the climate are still the same as they were in London before the Revolution; and it is evident that if plague has disappeared, other zymotic diseases, but notably dysentery, scurvy, and fever, have declined. Cholera was on an average then as fatal as it has been recently, and probably much more fatal than it will be again if London be supplied with pure water.

The nation exults justly in the progress of its manufactures. But the progress of its manufactures is surpassed by the progress of the health of its capital.

The improvement in the health of London has proceeded step by step with the amendment of the dietary, the drainage of the soil on which the houses stand, the purification of the water which the people drink; with the sweetening of the air; and with the progress of medical science, which is the source of sound sanitary doctrines.

So long as these improvements are maintained, the diseases of the seventeenth century will not recur; and all further progress is in the hands of the people. They can work out their own salvation, with God's blessing. The causes of disease are numerous; but every one that has hitherto been discovered can be to a certain extent controlled. If by persevering in the exact observation and analysis of the diseases of the population, science succeeds in bringing to light the evils of unnatural diseases still existing, we may hope confidently that those evils will be averted; and that, rising from the Thames, the site of London, which was pronounced in the seventeenth century a field of blood and terror, will be a field of health, concourse, and security to the population of the Metropolis of the Empire.

(a) See the “History of Epidemics” by Hecker, and the ingenious book of Mr. Parkin.

TABLE 17.—ANNUAL RATE of MORTALITY per 1,000 among OFFICERS of the INDIAN ARMY.

Ages.	Colonel Henderson (1814-1833).			Ages.	Mr. Neison (1800-1847.)	Mr G. Davies (1760-1839).
	Years of Life in the Service.	Deaths.	Mortality per 1,000.			
18—	9,122	205	22·73	15—	14·59	26·49
20—	20,830	603	29·37	20—	23·51	27·18
25—	16,731	540	32·80	25—	25·33	28·39
30—	12,329	429	35·41	30—	28·18	30·76
35—	9,635	371	39·26	35—	29·06	33·42
40—	6,770	268	40·39	40—	30·15	37·06
45—	3,088	141	46·72	45—	38·65	41·45
50—	1,725	73	43·22	50—	30·27	—
55—	963	43	45·65	55—	42·90	—
60—	723	36	51·06	60—	40·00	—
65—	506	39	80·08			
70—	180	20	117·65			

TABLE 18.—MORTALITY per Cent. in the following Periods of Years among those Officers in the Bengal Army who have received their Appointments during the present Century. (Constructed from Henderson and Neison's Tables. See Neison's Report on Bengal Military Fund, p. 11.)

Ages.	Mortality per Cent.		
	1800-19.	1820-39.	1840-47.
15—	1·591	1·354	1·128
20—	2·303	2·038	2·492
25—	2·019	2·444	3·226
30—	3·102	2·282	3·389
35—	1·787	2·630	3·137
40—	- -	2·455	3·586
45—	- -	3·026	4·364
50—	- -	4·289	2·732
55—	- -	3·999	4·720
60—	- -	- -	4·013

TABLE 19.—MORTALITY amongst OFFICERS who entered the MADRAS MILITARY FUND, from 1808 to 1857, including those who continued Members after Retirement.

Ages.	Years of Life.	Deaths.	Mortality per Cent.
14—	4,835	142	2·937
20—	16,013	531	3·316
25—	25,848	834	3·226
35—	13,783	403	2·994
45—	7,137	196	2·746
55—	2,614	78	2·983
65—	933	49	5·252
75—	146	17	11·645
85—	4	1	25·000

TABLE 20.—MORTALITY amongst the WIVES of OFFICERS in the MADRAS ARMY, 1808 to 1857 inclusive.

Ages.	Years of Life.	Deaths.	Mortality per Cent.
15—	879	17	1·934
20—	3,946	68	1·723
25—	9,435	117	1·240
35—	5,337	73	1·368
45—	2,059	18	·874
55—	511	7	1·370
65—	—	—	—
75—	—	—	—
—	—	—	—

TABLE 21.—MORTALITY amongst the WIDOWS of OFFICERS in the MADRAS ARMY from 1808 to 1857 inclusive (chiefly in England.)

Ages.	Years of Life.	Deaths.	Mortality per Cent.
15—	32	—	—
20—	273	2	·733
25—	1,771	27	1·525
35—	2,547	30	1·178
45—	2,019	35	1·733
55—	1,253	22	1·756
65—	408	17	4·166
75—	59	7	11·864
—	—	—	—

The Table may be read thus :—At the age 25-35, out of 25,848 years of life, there were 834 deaths, or 3·226 per cent., amongst the OFFICERS of the Madras Military Fund, from 1808 to 1857.—(Facts supplied by Mr. SAMUEL BROWN.)

TABLE 22.—MEAN AFTER LIFETIME (Expectation of Life) of MALES at the Age *x* in ENGLAND and in INDIA.

Age. (<i>x</i>)	Healthy Districts of England.	All England.	Madras Civil Service.	Officers serving in India. (Colonel Henderson.)	Soldiers in India.	Pensioners who have served in East and West Indies.
	Years.	Years.	Years.	Years.	Years.	Years.
20	43·40	39·48	37·02	24·04	17·70	—
25	39·93	36·12	34·40	22·30	17·78	—
30	36·45	32·76	31·92	20·81	17·08	—
35	32·90	29·40	29·29	19·38	16·20	—
40	29·29	26·06	26·56	17·97	15·42	22·29
45	25·65	22·76	23·82	16·59	15·07	20·08
50	22·03	19·54	21·11	15·12	14·32	17·85
55	18·49	16·45	18·59	13·24	13·20	15·29
60	15·06	13·53	16·04	10·88	11·63	12·79
65	12·00	10·82	13·21	8·55	9·59	10·35
70	9·37	8·45	10·31	6·73	8·33	8·16
75	7·15	6·49	7·58	—	6·50	6·40
80	5·37	4·93	5·29	—	4·95	5·04

Formula : $\frac{L_x}{l_x} - .5 =$ the mean after lifetime at the age *x*. This is sometimes called the *expectation of life*—*vie moyenne*—or *mean duration of life*.

NOTE.—The mean after lifetime of Soldiers in India and of Pensioners in East and West Indies is deduced from the two Life Tables (Tables 12 and 15). For the Madras Civil Service it is deduced from a Table given by Mr. Neison on page 9 of his "Report on the Madras Civil Fund."

The Table may be read thus :—The mean after lifetime of a male aged 20 would be, in the Healthy Districts, 43·40 years ; in All England, 39·40 years ; in the Madras Civil Service, 37·02 years ; and for Soldiers in India, 17·70 years. At age 40 the mean after lifetime is 29·29 years in Healthy Districts ; 26·06, in All England ; 26·56, in the Madras Civil Service ; 22·29 amongst Pensioners who have served in East and West Indies ; and 15·42 amongst Soldiers in India.

At age 60 the members of the Madras Civil Service have the advantage of 1 year in their mean after lifetime over the males in the Healthy Districts, and of 2½ years over the males of All England.

TABLE 23. — ANNUAL PREMIUM which will insure £100, over the whole Term of the Life of a MALE aged x in ENGLAND and in INDIA (the latter deduced from the Life Table for the English Soldier in India).

Age (x)	3 per Cent.		5 per Cent.	
	England.	India.	England.	India.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
20	1 12 5	5 3 5	1 6 2	5 0 10
25	1 16 7	5 0 9	1 9 10	4 16 11
30	2 1 8	5 4 9	1 14 4	5 0 8
35	2 8 1	5 10 6	2 0 2	5 6 5
40	2 16 2	5 16 1	2 7 9	5 12 0
45	3 6 8	5 16 9	2 17 9	5 11 7
50	4 0 5	6 1 3	3 11 0	5 14 10
55	4 18 6	6 10 7	4 8 8	6 2 10
60	6 3 3	7 8 4	5 13 1	6 19 6
65	7 17 7	9 2 1	7 7 3	8 13 7
70	10 4 7	10 8 5	9 14 1	9 18 0
75	13 7 3	13 7 6	12 16 6	12 18 1
80	17 8 4	17 8 3	16 17 1	17 10 2

Single premium to insure 100*l.* payable at the death of a male aged 20 in England and in India.

		3 per cent.	5 per cent.
		£ s. d.	£ s. d.
Age 20 {	England	- 35 14 11	21 11 2
	India	- 63 19 6	51 8 8

Formulas :—

$\pi_x = ax - d$ = annual life premium to insure 1*l.* payable at the end of the year in which death takes place.

$\Pi_x = 1 - dA_x$ = single premium to insure 1*l.* payable at the death of the insured.

TABLE 24. — ANNUAL PREMIUM which will insure £100 over the WHOLE TERM of LIFE of a MALE aged x , in ENGLAND and in INDIA (*expressed according to the Decimal System*).

Age (x)	3 per Cent.		5 per Cent.	
	England.	Soldiers in India.	England.	Soldiers in India.
	£ fl. mils.	£ fl. mils.	£ fl. mils.	£ fl. mils.
20	1 6 20	5 1 71	1 3 09	5 0 42
25	1 8 29	5 0 36	1 4 91	4 8 44
30	2 0 84	5 2 37	1 7 18	5 0 32
35	2 4 04	5 5 26	2 0 10	5 3 19
40	2 8 10	5 8 05	2 3 89	5 6 01
45	3 3 33	5 8 36	2 8 87	5 5 79
50	4 0 20	6 0 64	3 5 50	5 7 42
55	4 9 26	6 5 30	4 4 35	6 1 43
60	6 1 64	7 4 18	5 6 56	6 9 75
65	7 8 80	9 1 06	7 3 63	8 6 79
70	10 2 28	10 4 20	9 7 04	9 9 01
75	13 3 62	13 3 74	12 8 26	12 9 06
80	17 4 16	17 4 12	16 8 55	17 5 10

This Table may be read thus :—The rate of premium on a life aged 20 is 1*l.* 6 florins 20 mils in England, and 5*l.* 1 fl. 71 mils, in India. *The latter may be read as 51·71 rupees,*

TABLE 24 a.

The following are the INDIAN PREMIUMS charged by the ALBERT and MEDICAL INSURANCE OFFICE.

Age.	Without Profits.	
	Civil.	Military.
	£ s. d.	£ s. d.
20	3 0 9	3 10 0
30	3 12 0	4 0 0
40	4 10 0	4 14 0
50	5 18 0	6 2 0
60	8 6 0	8 10 0

TABLE 25.—PRESENT VALUE of an ANNUITY of £1 on the Life of a MALE aged x , in ENGLAND and in INDIA.

A ge (x)	3 per Cent.		5 per Cent.	
	England.	Soldiers in India.	England.	Soldiers in India.
20	22·06	12·37	16·47	10·20
25	21·09	12·58	15·99	10·41
30	20·01	12·27	15·43	10·21
35	18·81	11·85	14·77	9·92
40	17·47	11·47	13·98	9·65
45	16·01	11·43	13·07	9·67
50	14·42	11·14	12·03	9·52
55	12·76	10·59	10·87	9·17
60	11·02	9·68	9·60	8·52
65	9·27	8·32	8·25	7·44
70	7·61	7·50	6·91	6·82
75	6·14	6·14	5·69	5·66
80	4·92	4·92	4·63	4·49

TABLE 26.—COMPARATIVE ANNUAL PER-CENTAGE of MORTALITY of the OFFICERS of the THREE ARMIES of BENGAL, MADRAS, and BOMBAY.*

PRESIDENCY.	Colonels.	Lieut.-Colonels.	Majors.	Cap-tains.	Lieu-tenants.	Cornets and Ensigns.	Sur-geons.	Assis-tant Sur-geons.	Total or General Per-centage.	General Average.
Bengal - - - -	5.94	4.84	4.10	3.45	2.75	2.34	- -	- -	3.12	} 3.85
Madras - - - -	5.40	6.11	5.42	5.02	4.17	3.80	4.68	4.31	4.49	
Bombay - - - -	5.74	5.45	3.77	3.78	3.96	3.15	4.08	4.21	3.94	
Mean age at death of Bengal } Officers - - - - }	61	51	40	36	18 to 33					

* Asiatic Researches, vol. 20, p. 201.

TABLE 27.—TABLE of GOVERNORS-GENERAL of INDIA, showing at the Date of assuming the Government the Number of Years they were expected to live by the English Life Table, and the Number of Years they actually enjoyed. Their Years of expected Lifetime were 295 Years ; they actually enjoyed 286 Years, and adding *nine*, the expectation of the surviving Governor-General, this also amounts to 295 Years. The mean Lifetime on assuming the Government was 21 Years by the Table ; or the average number of Years which they afterwards actually enjoyed.

GOVERNORS-GENERAL.	Born.	Assumed the Government.	Quitted the Government.	Died.	Years of Lifetime after assuming Government.		
					Ex-pected.	En-joyed.	Dif-ference.
Warren Hastings *	Dec. 6, 1732	April 13, 1772	Feb. 1, 1785	Aug. 22, 1818	27	46	+19
Lord Cornwallis -	Dec. 31, 1738	Sept. 12, 1786	Oct. 28, 1793	Oct. 5, 1805	21	19	- 2
Lord Teignmouth (Shore).	Oct. 8, 1751	Oct. 28, 1793	Mar. 12, 1798	Feb. 14, 1834	25	40	+15
Marquis Wellesley (Mornington).	June 20, 1760	May 17, 1798	July 30, 1805	Sept. 26, 1842	28	44	+16
Lord Minto - -	April 23, 1751	July 31, 1807	Oct. 4, 1813	June 21, 1814	16	6	-10
Marquis of Hastings (Moir).	Dec. 7, 1754	Oct. 4, 1813	Jan. 9, 1823	Nov. 28, 1826	15	13	- 2
Lord Amherst -	Jan. 7, 1773	Aug. 1, 1823	Mar. 10, 1828	1857	20	34	+14
Lord Wm. Bentinck	Sept. 1, 1774	July 14, 1828	Mar. 20, 1835	June 17, 1839	18	10	- 8
Lord Metcalfe † -	Jan. 30, 1785	Mar. 20, 1835	Mar. 4, 1836	Sept. 5, 1846	20	11	- 9
Lord Auckland -	Aug. 25, 1784	Mar. 4, 1836	Feb. 28, 1842	1849	19	13	- 6
Earl of Ellenborough	Sept. 8, 1790	Feb. 28, 1842	June 15, 1844	(living 1863)	19	20	+ 1
Viscount Hardinge	Mar. 30, 1785	July 23, 1844	Jan. 12, 1848	1856	14	12	- 2
Marquis of Dal-housie.	April 22, 1812	Jan. 12, 1848	1856	1860	29	12	-17
Earl Canning -	Dec. 14, 1812	1856	1861	1862	24	6	-18

* Warren Hastings first went to India in 1750, after which he lived 68 years.
† Lord Metcalfe arrived at Calcutta on January 30th, 1801, nearly 16 years of age, when his expected lifetime at that age was 42. He lived in India 35 years, and 10 years longer in England, Jamaica, and Canada.

TABLE 28.—COMPARATIVE TABLE showing the SICKNESS, MORTALITY, and INVALIDING in the EAST INDIA COMPANY'S TROOPS (Natives and Europeans) in each of the Presidencies during the Years 1825-1844.*

Presidency.	Europeans or Natives.	Years of Life, or aggregate Strength (1825-44).	Admissions into Hospitals during the Years 1825-44.	Deaths from all Causes.	Deaths from Cholera.	Invalids.	Ratio per Cent. of ordinary Deaths to Strength.	Ratio per Cent. of Cholera Deaths to Strength.	Ratio per Cent. of Total Deaths to Strength.	Ratio per Cent. of Number invalidated.
Total of three Presidencies {	Europeans -	240,577	382,600	13,012	1,741	6,939	4.685	0.724	5.409	2.884
	Natives -	3,881,660	2,591,107	69,973	13,260	75,077	1.461	0.342	1.803	1.934
Madras - {	Europeans -	101,210	135,720	3,892	432	2,101	3.419	0.427	3.846	2.076
	Natives -	1,196,260	904,325	25,064	6,976	23,479	1.512	0.583	2.095	1.963
Bombay - {	Europeans -	50,987	88,720	2,589	288	1,611	4.513	0.565	5.078	3.160
	Natives -	638,975	586,047	8,251	1,796	21,155	1.010	0.281	1.291	3.311
Bengal - {	Europeans -	88,380	158,160	6,531	1,021	3,227	6.230	1.150	7.380	3.600
	Natives -	2,046,425	1,100,735	36,658	4,488	30,443	1.570	0.220	1.790	1.500

* Paper by Colonel Sykes in the Statistical Journal, vol. x., p. 100.

TABLE 29.—CONJUGAL CONDITION of BRITISH-BORN SUBJECTS in INDIA.—Proportion per Cent. of Married, Unmarried, and Widowers, at each Age.

Ages.	Royal Troops.						East India Company's Troops.			Civilians and Civil Population.		
	Officers.			Soldiers.								
	Married.	Unmar-ried.	Widow-ers.	Married.	Unmar-ried.	Widow-ers.	Married.	Unmar-ried.	Widow-ers.	Married.	Unmar-ried.	Widow-ers.
Total of 20 and upwards.	19·2	77·5	3·3	6·5	93·0	·5	28·8	69·3	1·9	45·4	50·1	4·5
20—	2·8	97·2	—	1·7	98·2	·1	5·1	94·9	—	12·7	86·9	·4
25—	13·0	86·1	·9	6·9	92·7	·4	19·2	79·7	1·1	31·8	66·7	1·5
30—	29·2	69·2	1·6	15·7	83·0	1·3	36·9	61·5	1·6	51·8	44·6	3·6
35—	42·5	50·2	7·3	21·9	75·1	3·0	53·2	43·5	3·3	66·1	29·2	4·7
40—	49·2	39·9	10·9	18·9	75·9	5·2	71·9	24·1	4·0	70·5	21·7	7·8
45—	55·2	27·6	17·2	10·7	75·0	14·3	77·5	14·5	8·0	72·3	18·0	9·7
50—	55·9	20·6	23·5	—	—	—	72·3	13·7	14·0	73·8	14·1	12·1
55—	53·8	23·1	23·1	—	—	—	88·1	4·8	7·1	71·9	13·2	14·9
60—	66·7	33·3	—	—	—	—	79·5	7·7	12·8	72·8	10·2	17·0
65—	33·3	44·5	22·2	—	—	—	73·7	10·5	15·8	72·5	6·9	20·6
70—	—	—	—	—	—	—	100·0	—	—	61·8	2·9	35·3
75 and upwards	—	—	—	—	—	—	—	—	100·0	58·3	12·5	29·2

NOTE.—The Table may be read: —of 100 officers 20 and under the age of 25, there were 2·8 married, 97·2 unmarried.

TABLE 30.—ANNUAL RATE of MORTALITY amongst CHILDREN in INDIA and in ENGLAND.

Ages.	Children of English Officers in India.* (Facts supplied by Major-General Hanyington.)			Annual Rate of Mortality per Cent. amongst Children of English Officers in Madras.* (Facts supplied by Mr. Samuel Brown.)		Annual Rate of Mortality per Cent.	
	Years of Life.	Deaths.	Annual Rate of Mortality per Cent.	Boys.	Girls.	Healthy Districts.	England.
Under 5 years	21,019	1,384	6·585	3·589	3·604	4·036	6·738
5 and under 10	11,424	72	·630	·530	·568	·688	·916
10 „ 15	6,682	40	·599	·234	·319	·431	·527

* Many of the children proceed to England at about the age of five years.

TABLE 31.—MORTALITY amongst 2,993 SONS of OFFICERS in the Madras Army, from 1808 to 1857 inclusive, including 749 who became Annuitants.

Ages.	Years of Life.	Deaths.	Mortality per Cent.
0	1,399	134	9·578
1	2,618	152	5·806
2	2,425	56	2·311
3	2,292	32	1·396
4	2,188	18	·823
5-10	9,426	50	·530
10-15	7,272	17	·234
15-21	5,968	39	·654
Total	33,602	498	1·482

TABLE 32.—MORTALITY from 1808 to 1857, amongst 2,884 DAUGHTERS of OFFICERS in the Madras Army, including 774 who became Annuitants.

Ages.	Years of Life.	Deaths.	Mortality per Cent.
0	1,348	110	8·160
1	2,305	137	5·943
2	2,325	62	2·667
3	2,187	32	1·463
4	2,074	28	1·350
5	8,975	51	·568
10	6,899	22	·319
15	4,879	27	·353
20	2,294	16	·697
25	1,004	6	·598
30	510	2	·392
35	279	2	·717
40	163	1	·613
45	84	1	1·190
50	36	1	2·777
55	15	1	6·666

ERRATUM.

For "Kurnool" (in Bengal Presidency) *read* "Kurnal" *passim*.

PRÉCIS OF EVIDENCE

TAKEN BEFORE HER MAJESTY'S COMMISSIONERS APPOINTED TO INQUIRE
INTO THE SANITARY STATE OF THE ARMY IN INDIA,

ARRANGED

To serve as an Analytical Index under the following Heads :

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P R É C I S.

I.—SANITARY DESCRIPTION OF MILITARY STATIONS IN INDIA.

SANITARY
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OF STATIONS.

Sir RANALD MARTIN—, describes the stations as selected without care, comprising every variety of climate, often unhealthy, under malarious influences, damp, ill drained, and some of them subject to floodings. P. 1, Q. 6–11. The majority of old stations have been selected by generals of division, presumptively on strategic grounds, but often by chance. P. 4, Q. 88–93.

Colonel SWATMAN—, considered the stations generally were selected with a view to military arrangements. They vary much as to healthiness. Agra, which was formerly healthy, was now the contrary; it was damp from water lying about during the rains. Dacca, occupied by natives, was unhealthy. Meanmeer was more healthy, being removed from a dirty city; it has also been drained. At Peshawur the troops suffered it was thought from irrigation. Surface cleansing and removal of nuisances is attended to now as a general practice. The regimental bazaars are in the rear of the cantonments, and looked after by the quartermaster, but there are no special regulations regarding their cleanliness. P. 41, Q. 303–415. The selection of a new station would usually be left to the quartermaster-general, with an engineer and a medical officer. P. 46, Q. 511–516.

Mr. A. STEWART—, describes Cawnpore as tolerably healthy during three or four cold months of the year, but very severe at other times. It was very unhealthy from 1842 to 1845. The soil is sandy, hot winds prevail, and the temperature is very high. It lies flat about a quarter of a mile from the Ganges, and liable to be annually overflowed to a great extent on one side, when, being generally ill-drained, the water is apt to lodge a good deal. There is much irrigation at some distance from the cantonments, which are at some distance from the native town. The sanitary arrangements were extremely imperfect. There is much broken ground,—ravines,—in the neighbourhood, usually in a filthy state; and the river during the rains rises to four times its ordinary width on the side opposite the cantonments. The subsoil is red sand mixed with clay. Water disappears rapidly from the surface. The latrines (open cesspits) were sometimes exceedingly offensive; the soil was removed by carts at night. There is a plentiful supply of good water from wells. P. 53, Q. 636–653. Meerut is more healthy than Cawnpore, more favourable for drainage though flat, and in a much better climate; as stations go, one of the best in India. P. 56, Q. 695–703. Umballa is a good station, soil light, sandy, with clay, partially drained, but rather flat; it is liable to inundations, from which the troops suffer. On one occasion an overflow of this kind was followed by much cholera and fever. P. 59, Q. 744–749. Kirkee, with all its disadvantages, is the healthiest station he ever occupied; the natural drainage is favourable; soil partly black; 1,855 feet above the sea. P. 59, Q. 756–761. Of late years there has been more attention paid to surface cleansing in the cantonments than formerly; still, in addition to the latrines, there is a good deal of offensiveness. There are certain regulations, but they are not always carried out. Commanding officers cannot act where expense is involved. Thinks a sanitary officer, *with authority to act*, would be very useful. P. 60, Q. 769–779. General sanitary arrangements, levelling of the ground, sewerage, &c., are required at all the stations. P. 63, Q. 807–808.

Lieutenant-Colonel GALL—, considers Kirkee a comparatively healthy station; it is a small station, having generally one regiment of cavalry only. There might be two if the barracks were good. They are very bad now. Water is scarce, so that wells must be dug, which would be expensive; the soil is rocky; the river is at some distance for drinking-water. P. 76, Q. 898–903. Kirkee is well drained. At Meerut the ground is against the engineer, so that the drains have to be swept down and nuisances exist. Lahore was the least healthy station he had occupied. P. 77, Q. 911, 912.

Captain J. E. T. NICOLLS—, states that stations in the plains of Northern India are uniformly flat, with slight undulations. Dinapore is surrounded with water during the rains, and Futtypore has a few marshes about it. Irrigation is used, sufficient for the crops only, from wells, and the water dries up quickly. There is every facility for surface drainage, but none for sewerage, there not being fall enough. Ordure, &c. is daily removed by hand and buried, and the latrines are arranged accordingly, and all nuisance avoided. Cesspits are not used, except at one time at Dinapore, and from which some of the wells became polluted. New sites are reported on by a committee of military, medical, and civil officers to the Commander-in-Chief, and are approved as a rule by the Governor General. This practice has obtained two or three years only; formerly mere temporary stations probably grew into permanent ones without inquiry, and this may apply to the bulk of those existing. None of these plain stations are in the neighbourhood of hills which could be occupied instead. A new station is regularly laid out, so as to secure ample ventilation. Pp. 81, 82, Q. 1024–1080, and 1104, 1105.

Dr. McLENNAN—, describes the climate of Poona and Malligaum as tolerably healthy. Bombay is unhealthy; the average temperature about 80°, and the yearly rain-fall 70 or 80 inches. The town is entirely without drainage, and there is a ditch round Fort George. Nuisances abound by improper disposal of the dead, cess-pools, foul dung heaps, and salt marshes on the neighbouring island of Salsette. There is occasional flooding which is probably beneficial. The surface filth is most disgusting especially on the beach, and this is aggravated by the daily washing over of the tide. Pp. 85, 86, Q. 1158–1165. Does not think any improvement could be made in the existing regulations for selection of sites. P. 88, Q. 1220.

Dr. COLVIN SMITH—, considers that St. Thomas' Mount, Madras, would be a healthy station under proper conditions. Rangoon was unhealthy during the war. Secunderabad was healthy when he was there. Kurnool is hot and unhealthy for Europeans, and Jubblepore is very malarious; there is an immense marsh close to which the barracks are built, causing much sickness; the neighbouring country being healthy, it might be easily drained. Rangoon was also marshy, and Prome too, which was abandoned from its unhealthiness. Impurities are removed daily at all stations under the police. Pp. 98, 99, Q. 1352–1385. Much better sites were to be found in the immediate neighbourhood of those at present occupied at many stations. P. 102, Q. 1500, 1501.

Major-General GOODWYN—, describes Kurnool as flat, the canal being close to the cantonments, with no other facilities for drainage. Neemuch was well adapted for drainage in an undulating country, and the station high and dry. The Cawnpore barracks are on the lowest ground incapable of drainage. The drainage from the bazaar in the rear passes through the barrack lines. Cawnpore might be well drained; there are

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numerous excavations, receptacles for stagnant water and filth. At Calcutta it was difficult to drain Fort William properly. Berhampore was in a low marshy position. The selection of sites rested with the civil authorities. There is no flushing of drains and no outfalls provided; it takes its natural course a short distance from the buildings. Pp. 106-108, Q. 1636-1700.

Major-General F. C. COTTON—, has inspected all the stations in Madras. Jackatalla is in a fine open country well supplied with water, and in a good position. P. 124, Q. 2008-2016. Irrigation, by which the country is kept flooded the greater part of the year and dry the rest, is carried out largely in Southern India without any ill effects. Excessive and continued heat, like cold, seems to make countries more safe from malaria and fever. Hong Kong, which is very dangerous, is temperate compared with Madras. P. 126, Q. 2038-2054. Had 20,000 natives and 40 Europeans employed on irrigation works at Godavery; the exposure did little or no harm to the temperate. Men are better employed in the air than confined in buildings. Q. 2083. Bangalore is a good healthy station. These high stations have great facilities for drainage and removal of impurities. Does not think Dr. Heyne's opinion now prevails that the laterite formation is usually associated with fever; he must have written 30 years ago. A careful investigation into the sources of fever would be highly valuable. It prevails at all levels up to 4,000 feet. Cholera cannot be connected with particular sites. P. 128, Q. 2092-2111.

Mr. LONGMORE—, describes the stations in Lower Bengal as situated on low ground having no elevation near. Calcutta is unhealthy from its flatness and imperfect drainage. Obstruction of ventilation within the fortifications, near which the river is also densely crowded with shipping, and the habits of the natives, the chief part of the city inhabited by them is extremely pestilential. Improvements were in progress for flushing drains and getting rid of ordure thrown into the river, but Fort William will be always unhealthy for troops. Dead bodies often get entangled among the crowded shipping. They are thrown in the river, the people being too poor to purchase fuel to burn them, for which Government should provide wood. Barrackpore is very superior in all sanitary respects to Calcutta. Pp. 129, 130, Q. 2130-2157. Dinapore has always been unhealthy; there is a nullah which receives all kinds of filth, and into which the river Soane periodically overflows; it is a bad station. P. 132, Q. 2181.

Dr. MACLEAN—, considers that many of the stations of Madras were occupied without regard to sanitary considerations, then never thought of, but merely by accident because the troops happened first to encamp there. Attention is now paid to the selection of proper sites, but the rule is sometimes forgotten. Mentions an instance when he was placed on a committee and asked to sign a report in favour of a site without having been summoned. It turned out bad and was condemned. Pp. 136, 137, Q. 2223-2238. Pondicherry is not crowded, and is better drained than Madras, and the water better; it is consequently more healthy. The soil in the Nizam's country is granite, and where granite is in a state of decay places are unhealthy; also when the ground is broken up for the first time. The application of water is beneficial. P. 139, Q. 2306-2320. Sir Patrick Grant has urged the abandonment of the cantonment at Secunderabad. Q. 2343.

Dr. McCOSH—, describes Prome as particularly unhealthy; it is shut out from the prevailing winds, and inundated during the rains; selected without reference to sanitary considerations, being an important town of Burmah. There is a range of hills about 50 miles distant. The Irrawaddy is navigable at all seasons to and above Prome. Rangoon is liable to tidal inundation, but is a healthy station for the tropics, much better than Calcutta; so is Pegu generally as compared with Bengal. There are no hills within 100 miles of Rangoon. The whole country is annually flooded, and when the river falls stagnant pools are left to evaporate between the nullahs; drainage to carry off the water rapidly might be easily effected. Pp. 146, 147, Q. 2444-2488.

Sir JOHN LAWRENCE—, considers that some sites for cantonments have been extremely well selected, others badly. Drainage has not been cared for as it ought, but this has improved considerably of late, and much attention has been paid to latrines, &c. P. 190, Q. 2922-2924. Improvements might be made in the cities, as Delhi and Lahore; but epidemics often appear in the cantonments some miles off, before the towns. The whole country round these old cities is rotten and decayed, so that it is difficult to find healthy sites within several miles. Great care is necessary in the selection; objections are not always obvious at first sight. The favourable character or otherwise much depends on the committee selected to report. The members should be specially qualified and appointed by the Governor-General and Commander-in-Chief, upon the recommendation of the Principal Medical Inspector, the General of Division, and the Governor of the Province. The best men should be brought from any distance, if necessary; not choosing persons because they happen to be on the spot. Everything should be done to secure the best sites, and those which are proved unhealthy should be abandoned. Many of the present cantonments have arisen out of old standing camps. Trees for shade, &c. are advantages; it is underwood* that is unhealthy. P. 197, Q. 3017-3032.

Col. GREATHED—, states that there are establishments for surface cleansing and removal of refuse under the brigadier at all stations; there are under him the Engineer, Bazaar Superintendent, and Quartermaster of the week, who makes his report. The refuse is often burned; and there is no annoyance from the bazaars, latrines, stables, or slaughter-houses; only from the barrack urinaries. There are very good regulations. P. 202, Q. 3120-3132.

Dr. BIRD—, describes Bombay and Colaba as undrained, warm, damp, and unhealthy during eight months in the year; Poona and Kirkee are comparatively dry and temperate; Poona is one of the healthiest localities in India. Belgaum is less favourable, there are ravines and broken ground about the cantonments. Pp. 213, 214, Q. 3413-3434. Kayra, which was abandoned, is an instance of a bad selection of site in the midst of swamps and broken ravines; the mortality was very great, though the buildings were altogether superior. P. 216, Q. 3482-3484.

Sir P. CAUTLEY—, states that the drainage of the stations in Bengal was generally defective, but latterly great alterations were being made. At Cawnpore the work has been done in detached bits without a comprehensive plan; had it been otherwise, it would doubtless have been effectual. The natives build their huts with mud dug at the spot, leaving the holes open; so that in constructing the canal through the Cawn-bazaar ponds full of black filth were found; there is also a total absence of ventilation; thinks that if such places as Cawnpore, Delhi, and Kurnool were systematically drained there would be comparatively little disease. The foul ravines, want of drainage, and the filth in the bazaar, would account for the frightful mortality existing at Cawnpore. These things might be remedied at a moderate cost, by which the health both of Europeans and natives would be considerably improved. Mentions Shamli in the Doab as an instance of what

* The Poona Committee recommend that no hedge-rows in the neighbourhood of cantonments and military roads be allowed to exceed three feet in height. (Appendix, p. 735.) The Muttra Committee point out the obnoxious practice of brick-burning near the works at new stations; stable litter, bones, and ordure are the ordinary fuel, creating wide spread abomination. At Peshawur, such kilns were burning 7½ years, and the health of the troops considerably improved after these were allowed to burn out in 1857. (Appendix, p. 213.)

might be done. This was a large town, always inundated in the wet season, and very unhealthy, the only channel for the water being a small tortuous nullah. A straight ditch was cut into the river, and there has never been a collection of water since. Colonel Baird Smith recommended a similar process at Meerut; and Major Wilberforce Greathed succeeded in draining the interior of Delhi by under drains into the Jumna. This want of drainage is the universal want from Calcutta upwards; open drains cheaply constructed are the best for the purpose. P. 234, Q. 3901-3940. The unhealthiness of the cantonment at Delhi probably arose from its proximity to a nullah from an extensive jheel; had the natives been listened to in reference to this, to them notorious, jheel, the cantonment would not have placed there. Delhi itself is one of the healthiest places in Bengal. Irrigation is not injurious, except when abused by overflowing and letting the water lie about in holes, which produces malaria, causing intermittent fever, and spleen; this might be remedied by drainage combined with the irrigation and levelling the ground in the neighbourhood of towns. P. 236, 237, Q. 3960-3992.

Mr. A. GRANT—, states that the conservancy and sanitary arrangements of the hill stations are often extremely defective, though formerly they were much worse. Believes the prevalence of diarrhoea is to be attributed to these causes rather than to cold or damp. P. 262, Q. 4484-4492.

Dr. R. D. THOMPSON—, considers the mode of disposing of the sewage at Bombay very objectionable, it passes into the sea, and is very offensive; the burial grounds are also very bad. P. 276, Q. 4873-4875.

Colonel DURAND—, thinks the question of stations of great importance; no doubt sanitary improvement may always be going on, and the mortality might be reduced; it is a question of expense. Stations have been moved with the extension of the frontier, but everything was done in Northern India by the aid of committees, &c. to select the best sites available. P. 287, Q. 5163-5172.

Sir C. TREVELYAN—, states that great care is now taken in the selection of sites; nothing could be better than the site in the Neilgherries, where the climate is like the South of France. P. 292, Q. 5259-5261. Madras being flat is not well drained, but the river contains excellent fish; it is dammed up, and periodically scoured by the rains. Formerly the sewers discharged their contents over the dry banks, but gutters having been cut in the sand they now are emptied in deep water until carried out to sea by the floods. P. 293, Q. 5277-5284. Madras is, perhaps, the second city in the Queen's dominions, and probably contains a million inhabitants, but there is no census, which it is desirable should be taken. The drainage is very bad, there being no means of flushing the sewers from want of water. He had initiated a plan for a municipal council, who should be empowered to raise funds and to carry out improvements of this nature, which he hoped would be established. Attention to these matters is the more important, inasmuch as the health of the troops must be affected by the local conditions and health of the population by whom they are surrounded. P. 294, Q. 5289-5314.

Dr. HUGH FALCONER—, states that the mean level of the country about Calcutta is hardly above the highest tides, so that any kind of drainage is exceedingly difficult; the practice is to dig large tanks to catch the water; and the sites for buildings are raised with the soil dug out for the tanks. P. 305, Q. 5390-5398. The conditions of drainage and surface differ materially, according to position and elevation, which greatly affects health, the deltas of large rivers being always the most unhealthy. The organic matter which is washed down from the higher levels there undergoes decay. Next to temperature, moisture most affects the health of Europeans in India; the drier the climate, concurrently with diminution of temperature, the more healthy. The southern side of the Himalaya mountains is often deluged with rain (in some places it has been estimated as high as 500 inches during the year), whilst the northern side is perfectly dry and sterile. The Terrai, covered with forest, swamps, and jungle, is most deadly during the rains, from vegetable decomposition poisoning the air, affecting not man only, but often domestic animals. That part between the Indus and the Sutlej, which is now cultivated, drained, and dry, is healthy. P. 306, Q. 5405-5458. Is not aware that rocks in the abstract have anything to do with sanitary conditions. It is where these are ground down into mud, forming soil, that the difference of condition comes into play. Had been led, from observation at Burmah and Singapore, rather to regard ferruginous soils as salubrious. Considers excess of heat and excess of moisture among the irremovable causes of disease in India. P. 309, Q. 5469-5479.

Dr. SUTHERLAND—, observes that, according to the returns, the records of meteorological facts are very imperfect, so that the elements of local climate are often little known. Except the surface cleansing of cantonments, little attention has been paid to sanitary improvement, there being no proper drainage, and even the surface drainage is bad. The privies and urinals are offensive, which always indicates danger. The removal of excreta should take place at least twice a day, but the system admits of great improvement. Roof-guttering is generally deficient, and the cook-houses and ablution-rooms are drained into cesspits, by which means the subsoil is kept damp. The bazaars, often close to the cantonments, as at Bangalore, are filthy, undrained, except at the surface, and supplied with tank-water full of impurities; the houses overcrowded and ill-ventilated. The towns are under even worse conditions, containing all the elements which even in more temperate climates would predispose every kind of fatal epidemic. P. 311, Q. 5490. No native population should be allowed within a certain distance from a military station; they should be to leeward, and plans should be laid down for streets, drainage, &c. before a bazaar is allowed to grow up. A porous soil, if undrained, speedily becomes saturated with decaying organic matter. By avoiding every removable cause of malaria, persons will be better able to withstand such as may be irremovable. P. 315, Q. 5510-5519.

Dr. WALLICH—, considers that sites should be selected on high grounds where there are trees which, without underwood, are beneficial. Stations are generally chosen from a military view, and the medical officer is little consulted; sanitary considerations not having been much thought of. P. 337, Q. 5889-5894.

Dr. DEMPSTER—, considers that sanitary arrangements must still be of first importance in the plains, where the great majority of deaths arise from diseases of undoubted malarious origin. Thinks that in the immediate neighbourhood of the notoriously unhealthy stations of Cawnpore, Kurnool, Dinapore, Delhi, Ghazepore, &c., healthy localities exist; refers to evidence procured by the Canal Sanitary Committee on this point. P. 463. At Peshawur he was one of the committee for selecting site for a new cantonment, who had presented a note on the necessity of prohibiting irrigation within one mile at least of the site, two miles being a more prudent distance in such a stiff, clayey soil, which should be thoroughly drained, of which the natural fall of the country admits. Has never since visited the place, therefore cannot say if the recommendations, with respect to irrigation, &c., were attended to, but believes that barracks have been erected on the original site, probably for military reasons. The prevailing diseases are colds, bowel complaints, and intermittent fevers in July, August, and September; but the mortality is unusually small. Much rain or westerly winds during these hot months produce unhealthiness. All the ordinary fruits and the water are wholesome, though the native population are prejudiced against water drinking. About eight miles to the east of Peshawur there is a fine open dry plain, and the soil is light and permeable, with large admixture of sand (about Kassim and Jubba), affording an eligible site for location of Europeans. P. 470. Loodiana is now abandoned as a station. It was remarkably healthy at the commencement of his residence there, and very

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much the reverse afterwards, which was accounted for by a stoppage of the natural drainage of the place, and its consequent inundation during following very wet seasons, producing malaria and virulent fever, from which the troops almost universally suffered, and it happened that those who occupied the best barracks from being nearer the malarious influence suffered more than others worst accommodated at a greater distance. The officers were nearest of all, and were affected longest. P. 471. Meerut (from 1850 to 1854) has long proved one of the most healthy stations, at which sick from Loodiana and Lahore quickly regained strength. No river or low moist land in the vicinity. An open plain 30 miles from the Ganges. Loose permeable soil of humus clay and sand. Good water from 11 to 24 feet of surface in dry season. Copious periodical rains. European fruits and vegetables abound. The general drainage is good; some defective portions were being regularly drained in 1854. The drains, however, were open (the expense of covering being thought too great), and highly offensive in hot weather, though lime was used every 24 hours. Recommends the practice of digging trenches behind the camp for native resort, to be periodically filled up. P. 472. Cawnpore is notorious as one of the most unhealthy stations, nearly seven miles along edge of the high bank, overlooking a very wide portion of the Ganges, nine-tenths of the channel being dry, except during the rains; the bank is chiefly clay, and is traversed by deep ravines. When the mutiny broke out large new barracks were being erected on a site which had been selected in the dry season, without inquiry, and which he found after the rains in 1856 to be a concealed marsh, covered with rank grass, and ankle-deep with water. Men placed on a similar site were more unhealthy than others occupying bad barracks close to the filthy city. The heat, soil, difficulty of drainage, and proximity of the Ganges combined to render Cawnpore unfit for location of Europeans. P. 473. Lucknow has several square miles of land immediately to the north well suited for barracks; it was found dry and free from swamp during the wet season. Natural drainage good; at a safe distance from the Goomtee and from the city. Found from inquiries that the inhabitants of this district were generally healthy; being within two hours of Cawnpore by rail, it may be found desirable to remove the force now kept there to Lucknow. P. 473. At Delhi the troops had been removed from the city, where they were healthy, to cantonments on the edge of low irrigated land, which proved so pestilential that the ground was abandoned. On inquiry he found that 90 per cent. of the natives in that locality were afflicted with spleen disease. His observations were afterwards confirmed by Dr. Paton. Believes that a comparatively safe position may be found some miles south of Delhi. P. 474. Dinapore is situated on the Ganges, much like Cawnpore. The soil, a rich mould, subject to constant overflow during the rains; irretrievably vicious as a European station. Fever and dysentery are generally prevalent in autumn, and cholera nearly every year. The climate here is neither so hot nor so cold as in the upper provinces. P. 474. Almorah, the capital of the hill district of Kumaon, is about 40 miles in the interior from the foot of the hills, stands 4,500 feet above the sea. Seasons similar to Landour; climate generally agreeable; slight diarrhoea prevalent on first residence (attributed to the water), also intermittent fever. Goitre is endemic in the neighbouring valleys. P. 475. Simla is also 40 miles in the interior of the hills; elevation, soil, and climate similar to Landour, heavily timbered, much grass and underwood. On some occasions low typhoid fever has prevailed. P. 475. Darjeeling, in the Sikkim territory, nearly as cool, but more moist than Landour. The barracks generally superior, but destitute of wash-houses. Air so moist that cold is seldom taken by remaining in damp clothes. Croup prevails among the young. Jungle should be passed when the sun is well up, and during hot or cold seasons. P. 475. Cantonments should be dry and in well-drained country, free from liability to inundation, on light permeable soil. Avoid river-banks or marshes. The health of the natives should be inquired into, and the quality and supply of the water. P. 475.

II.—BARRACK AND HOSPITAL ACCOMMODATION.

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Sir RANALD MARTIN—, states that the structural arrangements of barracks and hospitals generally are very deficient, and there is great neglect in reference to the removal of nuisances. The buildings are of brick, but universally defective, narrow, low, and confined, except the new barracks, and even these have not sufficient cubic space. None of the buildings are raised upon arches, nor have they double roofs, and the floors are continually damp. The health of the troops is very largely effected by bad barracks, as compared with those better constructed, as shown between Queen's and Company's barracks at Secunderabad. Verandahs are common, which are sometimes used for sleeping when the buildings are overcrowded. There is no rule as to cubic space, or ventilation, but punkahs and tatties are often beneficially used. The rooms are offensive at night. There is no organized system for providing means of ablution; water carriers are usually employed. Surface drainage and cleansing is quite as deficient as other arrangements, and should be placed under systematic medical police. Pp. 1, 2, Q. 10-54. The hospitals in India are not sufficiently ventilated, but they are attended by a class of warrant officers, besides orderlies and native attendants, so that as regards personal care they are not surpassed in the world. The buildings, drainage, &c. are defective, as in the barracks. P. 7, Q. 165-178.*

Colonel SWATMAN—, thought many of the old barracks most inferior; but the new ones admirable, with considerable means of ventilation. Lime washing and cleansing is now frequent. There is no difficulty as to the execution of repairs. The superintending engineer has large powers of action in emergency. P. 41, Q. 291-302. Baths were always provided at all places he had seen. P. 311.

Mr. A. STEWART—, states that the dragoon barracks at Cawnpore, which were very inferior, were removed before the mutiny. They were built in parallel lines from north to south, a bad arrangement, as the wind generally sets in from the east or west. No barracks ought to exist in the north-west provinces without being so placed as to get the full advantage of the wind. All the barracks are of one story, raised a little above the ground, but with no circulation of air underneath. It would be very advantageous to have the buildings well off the ground, so that the spaces underneath might be used as places of shelter and recreation; but if such places be not clean, ventilated, and drained, they are mischievous, especially as at Kirkee, where a drain with openings receiving water and filth ran underneath the barracks. The barracks

* See paper addressed to the East India Directors by Sir R. Martin, containing suggestions for promoting the health of the troops in India, pointing out that in 30 years from 1815 to 1845 ten millions sterling had been wasted by preventible mortality among the troops, and recommending various specified improvements in the structure, drainage, and ventilation of barracks and hospitals; also a better selection of stations on the hills; with hints for properly investigating the mountain climates. Addendum (No. 2), p. 19. The Umritsir Committee suggest the use of hollow bricks for barracks, which would not retain the heat so long after sunset (Appendix, p. 190.) The Poona Committee advise that barracks be lime washed "regimentally," and brushes kept in store for this purpose (Appendix, p. 735.) The Dinapore Committee consider that tatties are apt to cause chills and bring on rheumatism or ague. (Appendix, p. 59.)

were usually overcrowded. Difficult to state the cubical space per man ; it should be double what it now is. Sir C. Napier allowed 1,000 feet per bed. Has never ascertained by measurement what the space has been. In some places the barrack roofs and walls are double, in others not. All the old barracks were bad. The new building at Meanmeer, built by Sir C. Napier, was the only good barrack he ever saw. It would be sound economy to provide such all over India. The ventilation at present is by doors and windows, which are not glazed, and the space for beds between these is so narrow that the men lie exposed to thorough draughts ; the men, therefore, both in barracks and hospital, suffer as much from injudicious ventilation as from want of ventilation. Sometimes the men sleep in the verandahs for want of space inside. These draughts are especially injurious to patients suffering from chronic dysentery in the cold months. Tatties are used to cool the air during the hot months. At Meerut the barracks are arranged like those at Cawnpore ; they were frequently complained of from 1851 to 1855 ; some improvements have been made. The barracks at Meerut were very bad and deficient ; there was no accommodation for the married soldiers, who were therefore put into the enclosed verandahs. By great good fortune there was no epidemic when he was there. Considers the practice which prevails in India of placing the saddlery in the same room in which the men sleep very objectionable, impeding ventilation, &c. In new barracks room might be provided for the saddlery at the end of the dormitories. The infantry at Meerut are quartered in detached masonry huts, with about 30 men each ; these are favourable to ventilation if well carried out. The hospital at Meerut was very badly lighted, so dark that operations could only be performed after carrying the patients into the verandah, where they would be exposed to dust, sun, and wind. The hospitals generally are worse than the barracks. The thatched roofs are cooler than tiles, but liable to fire ; never tried the difference with a thermometer ; they are generally single. The old Lahore barracks were bad and very unhealthy ; the new buildings are very fine. Umballa has the best barrack after the new one at Meanmeer. The infantry barrack not so good ; it is a good barrack on a bad site. Hears that the health of the place has latterly been much improved by sanitary arrangements. Served at Kirkee 4½ years. The barracks are old and bad, only eight inches above the ground. The natural drainage of the site is favourable. Soil partly black. Kirkee is 1,855 feet above the sea. Throughout India there is great want of proper means of ablution ; men usually wash in the verandah or do the best they can ; they can very rarely bathe ; such accommodation ought always to be provided. There is no difficulty in obtaining water by means of carriers, either with bullocks or hand labour. Pp. 53-60, Q. 654-768. In Bombay the married soldier is usually better provided for than in Bengal, where there is often no separate accommodation ; at Kirkee they were in detached huts. A matron is provided in the Bombay hospitals to attend the women, but not in Bengal. P. 62, Q. 797-801.

Lieutenant-Colonel GALL—, states that the barracks at Kirkee are about 30 years old ; small, without ventilation ; having no protection from the monsoon. Wind and rain beat in during the wet season. It is very oppressive during the hot season. Barracks should be lofty and ventilated in a proper manner, not from the doors and windows. More space should be allowed for the beds. There should be double roofs and broad verandahs, in which the men could amuse themselves without exposure to the sun. At Lahore the new barracks were not built when he was there ; troops were much huddled together in the previous temporary ones. Washing-houses were introduced at Meerut in 1853. Recommends large and deep swimming baths, for which there is abundance of water. The men bathe in the river at Kirkee. For linen there is a washerman in every troop, who engages his own servants, and is responsible. The orderly officer reports as to the general cleanliness of the barracks to the commanding officer, besides which there is a barrack committee. Any works requiring expense would be reported to the brigadier, who cannot go beyond a small amount, even on emergency ; if expensive the engineer must report to his superior, and it might be further referred. There are printed "Station Orders" furnished to the officers. Pp. 76, 77, Q. 904-924. The bazaars are under bazaar masters, who are magistrates. Much liquor is clandestinely sold in the bazaars. It is the master's duty to prevent this among the soldiers, and any delinquents are severely punished. Camp followers are quartered at a little distance outside the lines, under the supervision of the commander. The quartermaster superintends the removal of surface nuisances, extending to the camp followers, and he is responsible to the commanding officer. Disorderly women may be turned out of the bazaar or sent before the magistrate. Knows of no observation with a view to prevention of venereal disease. The bazaar master is always a European. The bazaars are usually in pretty good order, and contrast favourably with native towns. There is difficulty in overcoming offensive habits of the natives. Pp. 76-78, Q. 904-942. Large roomy barracks should always be provided, 10 feet at least being allowed for two beds, and the rooms 25 feet high. It would be economical in the end. The same rule as to space should apply to hospitals in a stronger degree. Pp. 80, 81, Q. 1013-1018.

Capt. J. E. T. NICOLLS—, states that the buildings are all of one story ; the floors raised a foot or so from the ground by brick rubbish ; the ordinary materials are used ; they have single roofs ; thinks improvements in details may be made, but approves generally the standard plans now issued by the Government. The regulation is to have plunge baths. P. 83, Q. 1081-1098.

Dr. McLELLAN—, describes the barracks in Bombay as usually built of brick, with tile roofs single ; temporary buildings are of wood, with thatched or cadgan roofs. Floors are generally raised from one to four feet solid ; but it would be better if they were on arches high enough to be used as places of amusement or work ; 1,200 cubic feet per man was the regulated amount. The verandahs are from 7 to 12 feet wide. There are ventilators in the roof, but the air is close at night. Soldiers will shut themselves up. On the whole, considers the barrack accommodation deficient. Better means for ablution should be provided, and baths should not be made dark and uninviting as at Poona. Pp. 86, 87, Q. 1169-1195 ; p. 92, Q. 1282. 1,800 cubic feet space is allowed in hospitals. Q. 1283.

Capt. W. S. MOORSOM—, explained an improved punkah, for providing an improved current of air throughout the width of a large room, consisting of fans of wetted canvass, propelled by bullock power and multiplying wheels. The temperature would be regulated at pleasure by the velocity and quantity of water used. One machine driving 10 punkahs by a single bullock will suffice for a building containing 100 men, but by increased power barracks for 1,000 or 10,000 might be thus ventilated by one machine. Estimated cost of machine for 100 men 68*l.*, for 1,000 about six times as much. Pp. 95-98, Q. 1314-1348.

Dr. COLVIN SMITH—, states that the old barracks at Secunderabad were badly built, on low, undrained ground, full of holes. The barracks at St. Thomas Mount are badly situated under a hill, where there was no breeze, very close and confined. The new barracks at Trimulgherry are the finest he has ever seen. P. 100, Q. 1392-1397. Ventilation is usually from the top ; thinks that tatties should be used to reduce the temperature ; neither punkahs or thermantidotes were used in the barracks. There are ample means of ablution (but not baths) provided, of which the men do not sufficiently avail themselves. The arrangements in the hospitals are not convenient for ablution of the sick. P. 100, Q. 1406-1431. Thinks the native hospitals very good, but the

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old European ones deficient, badly ventilated, and air at night very impure from overcrowding; punkahs are used, and sometimes tatties; they should be always.

Major-General GOODWYN—, describes the old barracks at Cawnpore and Calcutta as very bad; they were, consequently, pulled down. At Chinsurah they were pretty good, but not sufficiently raised; the urinaries and cook rooms badly placed. P. 107, Q. 1654, 1663, 1674. Refuse and impurities are daily removed by hand labour; condemns the system of urine tubs in barracks P. 108, Q. 1681–1696. Baths are not always provided. There was only one at Fort William. There were none on the plan of the new barracks in course of erection, 1857. Barracks are one or two stories high, sometimes three. Brick is the principal material; the floors are generally limed; had recommended the use of iron in lieu of the unseasoned wood which alone can be got in India, and asphalte for floors, which had been tried at Fort William with perfect success. The increased durability would balance the original increase of cost in 20 years, as no wood there lasts more than eight years, rendering constant repairs, and new roofs necessary. The light iron work also offers great facilities for ventilation. The bricks should be of better quality, to keep out moisture; these iron roofs were double; he recommended double iron doors also, so as to dispense with both timber and grass, both of which are so liable to take fire. The absence of raised arcaded basements is a great fault. Thinks thermantidotes should be used; punkahs not sufficient. A new one was being tried, which he had not seen, it might have been Capt. Moorsom's. Thinks the cubical space allowed has been 800 or 1,000 feet. Slight repairs are done on the request of the commanding officer; but estimates are sent to Government for periodical repairs. They are usually proceeded with at once. P. 108, Q. 1710–1788.

Major-General COTTON—, thinks the new barracks at Jackatalla are unnecessarily high, as it increases the cost, and ventilation could be contrived without. P. 125, Q. 2025–2029.

Mr. LONGMORE—, states that the barracks in Calcutta are raised on arched basements, which somewhat diminishes the want of free ventilation in the fort.* P. 131, Q. 2158–2162. The barracks at Dinapore are bad; not raised as they should be off the ground. New temporary barracks have recently been erected; they are, consequently, also on the ground, in parallel lines, and constructed of bad materials; intended to last five years, but will probably be patched up, and used for a much longer period. A large part of the mortality is owing to such defects in barracks. P. 132, Q. 2181–2208. Thinks the plan of daily removing excreta the best for such a locality as Lower Bengal. Q. 2217–2221.

Dr. MACLEAN—, describes the old barracks at Secunderabad as very faulty and overcrowded; 1,200 men being stowed away in buildings constructed for 700. The new Trimulgherry barracks have not yet been fairly tried, having so many quartered in them that the verandahs were filled with beds. P. 140, Q. 2339–2346. Overcrowding and bad ventilation were the master sins of the old system. Q. 2352. At Secunderabad there were patcheries for married men, who were more healthy than men in barracks; thinks the system of building costly barracks an unfortunate one; the expense is so great that the requisite space is grudged, whilst the men would be much better in small detached bungalows, at much less cost. Epidemics also run through barracks; isolated dwellings are far superior. Single story buildings, placed *en échelon*, containing half a company each, would be much better than larger barracks. P. 142, Q. 2373–2388.

Dr. McCOSH—, states that the troops in Burmah were quartered in temporary wooden barracks, which were tolerably healthy. P. 147, Q. 2464, 2465. Never saw any built of masonry in that country. Q. 2482, 2483. Suggests that barracks should be constructed of common earthen conical pots about nine inches long, pervious to air, with circular roofs,—as used in Syria,—at half the ordinary cost. No timber would be required, so that they would be fire proof and ant proof, and last a century or two. P. 152, Q. 2630–2634. Ventilation provided by the engineer is often stopped by the men, which is the chief difficulty. Over-crowding is not common, but sometimes exists under force of circumstances. P. 153, Q. 2643–2646.

Mr. JULIUS JEFFREYS—, is of opinion that much unhealthiness is produced by the barracks being too near the ground. They should be elevated 15 or 20 feet. Suggests a plan for building light temporary barracks of great strength, formed of thin wood scantling placed edgewise, and thin sheet iron, which may be put up very rapidly. All the parts, though rough, and readily procurable on the spot, being fitted beforehand, and no scaffolding required. More protective from either cold or heat than brickwork, and proof against ordinary causes of fire. Pp. 165–169, Q. 2802–2830. Suggests, also, a method of cooling the air, and of ventilation by making a series of wells under the floors of buildings, dug to within a foot of the water level, and guarded from the admission of any decaying substances. The original expense would not exceed one year's cost of tatties. External air also may be pumped into the wells by a simple means described. P. 177, 178, Q. 2853–2859.

Sir JOHN LAWRENCE—, considers the modern barrack accommodation in Bengal is excellent, twice as good as formerly. Thinks there is no ground for complaint; but that they are too large. It would be better to build rooms to contain half a company each, as the men would be more comfortable and less subject to annoyance. The barracks at Sealkote are unreasonably good and extravagant; they are higher than necessary. Those at Hyderabad are also very fine. In Upper India it is not necessary to raise them on arches, though requisite in damp localities. The lower rooms might be used as libraries, workshops, and dining rooms, and the upper to sleep in. Lath and plaster or pots of earth outside flat roofs would serve the purpose of double roofs. The officers build their own houses, which are often not so good as the barracks now provided for the men. It would not much increase the expense to have smaller buildings. It is better to have two stories because there is not so much ground occupied and to be defended in case of disturbance. The front of the infantry barracks at Lahore was not less than a mile long; the canteen being at one end, which causes great fatigue to the men. The building should be concentrated as far as compatible with sanitary precautions, as at Rawul Pindi. A portion of each cantonment should be partly fortified; easily defensible in case of attack. Thatched roofs should be avoided. Pp. 189–191, Q. 2902–2936; p. 196, Q. 3010–3012. Approves the plan of having cottages for the married soldiers. There should be a separate hospital for women, with a European matron. P. 198, Q. 3037, 3041.

Colonel GREATHED—, states that the new barracks are very good, the old very bad. The improvement commenced about 15 years ago. At Poona, Kurrachee, and Hyderabad there are excellent barracks. Thinks building entirely with brick is a disadvantage; in hot weather the smell caused by the sulphurous fumes is like that of a brickfield, and the brick flooring in the verandahs is excessively hot. Plastering might remedy this, but the best flooring is rammed earth washed over with cow-dung; it keeps away vermin better than anything else, and is durable. At Deesa the barracks were bad, and those at Jullundur, though well planned, were of bad materials, and the floors were damp. There is plenty of air, the doors being always open, and box ventilators in the roof. The hospitals are universally spacious and airy. Urine tubs were not used in his regiment; but the urinaries outside, necessarily near the barracks, were very offensive at all times; a nuisance which

* See description of new barracks at Fort William, Addendum No. 2, p. 136.

could not be got rid of, though the engineers did everything they could. The drainage might be very much improved in this respect. The latrines were good, and well managed. The cleansing, whitewashing, and repairing of barracks is periodically done by the engineers; so that requisitions have seldom to be made. There is never any difficulty when demands are feasible. Plunge baths are generally provided, which are always full and used by many of the men. Thinks there should be bathing parades for all the men twice a week (*i. e.* two or three companies daily), by general order. The ablution rooms are generally imperfect, and in hospitals especially very defective; there should be a warm bath room attached to each hospital. P. 199–202, Q. 3085–3119. The greatest advantage attends placing the married men in separate huts; they will forego any comfort for privacy; when families are together the children and mothers squabble; when separate they can also rear poultry and so on. The best huts are at Hyderabad. In the Bengal hospitals separate wards for women, with European matrons, are much needed. P. 209, Q. 3315.

Dr. BIRD—, considers the barrack floors at Colaba, in 1841–4, were not sufficiently elevated; they should be on arches, water might be found within three feet of the surface, they are built of brick. At Kirkee, Poona, and Belgaum half burnt bricks and lime or mud and stone are used, and the buildings form three sides of a square; there were huts of stone or mud for the married men, which are quite as healthy and more convenient. All barracks should consist of two stories, using the basement for kitchens, &c., and ablution rooms, at present very insufficient, both in barracks and hospitals; roofs should be double. Considers mud floors, as used by the natives, objectionable under all circumstances; wood should be used, next to wood brick. The ventilation and light are obtained from venetian openings in the roofs or doors and windows, which are better than artificial ventilation. The provision of warm baths would be one of the greatest means of preserving health. It would be a saving in the end were all low country barracks reconstructed on these principles. P. 214–217, Q. 2426–2511.

Brig.-Gen. RUSSELL—, states that the new barracks generally in Madras are admirable; the old ones were deficient. The sanitary regulations are amply sufficient if carried out. The barracks at Moulmein, built in 1826, were of wood thatched with leaves; they were rather too full on landing 1,000 strong, and there was great want of accommodation for married people. There was a plan for new brick barracks, but he considers wood both cooler and drier; those built in 1826 were standing in 1857. The roofs should be shingled to prevent fire, and to bear the monsoon hurricanes. The Fort George barracks were very bad in 1845–7. An open drain passed close by; being within the fort no breeze could reach them. At Secunderabad the barracks were built in squares, one within another, and there was no ventilation; but after raising one of the buildings, in 1848, and putting on a Bengal roof, with wire gauze ventilators, no serious case of dysentery occurred among the men quartered within the building, the air of which was quite sweet in the morning, whilst the others were very offensive; these barracks were in a hollow with a swamp on one side and an old graveyard the other. At Trichinopoly the temporary thatched mud buildings were much cooler than the bomb-proofs, which the men could neither bear by day, or sleep in by night. Improvements were made at considerable expense. Never knew the Madras Government refuse a reasonable request for the benefit of the troops. The Rangoon barracks were of wood. In the permanent barracks the ventilation is often bad, and any apertures within reach are apt to be stopped by the men to avoid draughts. Cleansing and whitewashing is properly attended to, and the floors are swept four times a day. The external surface cleansing and drainage was also well performed. Ample provision is made, and requisitions are invariably attended to. Urine tubs were placed in the verandahs at night but removed before gun-fire. The married people were sometimes very badly accommodated. Prefers huts for them in all cases. P. 226–228, Q. 3689 and 3747. Plunge baths and ample means of ablution were being provided by the engineers some years ago, if not stopped for want of money. P. 231, Q. 3856. The artillery barracks at Secunderabad are on higher ground than the infantry, and were never fully occupied; though the buildings were not so well ventilated, there were better means of drainage, better external ventilation, and the water was derived from a different source. P. 233, Q. 3885, 3894.

Colonel G. CAMPBELL—, considers the barracks in Bengal built on Sir C. Napier's principle quite as good as those in England; others not so good. There is not sufficient upper ventilation in the old ones, which are very close at night. Urine tubs were placed outside the barrack room. The buildings are thoroughly cleansed once a year, and the walls once a week. There are delays and difficulties in getting repairs, from official routine. The surface drainage is well attended to. The mud floors are dry if sound, but when broken they retain and absorb the wet. There were baths of sufficient means of ablution in the new barracks, iron basins with plugs being used. In the old barracks there are earthen basins, which do not so well secure the use of fresh water by each man. Should think all had baths by this time. Always had a bathing tent on the march fitted up with large tubs. The cleansing of the bazaars is generally well attended to. The 52nd were in very bad temporary barracks at Lucknow, and believes those in which they are now, at Jhansi, are very unfit. At Lucknow they were put into the king's stables, and while there cholera broke out, but only in that building, under which manure was afterwards found several feet deep. This was an accident, *i. e.*, no one knew it, and though the air at night had been highly offensive the men had not complained. P. 239–244, Q. 4011–4053. The accommodation for married people is generally comfortable. Thinks separate houses to contain three families the best arrangement, as one servant might do for them. P. 246, Q. 4209–4210 and 4218.

Colonel DURAND—, thinks that the Governments of India of late years have none of them failed in doing everything that was possible to promote the comfort of the soldier, although the exigencies of the service has rendered the progress slow and difficult. Lord Ellenborough paid great attention to hospitals, as well as other arrangements. P. 283, Q. 5091–5095.

Sir C. TREVELYAN—, had much improved the barracks at Fort George, Madras, by lowering the wall of the Fort six feet,—the sea breeze being thus freely admitted throughout the Fort,—by opening doors, and enlarging windows. The beneficial effect was instantaneous. Verandahs were also erected for each story, and a large cistern, supplied by a steam pump, was erected to flush out the drains with sea water. The barracks in the Neilgherries are admirable; but those at Trichinopoly might be improved in many ways. A new wing was added to the hospital at Fort George, including rooms for officers; the drainage and ventilation of which had also been set right. Ground floors are coolest, and are therefore to be preferred, provided there be no malaria from the soil. P. 290, Q. 5238–5277.

Dr. SUTHERLAND—, considers that the barrack-rooms are too long, and contain too many men. Separate houses for 20 or 25 men should be the limit, placed *en échelon*. Double verandahs impede ventilation; and not more than two rows of beds should ever be placed between the opposite doors and windows. The men are often exposed to draughts, there being no sufficient ventilation at the top. The cubic space is often too small, and where it appears sufficient, from the great height, the superficial area is too confined. The buildings are not raised above the ground so as to secure perflation of air underneath. P. 311, Q. 5490–5493. The hospitals generally have similar defects to the barracks, and are not provided with means for bathing,

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which some of the barracks have. They are attended by natives ; but there should be trained regimental orderlies. The native hospitals are the most defective in everything. P. 313, Q. 5495. The cubic space should be regulated according to position. For India, the minimum should be 1,000 cubic feet per man, with 80 square feet surface ; the maximum 1,500 cubic feet, and 100 square feet area, or about double that allowed at home. Hospitals should have from 1,500 to 2,000 cubic feet per bed. P. 315, Q. 5508, 5509.

Sir A. TULLOCH—, considers the cubical space per man in barracks in India should not be less than 800 feet, and the roofs should be double. P. 317, Q. 5545–5548. Men would be more healthy and comfortable in small buildings for 10 men each, which the men might assist to erect themselves, than in enormous barracks erected at a cost of 80*l.* or 90*l.* per man. In the West Indies the 68th regiment built themselves huts, which lasted seven years, for 30*s.* a hut. In India the cost of barracks is 12*l.* per man annually. P. 325, Q. 5645–5650.

Dr. MOUTAT—, states that the native troops usually hut themselves, being averse to barracks from caste prejudices and love of privacy. Their families are not always with them. The huts are constructed of mud, with grass or palm leaf roof. They would not tolerate much interference. There is no drainage except ditches around the huts, and the lines are very dirty. Personally, the sepoys are clean, but otherwise dirty in their habits. P. 329, Q. 5674–5702. If the huts were properly ventilated and raised off the ground, and subsoil drainage enforced, their health and condition would be much improved. If done, when in course of erection, and the reason explained to them, there would be no objection to such interference. P. 331, Q. 5727–5733. There was one barrack at Dorundah, in which three native regiments were quartered in succession. There was no great objection raised, and fair average health was maintained by the men. P. 334, Q. 5801–5805.

Dr. WALLICH—, describes the huts of the native troops as huddled together and the drainage utterly disregarded. They are often surrounded by jungle impeding ventilation and are built of bamboo and straw with mud. The men sleep outside, except during the rains. It would be quite possible to induce them to live in barracks, which would be more healthy. P. 334, Q. 5812–5835.

Serjeant-Major WALKER—, would recommend more plunge baths at the stations. There is nothing the soldier in India likes so much. P. 343, Q. 6028–6029. Does not think more light is wanted in barrack rooms at night. One lamp in each room is sufficient for duty. P. 343, Q. 6038–6040. Barracks are often not sufficiently high and ventilated, and filthy cesspools emit fearful smells. The rooms at night are very bad. The closets are well kept, but are never more than 40 or 60 yards from the barracks. P. 346, Q. 6129–6132, 6137–6139. There are means of washing. The barracks, and the plains generally might be much more healthy if drained. Pools of water often lie about within the lines for days, and are dried by the sun, causing fever. Stone slabs would make the best floors. The cow dung smells, and is not liked from being dirty and long damp after being washed. P. 346, Q. 6146–6153.

Dr. DEMPSTER—, describes the barracks at Umballa, Meerut, and Loodiana as good, others are very bad ; but has found that in unhealthy seasons troops in the worst of them suffered less than others in better buildings at the same stations, simply because the former had the advantage in certain local conditions. The married men object to have their families near the unmarried barrack rooms ; therefore separate small buildings, at convenient distances, should be provided for the married men. These must be thatched ; no small unthatched building is habitable by Europeans in the hot season. Personal ablution for the soldier has been altogether neglected, until of late years means have been provided at some of the stations. At Cawnpore, as late as 1856, he had himself caused such articles as soap, towels, and pans to be provided in an outbuilding. Bathing should be generally adopted ; recommends pouring water over the body in preference to the plunge bath. The removal of surface nuisances has been attended to of late years, but the habits of the sepoy still present formidable difficulties. P. 464. The means of ventilation are by the punkahs ordinarily in use, pulled by natives. Also tatties, which will reduce the temperature from 105° to 76° almost instantaneously ; and the thermandidote invented by Dr. Ranken. These, however, should be properly and carefully applied at the top of the rooms to avoid draughts, on the plan proposed by Capt. Moorsom for revolving barrack punkahs. P. 468.

III.—IMPROVED TENTS.

TENTS.

Mr. A. STEWART—, suggests that hospital tents should be large and double-walled, with 2½ feet space between. Privy tents should be provided for troops on march, or in the field. P. 58, Q. 728.

Mr. JULIUS JEFFREYS—, considers that it would be highly advantageous to dispense with the very numerous tent walls in an encampment. Suggests a method of forming large tent rooms, large enough for a regiment, to be raised at one haul by bullocks, uniting comparatively great stability with most perfect ventilation, and water-tight. Suggests also that for protection from the sun the reflective power and opacity of metal should be employed by covering the canvass for these tents with bright tin bronze, by which means they would surpass many substantial buildings in their resistance of solar heat (proved by careful thermometrical experiments). Such tents would be cheaper than those now in use, of much less weight, occupy less space, and be greatly superior in all sanitary requirements. They may be put up as single tents, or any size required. The bronzed cloth might be made in India. Pp. 169–177, Q. 2831–2852.

Mr. HUGHES—, exhibited the model of a corrugated iron tent or portable building, with double roof and complete ventilation, capable of lodging 25 men, which may be erected by the men in two hours. Cool, fire-proof, strong, durable, and easily removed or repaired, every part being made in duplicate of uniform size. The weight of the tent is seven tons, and the cost under 200*l.* each. P. 288, Q. 5178–5237.

IV.—SUPPLY OF WATER.

WATER
SUPPLY.

Sir R. MARTIN—, states that the water in India is usually supplied by tanks and from rivers, and conveyed by hand instead of pipes ; the tanks are much neglected. P. 1, Q. 14–18.

Colonel SWATMAN—, described the water at Agra brackish. Water generally in India requires filtration, which is not attended to. The river water especially contains much sediment. P. 43, Q. 367–374.

Mr. A. STEWART—, states that much water is drunk by the soldiers, which is usually good. It might be filtered with advantage, as is often but not generally done, and should be drawn from taps instead of being dipped out of the cask, which stirs up the sediment. P. 61, Q. 786–796.

Capt. J. E. T. NICOLLS—, states that all water for the troops in the plains of Upper India is taken from wells, varying from 20 to 70 feet deep ; it is much the same throughout, and the best that can be obtained ; it is always filtered. The carriage of water to the hill stations is expensive. Pp. 82, 83, Q. 1071, 1099, 1103. Has been told that in the Himalayas the spring water is apt to be contaminated by poisonous plants ; it is there collected in tanks. P. 85, Q. 1151–1153.

Dr. McLELLAN—, states that the water at Bombay, brought from Vehar, is abundant and good ; it is not yet laid on to the houses, but the tanks are regularly cleansed. P. 86, Q. 1166–1168.

Dr. COLVIN SMITH—, describes the water, which he examined both chemically and microscopically, at Secunderabad (native lines) as bad, producing guinea worm. The men who took water from the river at Kurnool seldom suffered from guinea worm. Pp. 99, 100, Q. 1386–1391. Generally the water is good, has known bad wells, but good water could be procured at all the stations he had seen. The bad water might be purified by filtration. P. 103, Q. 1538–1542.

Major-General GOODWYN—, states that the Bengal stations are mostly supplied from wells by carriers at Berhampore, it was from the river ; there is no storing. P. 108, Q. 1702–1711.

Major-General COTTON—, had found bad water in one spot only in Southern India. P. 126, Q. 2063, 2064.

Mr. LONGMORE—, states that the well water within Fort William, Calcutta, is bad, and the barracks are therefore supplied from a tank at some distance by carriers, who require watching, to see that they really go there, instead of to the ditch reservoirs. The men drink a good deal of water. The tank is supplied by rain water and a certain amount of percolation from the impure river. There was no bath in the fort. P. 131, Q. 2163–2171.

Dr. McCOSH—, states that at Landour water is obliged to be brought from a descent of 1,000 to 1,500 feet ; but water is always to be found from 1,000 to 1,200 feet below the summit of a ridge, which may be a better site for a station than the top. P. 150, Q. 2563–2566.

Dr. ANGUS SMITH—, considers it would be unsafe to take water from wells without chemical analysis, and that a professional chemist at each presidency in India for consultation in various subjects would probably be of great value. Bad water would cause dysentery or ague ; it might be easily purified by filtration through charcoal and sand ; alum is not desirable. Pp. 162–164, Q. 2742–2767.

Mr. JULIUS JEFFREYS—, believes the upper stations in Bengal were almost entirely supplied from wells, and in the lower country from tanks, the latter being often full of organic impurities. Considers that wooden reservoirs lined with thin sheet iron might readily be constructed by the men themselves ; so that by the addition of a syphon and filter there might always be a store of pure water. At a very trifling cost the men might also acidulate the water and make it brisk with carbonic acid. P. 165, Q. 2794–2801.

Sir JOHN LAWRENCE—, states that the natives look much to the quality of the water, and often judge better than the English. P. 197, Q. 3013–3016.

Colonel GREATHED—, describes the water at Poona as abundant and good. At Kurrachee and Hyderabad the water which percolates from the Indus is dirty, but good. It is commonly filtered through three jars of charcoal and sand. P. 202, Q. 3133–3135.

Dr. BIRD—, states that Colaba is supplied with rain water stored at Salsette. Poona and Kirkee have wells. Believes it produces guinea worm in the hot weather. It contains much organic matter, and the wells are rendered foul by constant splashing and dipping. Tanks should be above ground and discharge into open troughs. Filtration would prevent much disease. P. 214, Q. 3433–3440.

Colonel CAMPBELL—, states that the well water generally was good and abundant. It was rather scarce at Umballa, and bad at Lucknow, a number of elephants having been buried near the wells. P. 241, Q. 4059–4063. Had recommended that in the hills the rain water should be caught and stored in tanks to avoid the organic impurities with which it must become impregnated from surface nuisances about the stations, thus causing diarrhoea, &c. P. 244, Q. 4152–4156.

Dr. LETHEBY—, is of opinion that impure water is even a more powerful source of disease than impure air. In 1853–4 the mortality from cholera was at least $3\frac{1}{2}$ times greater in parts of Southwark supplied with water impregnated with sewage than in other localities of the same district supplied with different water. Shallow wells will be charged with organic matter, especially in warm climates. Decomposing vegetable matter is more injurious than animal, but it rarely gives warning either by smell or taste. Water (like other fluids) comes in contact with those internal parts of the body which are affected by dysentery, cholera, diarrhoea, &c. Water may be easily tested for organic impurity by Condry's fluid (permanganate of potash), which destroys all organic matter ; also by nitrate of silver, chloride of gold, evaporation, and ignition. The presence of living animals and vegetables in stagnant water, tanks, &c. is beneficial. Organic impurities are easily removed by filtration through a ball of manufactured charcoal with peroxide of iron, connected with a flexible syphon. These are very cheap, and may be easily used by an army on the march. All the water used at military stations should be so filtered ; it might be afterwards stored and kept. The action of heat is temporary only. The quality of water is especially important in epidemic seasons. The utmost care should be taken in the selection and examination of the water. Water highly charged with organic matter (*e.g.* the well at Secunderabad, containing $11\frac{1}{2}$ grains per gallon) is capable of producing much disease. Iron pipes should be used for distribution. For bad water a pinch of alum, or, better still, sulphuric acid, so as barely to acidulate it, would neutralize the morbidification of organic matter. Pp. 265–269, Q. 4562–4689.

Dr. THOMPSON—, had examined the various wells of London, and found them much contaminated by sewage impurities, especially at the lower levels. Considers the water generally in the tanks and wells of India very much more impure. His experience of them has been quite shocking. The tanks are unprotected, and turbid from dust, &c. ; persons bathe in them ; surface impurities are washed into them. Had found great mortality, during cholera epidemics, to arise from the use of impure water in London (giving examples similar to those mentioned by Dr. Letheby). Would consider the water used in India highly dangerous in Marylebone, and would expect the mortality to be very much higher. Had no cholera on board his ship at Canton, having himself carefully selected the water. Cholera did exist in other ships. Connected occurrence of cholera at Bombay with impure tank water. The best process for determining the quantity of organic matter is to distil the ammonia. To purify the water it should be filtered and boiled. He divides water into three heads :—1. From pastoral drainage or natural springs, which is pure ; 2. Agricultural drainage or rivers containing surface impurities ; 3. Well drainage, with impurities in a greater degree. With regard to geological formation, the purest water is obtained from the Primary rocks, as granite and mica, and clay slate. Chalk is objectionable. Sand generally supplies pure water. Any organic matter in water is injurious ; vegetable, is less dangerous than animal matter ; five or six grains per gallon would be dangerous. Before giving an opinion on any water, a delicate analysis both as to quality and quantity of organic matter would be requisite. Rain water collected on flat roofs and stored in iron or slate tanks would undergo no change. All the elevated grounds would supply the best water. Determining the quality of the water and its proper purification are matters of paramount importance to the troops. Believes that from the absence of cool water the men are more inclined to intemperance. It has been proved that abstainers have an advantage of 19 per cent. over those who drink. The point of contact between pure water and organic matter, as in marshes, is most injurious ; also where the organic matter of impure water comes in contact with the sea water. Pp. 270–276, Q. 4708–4796.

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Sir A. TULLOCH—, considers the cubical space per man in barracks in India should not be less than 800 feet, and the roofs should be double. P. 317, Q. 5545–5548. Men would be more healthy and comfortable in small buildings for 10 men each, which the men might assist to erect themselves, than in enormous barracks erected at a cost of 80*l.* or 90*l.* per man. In the West Indies the 68th regiment built themselves huts, which lasted seven years, for 30*s.* a hut. In India the cost of barracks is 12*l.* per man annually. P. 325, Q. 5645–5650.

Dr. MOUAT—, states that the native troops usually hut themselves, being averse to barracks from caste prejudices and love of privacy. Their families are not always with them. The huts are constructed of mud, with grass or palm leaf roof. They would not tolerate much interference. There is no drainage except ditches around the huts, and the lines are very dirty. Personally, the sepoys are clean, but otherwise dirty in their habits. P. 329, Q. 5674–5702. If the huts were properly ventilated and raised off the ground, and subsoil drainage enforced, their health and condition would be much improved. If done, when in course of erection, and the reason explained to them, there would be no objection to such interference. P. 331, Q. 5727–5733. There was one barrack at Dorundah, in which three native regiments were quartered in succession. There was no great objection raised, and fair average health was maintained by the men. P. 334, Q. 5801–5805.

Dr. WALLICH—, describes the huts of the native troops as huddled together and the drainage utterly disregarded. They are often surrounded by jungle impeding ventilation and are built of bamboo and straw with mud. The men sleep outside, except during the rains. It would be quite possible to induce them to live in barracks, which would be more healthy. P. 334, Q. 5812–5835.

Serjeant-Major WALKER—, would recommend more plunge baths at the stations. There is nothing the soldier in India likes so much. P. 343, Q. 6028–6029. Does not think more light is wanted in barrack rooms at night. One lamp in each room is sufficient for duty. P. 343, Q. 6038–6040. Barracks are often not sufficiently high and ventilated, and filthy cesspools emit fearful smells. The rooms at night are very bad. The closets are well kept, but are never more than 40 or 60 yards from the barracks. P. 346, Q. 6129–6132, 6137–6139. There are means of washing. The barracks, and the plains generally might be much more healthy if drained. Pools of water often lie about within the lines for days, and are dried by the sun, causing fever. Stone slabs would make the best floors. The cow dung smells, and is not liked from being dirty and long damp after being washed. P. 346, Q. 6146–6153.

Dr. DEMPSTER—, describes the barracks at Umballa, Meerut, and Loodiana as good, others are very bad; but has found that in unhealthy seasons troops in the worst of them suffered less than others in better buildings at the same stations, simply because the former had the advantage in certain local conditions. The married men object to have their families near the unmarried barrack rooms; therefore separate small buildings, at convenient distances, should be provided for the married men. These must be thatched; no small unthatched building is habitable by Europeans in the hot season. Personal ablution for the soldier has been altogether neglected, until of late years means have been provided at some of the stations. At Cawnpore, as late as 1856, he had himself caused such articles as soap, towels, and pans to be provided in an outbuilding. Bathing should be generally adopted; recommends pouring water over the body in preference to the plunge bath. The removal of surface nuisances has been attended to of late years, but the habits of the sepoy still present formidable difficulties. P. 464. The means of ventilation are by the punkahs ordinarily in use, pulled by natives. Also tatties, which will reduce the temperature from 105° to 76° almost instantaneously; and the thermandidote invented by Dr. Ranken. These, however, should be properly and carefully applied at the top of the rooms to avoid draughts, on the plan proposed by Capt. Moorsom for revolving barrack punkahs. P. 468.

III.—IMPROVED TENTS.**TENTS.**

Mr. A. STEWART—, suggests that hospital tents should be large and double-walled, with 2½ feet space between. Privy tents should be provided for troops on march, or in the field. P. 58, Q. 728.

Mr. JULIUS JEFFREYS—, considers that it would be highly advantageous to dispense with the very numerous tent walls in an encampment. Suggests a method of forming large tent rooms, large enough for a regiment, to be raised at one haul by bullocks, uniting comparatively great stability with most perfect ventilation, and water-tight. Suggests also that for protection from the sun the reflective power and opacity of metal should be employed by covering the canvass for these tents with bright tin bronze, by which means they would surpass many substantial buildings in their resistance of solar heat (proved by careful thermometrical experiments). Such tents would be cheaper than those now in use, of much less weight, occupy less space, and be greatly superior in all sanitary requirements. They may be put up as single tents, or any size required. The bronzed cloth might be made in India. Pp. 169–177, Q. 2831–2852.

Mr. HUGHES—, exhibited the model of a corrugated iron tent or portable building, with double roof and complete ventilation, capable of lodging 25 men, which may be erected by the men in two hours. Cool, fire-proof, strong, durable, and easily removed or repaired, every part being made in duplicate of uniform size. The weight of the tent is seven tons, and the cost under 200*l.* each. P. 288, Q. 5178–5237.

IV.—SUPPLY OF WATER.**WATER
SUPPLY.**

Sir R. MARTIN—, states that the water in India is usually supplied by tanks and from rivers, and conveyed by hand instead of pipes; the tanks are much neglected. P. 1, Q. 14–18.

Colonel SWATMAN—, described the water at Agra brackish. Water generally in India requires filtration, which is not attended to. The river water especially contains much sediment. P. 43, Q. 367–374.

Mr. A. STEWART—, states that much water is drank by the soldiers, which is usually good. It might be filtered with advantage, as is often but not generally done, and should be drawn from taps instead of being dipped out of the cask, which stirs up the sediment. P. 61, Q. 786–796.

Capt. J. E. T. NICOLLS—, states that all water for the troops in the plains of Upper India is taken from wells, varying from 20 to 70 feet deep; it is much the same throughout, and the best that can be obtained; it is always filtered. The carriage of water to the hill stations is expensive. Pp. 82, 83, Q. 1071, 1099, 1103. Has been told that in the Himalayas the spring water is apt to be contaminated by poisonous plants; it is there collected in tanks. P. 85, Q. 1151–1153.

Dr. McLELLAN—, states that the water at Bombay, brought from Vehar, is abundant and good ; it is not yet laid on to the houses, but the tanks are regularly cleansed. P. 86, Q. 1166–1168.

Dr. COLVIN SMITH—, describes the water, which he examined both chemically and microscopically, at Secunderabad (native lines) as bad, producing guinea worm. The men who took water from the river at Kurnool seldom suffered from guinea worm. Pp. 99, 100, Q. 1386–1391. Generally the water is good, has known bad wells, but good water could be procured at all the stations he had seen. The bad water might be purified by filtration. P. 103, Q. 1538–1542.

Major-General GOODWYN—, states that the Bengal stations are mostly supplied from wells by carriers at Berhampore, it was from the river ; there is no storing. P. 108, Q. 1702–1711.

Major-General COTTON—, had found bad water in one spot only in Southern India. P. 126, Q. 2063, 2064.

Mr. LONGMORE—, states that the well water within Fort William, Calcutta, is bad, and the barracks are therefore supplied from a tank at some distance by carriers, who require watching, to see that they really go there, instead of to the ditch reservoirs. The men drink a good deal of water. The tank is supplied by rain water and a certain amount of percolation from the impure river. There was no bath in the fort. P. 131, Q. 2163–2171.

Dr. McCOSH—, states that at Landour water is obliged to be brought from a descent of 1,000 to 1,500 feet ; but water is always to be found from 1,000 to 1,200 feet below the summit of a ridge, which may be a better site for a station than the top. P. 150, Q. 2563–2566.

Dr. ANGUS SMITH—, considers it would be unsafe to take water from wells without chemical analysis, and that a professional chemist at each presidency in India for consultation in various subjects would probably be of great value. Bad water would cause dysentery or ague ; it might be easily purified by filtration through charcoal and sand ; alum is not desirable. Pp. 162–164, Q. 2742–2767.

Mr. JULIUS JEFFREYS—, believes the upper stations in Bengal were almost entirely supplied from wells, and in the lower country from tanks, the latter being often full of organic impurities. Considers that wooden reservoirs lined with thin sheet iron might readily be constructed by the men themselves ; so that by the addition of a syphon and filter there might always be a store of pure water. At a very trifling cost the men might also acidulate the water and make it brisk with carbonic acid. P. 165, Q. 2794–2801.

Sir JOHN LAWRENCE—, states that the natives look much to the quality of the water, and often judge better than the English. P. 197, Q. 3013–3016.

Colonel GREATHED—, describes the water at Poona as abundant and good. At Kurrachee and Hyderabad the water which percolates from the Indus is dirty, but good. It is commonly filtered through three jars of charcoal and sand. P. 202, Q. 3133–3135.

Dr. BIRD—, states that Colaba is supplied with rain water stored at Salsette. Poona and Kirkee have wells. Believes it produces guinea worm in the hot weather. It contains much organic matter, and the wells are rendered foul by constant splashing and dipping. Tanks should be above ground and discharge into open troughs. Filtration would prevent much disease. P. 214, Q. 3433–3440.

Colonel CAMPBELL—, states that the well water generally was good and abundant. It was rather scarce at Umballa, and bad at Lucknow, a number of elephants having been buried near the wells. P. 241, Q. 4059–4063. Had recommended that in the hills the rain water should be caught and stored in tanks to avoid the organic impurities with which it must become impregnated from surface nuisances about the stations, thus causing diarrhœa, &c. P. 244, Q. 4152–4156.

Dr. LETHEY—, is of opinion that impure water is even a more powerful source of disease than impure air. In 1853–4 the mortality from cholera was at least $3\frac{1}{2}$ times greater in parts of Southwark supplied with water impregnated with sewage than in other localities of the same district supplied with different water. Shallow wells will be charged with organic matter, especially in warm climates. Decomposing vegetable matter is more injurious than animal, but it rarely gives warning either by smell or taste. Water (like other fluids) comes in contact with those internal parts of the body which are affected by dysentery, cholera, diarrhœa, &c. Water may be easily tested for organic impurity by Condy's fluid (permanganate of potash), which destroys all organic matter ; also by nitrate of silver, chloride of gold, evaporation, and ignition. The presence of living animals and vegetables in stagnant water, tanks, &c. is beneficial. Organic impurities are easily removed by filtration through a ball of manufactured charcoal with peroxide of iron, connected with a flexible syphon. These are very cheap, and may be easily used by an army on the march. All the water used at military stations should be so filtered ; it might be afterwards stored and kept. The action of heat is temporary only. The quality of water is especially important in epidemic seasons. The utmost care should be taken in the selection and examination of the water. Water highly charged with organic matter (*e.g.* the well at Secunderabad, containing $11\frac{1}{2}$ grains per gallon) is capable of producing much disease. Iron pipes should be used for distribution. For bad water a pinch of alum, or, better still, sulphuric acid, so as barely to acidulate it, would neutralize the morbidification of organic matter. Pp. 265–269, Q. 4562–4689.

Dr. THOMPSON—, had examined the various wells of London, and found them much contaminated by sewage impurities, especially at the lower levels. Considers the water generally in the tanks and wells of India very much more impure. His experience of them has been quite shocking. The tanks are unprotected, and turbid from dust, &c. ; persons bathe in them ; surface impurities are washed into them. Had found great mortality, during cholera epidemics, to arise from the use of impure water in London (giving examples similar to those mentioned by Dr. Letheby). Would consider the water used in India highly dangerous in Marylebone, and would expect the mortality to be very much higher. Had no cholera on board his ship at Canton, having himself carefully selected the water. Cholera did exist in other ships. Connected occurrence of cholera at Bombay with impure tank water. The best process for determining the quantity of organic matter is to distil the ammonia. To purify the water it should be filtered and boiled. He divides water into three heads :—1. From pastoral drainage or natural springs, which is pure ; 2. Agricultural drainage or rivers containing surface impurities ; 3. Well drainage, with impurities in a greater degree. With regard to geological formation, the purest water is obtained from the Primary rocks, as granite and mica, and clay slate. Chalk is objectionable. Sand generally supplies pure water. Any organic matter in water is injurious ; vegetable, is less dangerous than animal matter ; five or six grains per gallon would be dangerous. Before giving an opinion on any water, a delicate analysis both as to quality and quantity of organic matter would be requisite. Rain water collected on flat roofs and stored in iron or slate tanks would undergo no change. All the elevated grounds would supply the best water. Determining the quality of the water and its proper purification are matters of paramount importance to the troops. Believes that from the absence of cool water the men are more inclined to intemperance. It has been proved that abstainers have an advantage of 19 per cent. over those who drink. The point of contact between pure water and organic matter, as in marshes, is most injurious ; also where the organic matter of impure water comes in contact with the sea water. Pp. 270–276, Q. 4708–4796.

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Dr. A. H. HASSALL—, considers that the wells in India would probably contain a quantity of organic matter by percolation. Water may be contaminated by cesspools at 100 yards or more. Water from mountain land and rain water would be tolerably pure. Wells should be covered and the water filtered; but filters require renewal, neither do they in many cases remove all impurity. Frequently water which is very palatable is impure. Diseases might be propagated by impure water, and it would be dangerous to place a regiment where another had been previously suffering from cholera with the same water supply. A practical chemist only can determine the amount of organic matter in water, though a tolerably exact opinion may be formed by any medical man, both by analysis and with the microscope. Pp. 276-278, Q. 4897-4950.

Sir C. TREVELYAN—, states that the water supply of Madras is very deficient, there being no means of flushing the drains. The water is chiefly derived from wells near the surface, which are partially contaminated by the drains. P. 294, Q. 5303-5318.

Dr. HUGH FALCONER—, does not consider stagnant water necessarily bad. If there be sufficient vegetable and animal life in the water, it will be maintained in a sound state. The water at Calcutta is generally good, *i.e.*, in the ponds, which are covered with vegetation, from which alone the natives will drink. These are quite free from the drainage of the country near them. P. 306, Q. 5399-5405. Would prefer water having a fair balance of vegetable and animal life in it to rain water, though the latter carefully stored would be good. The tanks from which the troops generally are supplied do not contain living animal or vegetable matter, and the water is, therefore, not so good. They are too deep. P. 309, Q. 5459-5468.

Dr. SUTHERLAND—, from an examination of returns from India, is of opinion that the state of the water supply, both for domestic use and for drainage, is one of the cardinal defects in India, and a predisposing cause of diseases, especially of the zymotic class. P. 311, Q. 5490, 5521-5525.

Dr. MOUAT—, states that the native lines are usually supplied from tanks of rain and drainage water, and springs, one of which is set apart for bathing, and generally one large drinking tank is kept purer than the rest; they are often muddy after rain. In Calcutta, they are filled from the river. The natives attach importance to pure water, and ascribe diseases to bad water. Cholera would be produced in marshy districts and by water from tidal rivers. The men would not permanently object to iron pipes for conveying water, if proper management be observed in their introduction. Has no doubt disease is occasioned by bad water and bad conservancy. P. 330, Q. 5703-5721. The natives do not use latrines, and the excretæ, therefore, after rain get washed into the tanks by percolation through the soil. The Europeans get the same water, though there be no communication between the lines. P. 333, 5782-5789.

Dr. WALLICH—, states that the water at Berhampore is charged with organic matter, which is washed into the tanks during the rains. Would recommend the storing of rain water in iron tanks. Considers the minute particles of animal and vegetable matter produce fevers, dysentery, and cholera. Considers the vegetable scum and film injurious when passing into a state of decay. The natives have no idea of sanitary precautions and are filthy in their habits, polluting the water. Filtration would be difficult on a large scale and more expensive than storage. Continued boiling would be the greatest safeguard, but these organisms will stand an immense amount of heat and are apt to grow again. P. 335, Q. 5836-5860.

Serjeant-Major WALKER—, describes the water at Calcutta as dangerous and not fit for use; is certain numbers of men are killed by it. It is generally good at other stations. P. 346, Q. 6133-6136.

Mr. JULIUS JEFFREYS—, recommends the filtration of water after boiling, upon a simple plan, described by him. P. 494. He also submits a method of rendering rapid water grateful and refreshing by means of gas generated from acid and lime; also by charcoal and limestone, where acid cannot be easily obtained P. 494.

Dr. EATWELL—, doubts fever being produced by bad water, which, however, would cause cholera, &c. Suggests chemical examination of the waters of those districts where fevers prevail. P. 481.

V.—COMMISSARIAT ARRANGEMENTS.

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Sir R. MARTIN—, considers the ration to be satisfactory as supplied by the commissariat. Spirits are allowed, and it is difficult to enforce restrictions on their use in the bazaars. Malt liquor would be preferable, and it has been brewed at some of the hill stations with tolerable success. Tea, coffee, and cocoa are issued. P. 3, Q. 55-70. Spirits are always prejudicial, except, perhaps, on full march, after eating. Pp. 17, 274.*

Colonel SWATMAN—, thought the ration very good, but more meat than a pound a day was desirable for growing youths. Beer and spirits are sold at the canteen under regulation. They are not allowed to be sold in the bazaars, but this is evaded; and it would be undesirable to prevent the sale of spirits at the canteen, as the men would resort to the bazaars. Licences are granted to natives, which should not be done. Beer brewed in India will not keep. The habits of the soldier as to temperance are somewhat improved. P. 44, Q. 422-467.

Mr. A. STEWART—, thinks the ration is very good. The soldiers generally drink arrack with water and malt liquor. P. 61, Q. 784 and 793. The sale of spirits should be discouraged, but not forbidden in cantonments; there are times when spirits are desirable. Besides, if the men were not allowed to purchase them, and became discontented, smuggling of inferior spirits would be the consequence. An increased use of malt liquor in lieu of spirits was attended with very marked beneficial results at Meerut in 1851-5. It would be advantageous to watch the men by the corporals, to observe their general habits, especially during epidemics. Pp. 61, 62, Q. 802-806.

Dr. RENNIE—, considers that food, both as regards quality and quantity, should be adapted to climate, just as clothing should be so adapted. As oxygen is the essential element of life, the quantity of which varies according to climate, the quantity of food required must vary also. From 30 to 35 ounces is sufficient for labouring men in England, but soldiers in England get 48 ounces, hence they have much disordered digestion, though the mean temperature is 50°. In India, however, with the thermometer at 87° in the shade, the soldier gets 52 ounces; and much of what is called tropical disease is owing to this over-feeding. This state of things is aggravated by the use of spirits and tobacco. Considers that the lungs are impaired in this manner by a species of hypertrophy resulting from excessive nutrition. Recommends that the quantity of animal food be reduced, and all fat oily substances avoided. Bread and vegetables should form the staple, with a moderate allowance of fresh meat; ventilation should be carefully enforced. Smoking should be relinquished as a condition of entering the army. Considers the use of alcohol a common cause of sunstroke, which is also induced

* See p. 32, "Fourth," &c.

by the use of tight belts obstructing the action of the viscera.* Thinks all weight should be sustained from the shoulders. Addendum, No. 2, pp. 72-76.

Lieut.-Colonel GALL—, considers the soldier's ration ample, embracing meat, bread, vegetables, sugar, tea, rice, salt, and firewood, issued at about 5*d.* a day. Latterly even a pound and half of meat was allowed, more than the men could consume; they can exchange with the cook. The usual beverages are spirits, porter, and arrack. The spirits are sold with water at the canteen; the men are not allowed to drink it elsewhere. Thinks if the spirit rations were discontinued the men would clandestinely procure the cheap spirit of the country, on which a man may get drunk for a halfpenny. Occasionally at present the men exceed a little after receiving money. The usual issue is one quart of porter and one dram; the latter may be exchanged. Porter is cheapened to encourage its use in lieu of spirits. The habits of the soldier have improved, and they are consequently more healthy. There is less mortality and invaliding. P. 78, Q. 943-961.

Dr. McLENNAN—, considers the cooking arrangements in the Bombay barracks very deficient; the rooms are small, inconvenient, and without chimneys. The ration is good and sufficient. It would be the fault of the regimental authorities if bad provisions were taken. Thinks it very important that the use of spirits should be altogether disallowed; and that beer is also injurious, though producing a different class of disease. The canteen should be supplied with ice, soda-water, &c. Intemperance, though not always traceable, much increases the difficulty of treating other diseases, so that the number injured by it cannot be calculated. Nevertheless, during ten years, 1846-56, one-tenth of the cases in the European General Hospital, Bombay, were from delirium tremens and ebrietas—a larger number than from any other disease, fever excepted; whereas there were more deaths from alcohol than either fever, hepatitis, or diarrhoea, and nearly as many as from cholera. Nevertheless the soldiers have very much improved of late years in habit and character. P. 90, Q. 1228-1231.

Dr. COLVIN SMITH—, thinks the rations are good and well cooked. There might be more variety in the way of vegetables. Spirits are issued to the men in the field, which would be better discontinued; beer should be substituted, and would be a great saving in the long run. Grog was often given in the morning before starting on the march, though against orders. The men who had been habituated to this would grumble, were it stopped suddenly. The medical officers' recommendations in such cases are not always attended to, the men's tastes being consulted. Coffee in the morning should be substituted for the dram. P. 101, Q. 1432-1458; P. 102, Q. 1523, 1524.

Major-General GOODWYN—, can suggest no improvement in cooking arrangements, except asphalte floors for cleanliness. P. 110, Q. 1782-1784.

Dr. MACLEAN—, considers the soldiers' habits very unfavourable to health. They are very intemperate. P. 141, Q. 2354. Has witnessed very sensible effects from disuse of spirits in temperance regiments. Much depends on the commanding officer. P. 143, Q. 2390-2392.

Dr. McCOSH—, thinks every care is taken as to the soldiers' rations. Spirits are served out at the men's option. Ale might be more generally introduced. Very good ale is brewed in the hills, and the whole army might thus be supplied if a heavy contract were insured by Government, by which a quarter of a million annually might be saved on ale alone. The cooking is satisfactory. P. 151, Q. 2582-2596, 2629.

Sir JOHN LAWRENCE—, considers that the soldiers eat too much animal food, and drink too much. They eat meat two or three times a day. They buy bacon and pork with extra money. It would be advantageous could they be induced to eat less meat, and more vegetable food. P. 182, Q. 2942-2948. Thinks very fair beer is brewed in the hills, but that it would not keep any length of time in the plains. P. 196, Q. 3001-3003. These habits of repletion greatly increase the mortality. Europeans who are sober and temperate do not suffer in anything like the same proportion as the soldiers. P. 198, Q. 3033-3036.

Col. GREATHED—, can suggest no improvement in the ration; the soldier is very well fed. It is the fault of the commanding officer if he is not. Prior to 1854 the decision of the regimental committee, which is now final, might have been referred to a ration committee. The meat is the best grass fed; and 8 oz. of vegetables are supplied when obtainable. They get fruit also. The cooking is done by the natives, who are good servants. The utensils are tinned every month. The men live much better there than in England; there is no comparison. Care was required to prevent their exchanging the rations for bacon. In the 8th regiment the men were allowed to take money instead of the ration, with which they were better pleased, and provided themselves better. Spirit is sold only in the canteen under strict regulation, and served out on the march once or twice a day at the discretion of the commander. The police regulations are good, and there is consequently little drunkenness. Would abolish the sale of spirits if possible, substituting beer, but it would be difficult. The loss of the canteen fund provided by the tax levied on the soldiers' spirits would be one obstacle. From this fund amusements are paid for, &c. The English beer is better than that brewed at Mussourie. Pp. 202-204, Q. 3136-3200.

Dr. BIRD—, considers the cooking arrangements generally deficient, though the ingenuity of the native cooks tend to supply this defect. The men should be well dieted in India, the appetite being capricious. They are better fed than in England, having greater variety in cooking, spicing, &c. Thinks the waste of the constitution being greater in hot climates, the diet should be more nutritious. A pound of meat is sufficient. Vegetable diet is preferable in many respects; would recommend the abolition of rich aliment and stimulants for newly-arrived Europeans to facilitate their acclimation. The arrack ration is a great cause of ill-health, and should be discontinued. Beer is better; but not so good as light wines, sherbets, effervescing water, &c. Cape wines are cheap. After the effect of the change is past, does not think the present ration excessive, and the men would regulate their consumption by their amount of exercise. P. 217, Q. 3512-3540.

Brig.-Gen. RUSSELL—, states that on first landing at Moulmein the men got an injurious Chinese spirit called shamshu, from just behind the cantonments, also fresh pork, which together produced dysentery among them. P. 226, Q. 3691, 3692. Every effort was made to draw men from the canteen, which was kept as far as possible from the place of amusement. The men preferred going thither and getting their porter fresh to having it brought to them at dinner. They cannot get more than two drams of spirits, which they regard as a right. Thinks discontent would follow its reduction. It would drive them to the bazaars for liquor. There should be no excuse for drunkenness, which should never be overlooked. Pp. 229, 230, Q. 3779-3790. Sufficient care is not taken in some regiments as to what the men eat, *e.g.* bad pork, eggs, and fowls, which

* The Thyet Myo Committee recommend that a strict register be kept of all spirit drinkers, and the date of every dram they take, as a help to the men to break themselves of the habit. (Appendix, p. 565.) Mr. Hare, remarks that the effect of some of the native spirits is to drive men mad. The quantity of animal food is far too great, and the men often complain of this. In the navy, the scale is 35½ ozs. of solid food, of which only 9½ is animal, while the soldier gets 16 ozs. of meat. In Burmah, the sailors withstood the climate much better than the soldiers, who lodged for the pea-soup and pudding eaten by the former. (Appendix, p. 185.)

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perhaps died of disease, and toddy is brought into the barracks. In the 84th regiment men had a contract for 8oz. of mutton and 6oz. of bread beyond the full ration. The men do not like salt rations, preferring inferior fresh meat. P. 233, Q. 3895-3900.

Colonel CAMPBELL—, suggests that there should be a trained commissariat. There is no special corps. These officers being selected from regiments, some are exceedingly good, others as bad, and there is a great obstacle in the way of procuring good rations. At Umballa impure bread was supplied, and for months the regimental committee was thwarted by the brigadier, who ordered a station committee, thus plainly disobeying the general order that the regimental committee should be final. Some commissariat officers never had a bad loaf, others could never yet a good one. The 52nd regiment was well supplied during the mutiny, being connected with a very excellent commissariat officer. There is no difficulty in getting supplies on the march. Had known attempts made to bribe officers, which is a thing to be guarded against. A certain quantity of spirits may be served at the canteen, but many do not take it. The previously confirmed drunkards in the 52nd relinquished their intemperate habits on landing in India, which could not be accounted for. The withdrawal of spirits would produce discontent and be rather mischievous. Bottled beer ought to be sold; it was prohibited by order, and was a great deprivation, as in hot weather the draught beer which is sent out gets flat. Beer was brewed at Meerut by an officer to great advantage; but as a matter of pride this was not approved, and it was discontinued. The beer was not liked so well as the English. The 52nd were very temperate in India. There was not one case of delirium tremens or injury from drinking. It was most extraordinary. Discipline was strict, and the police excellent. Pp. 241, 242, Q. 4064-4108.

Dr. R. D. THOMPSON—, believes that the absence of cool water inclines the men to intemperance. It has been proved from the mortality tables that abstainers have an advantage of 19 per cent. over those who drink. P. 276, Q. 4877-4879.

Commissary-General THOMPSON—, states that the commissariat service is in substance a special one; the officers being selected and nominated on probation for a year, when they pass an examination and are then permanently appointed, and serve on an average from 20 to 25 years. If inefficient they are turned out. They have no voice in receiving or rejecting the rations. The quality of supplies depends entirely on the commanding officer, who can reject bad provisions, the contractor being bound under penalties and forfeiture to supply good articles, and the regimental decision is final. There is sometimes a difficulty in getting good bread, but after five rejections within 30 days the contract is annulled, so that inferior bread ought not to be taken. The commissariat officer inspects the rations, but has no power to reject without the military authorities. The commissary-general makes the contracts. It is imperative by the regulations to accept the lowest tender unless anything is known against the contractor. The hospitals are supplied in the same way. The meat is the best grass-fed beef five days, and mutton twice a week. The men employ their own cooks. Beer is sent from England. There are breweries at Kussowlie and Mussourie, but the men do not like the beer so well as English, though it is cheaper. Beer is sold to the soldier by the government at a loss—amounting probably last year to 25 lacs of rupees (or 300,000*l.*). Complaint is sometimes made of the grass, fed mutton for the hospitals. It is perhaps not good enough for sick men, but if rejected none so good of the same kind could be procured in the market, and there is nothing else to be got. Gram-fed sheep are eight times the price of grass-fed. The commissariat also carries tents, baggage, and everything on the march. It is difficult to get vegetables at all seasons; potatoes are expensive, but are supplied whenever procurable. Complaints are made when these cannot be obtained. Vegetables are important, and seeds of all kinds have recently been sent to each station for the purpose of raising their own supplies. Considers the regimental bazaars better than free markets for supplies. Would prefer doing away with the contract system, making the commissariat officer solely responsible for the quality of articles supplied. Native hospital nurses are very attentive. Believes they give satisfaction. Pp. 279-283, Q. 4951-5090.

Dr. SUTHERLAND—, considers the ration is ample, and being chiefly consumed in the middle of the day, without exercise, predisposes to disease. Cooking arrangements are defective. The habitual tipping of spirits ought to be put an end to. P. 313, Q. 5494.

Sir A. TULLOCH—, recommends that beer should be brewed at the hill stations in India, as the Government are now paying 200,000*l.* a year for beer. Hops and barley may be raised there. What has been hitherto tried has not been by professional brewers. Food, generally, might be procured cheaper in the hills than on the plains. P. 325, Q. 5650-5658.

Dr. MOUAT—, states that the natives feed themselves, and generally buy the cheapest food, being very penurious. They are apt to suffer from changing from wheaten bread to rice. P. 331, Q. 5724-5726.

Serjeant-Major WALKER—, states that the soldier is better fed in India than in England, there is far greater variety, in cooking especially. The bread has much improved of late years, also the supply of vegetables, which is now abundant. Beer is also plentiful and good, and cheaper than in England, being sold at a loss to the Government. Each man may draw two drams of rum, or one dram and one quart of beer per diem. Native spirit is sometimes smuggled into the stations and kills many men, but the military police regulations are now so much improved that it is difficult to evade them. Still drunkenness may often occur through neglect or mistake on the part of non-commissioned officers in charge of the canteen, also by the men giving beer drawn for their own dinner to their comrades, who may thus get too much. Although much intemperance, there is less among the men in India than England, and less crime. The men would not like to be debarred from the use of spirits, unless first persuaded that it would be best for them. Familiar lectures by medical officers would be beneficial for this purpose. P. 338, Q. 5923-5982.

Dr. DEMPSTER—, states that, as regards food, the English are apt to continue their old habits of diet in hot climates, which is unnecessary and injurious. Points out contrast between English and French in this respect at the Mauritius, and the much greater amount of disease among the former in consequence. In India Irish recruits consume many times the bulk of animal food they did at home, yet an equal quantity cannot be taken with safety. Vegetables are now supplied as part of the ration, which has been altogether improved; but there is yet too much animal food. The cookery is too gross, and pork from ordure-fed swine is eaten. Drunkenness promotes the invasion, and retards the cure of every tropical or other disease. Always endeavoured to discourage the use of spirits. Instances the fact of a troop of horse artillery, which at one time had 50 per cent. in hospital, after the introduction of temperate habits at Meerut (only 20 then drew spirit rations), marching to Sealkote with a clean bill of health, no death having occurred for two years. Advises pure water or slightly acidulated drinks only in general, but in some cases pale ale, *i.e.*, for weak persons after several years' residence. P. 333. Rum made in Bengal is usually consumed. The bulk of malt liquors is objectionable. Would recommend abstinence from all such stimulants, and tea and coffee as substitutes. Is acquainted with officers celebrated for powers of endurance who confined themselves to cold tea. The smuggling of arrack already occasions much trouble, and its prohibition would occasion further loss of revenue. It is difficult to keep ale imported from England. Porter keeps better. Had examined and tested beer made in

the hills at Mussourie by Mr. Mackinnon. It was much liked and in good demand. Pronounced by special committee to be good and wholesome. Some put aside in bottle through the hot season was afterwards found perfectly good and quite transparent, after standing in the glass 12 hours. P. 476. Unbolted wheat meal bread should be provided for the troops in preference to that made from "soojee," the preparation of which he describes. P. 479.

Lieut.-Col. OUCHTERLONY—, gives results of his experiments in brewing on the Neilgherries, the beer having been approved by those who tried it; so that the trade would pay professional brewers if supported by Government. Adds return of loss by getting beer from England. P. 482.

COMMISSARIAT
ARRANGE-
MENTS.

VI.—DRESS AND ACCOUTREMENTS.

Sir R. MARTIN—, is of opinion that enormous improvements might be made in the military dress, and that it is most important to determine what is the best covering for the head.* Thinks flannel should be generally worn both day and night, as a protection from sudden changes of temperature. The soldier in India carries from 40 to 60 rounds of ammunition, but the knapsack is conveyed in carts. The march is usually at night. P. 3, Q. 75–87.

DRESS AND
ACCOUTRE-
MENTS.

Mr. A. STEWART—, thinks alterations in the dress are very desirable. The metal helmet should never be worn in India. Neglect in this respect is apt to induce sun-stroke. Wicker helmets and shakos are now being introduced. Considers the constant use of flannel highly important; also loose summer clothing. Thinks a double felt helmet the best, with inner chamber and air holes, and having quilted flannel covers with curtains for protection from the sun. P. 63, Q. 809–815.

Dr. RENNIE—, considers that all weight should be sustained from the shoulders. Sun-stroke is often induced by the action of tight belts impeding the action of the viscera. Addendum No. 2, pp. 72–76.

Lieutenant-Colonel GALL—, thinks the cloth tunic admirably adapted for 10 months in the year; in hot months a canvass frock is worn, and a wicker helmet is now worn. Approves of flannel next to skin. A tight turban over the felt cap or helmet is useful to keep off the sun. The hassar boot is preferable to trousers and Wellingtons. A light waterproof cloak with hood would be serviceable.† P. 79, Q. 982–986.

Dr. McLENNAN—, suggests that red flannel shirts might be substituted for cotton. The coat could not always be worn over it. For the head lightness is of less importance than protection from the sun. P. 88, Q. 1212–1216.

Dr. COLVIN SMITH—, approves the dress recently introduced,—a dust-coloured dress without a stock, and a covered wicker helmet. The flannel used is too hard and hot; would have a lighter kind. Soldiers do not like flannel. Would recommend the wearing of a cummerbund, even more than a cholera belt. P. 102, Q. 1487–1499.

Mr. JULIUS JEFFREYS—, recommends the adoption of double ventilating helmets (weight being of minor importance, if ventilation is free), and gives three models of different kinds. The exterior should be bright to resist, by reflection, the sun's rays, the interior capable of being loosened or made tight to any shaped head by the turn of a screw, and protection afforded both for the eyes and for the neck. Cane-work perhaps the best foundation. A proper hat would save numbers of lives. Soft flannel should be universally worn, and a loose tunic or curtain to protect the spine should be suspended a few inches from the back. P. 180–187, Q. 2860–2886.

Colonel GREATHED—, considers the present dress excellent, and can suggest no improvement. It consists of a khakee tunic and trousers, with no stock, except in cold weather, and a helmet of wicker work. English boots are used. A greater number of sizes might be made with advantage. They are now always taken to pieces and remade, to fit the men at their own expense. But they march well. Has seen 40 or 50 men after a march go out shooting the whole day, and begin again next morning. There should be a halt after the first half hour to enable the men to adjust their shoes, which is one of the most important halts of the day.‡ Has marched 300 miles with men without one straggler on the line. P. 206, Q. 3238–3250.

Dr. BIRD—, considers that woollen should be worn next the skin by the soldiers, as much injury arises from throwing off clothing, and getting chilled after violent exercise. Such fabrics as are made in Scotland are better and cheaper than flannel, which shrinks. There should be a coloured cotton dress for hot weather. The wicker helmet, with a white cover, is the best head dress. The cummerbund is very useful. P. 218, Q. 3557–3573.

Brig.-Gen. RUSSELL—, objects to the infantry shako as not protecting the temples and back of the neck, and so hard that if not constantly in use it cannot be got on the head. The soldier does not care what weight is on his head, and generally fills his shako with something. The helmet now issued is better. Every man should have a cummerbund instead of belt or braces. The great coat does not turn off the water; a shower soaks it through. A better cloth would be cheaper in the end, and more conducive to health. The trousers are too small, and of thick, hard, woollen material. Tweed or tartan would be better. The stock should be discontinued. Would not recommend knickerbocker leggings. The soldier must be dressed not only for service, but to walk the bazaars. The natives make comfortable shoes, which the men always wear, except in wet weather, when they are glad to put on their ammunition boots. Never found more than five or six men who could not be called fitted from the sizes of the latter sent out. As the sea voyage spoils the stitches, they are generally made over. P. 231, Q. 3810–3835.

Mr. BISHOP—, considers the superiority of the knapsack invented by Mr. Berington over that commonly in use to be clearly demonstrated by the fact that, when properly adjusted to the figure of the man, the weight is felt only on the shoulders, whereas in the old pack the strain is chiefly upon the lower part of the back. The new knapsack having its axis resting on the transverse plane of the body, it is not necessary for the wearer to bend forward, as he must with that in ordinary use, to compensate for the weight behind. The arms also are quite unimpeded. It does not interfere with the action of the chest. If any such inconvenience has been felt, it probably arose from the manner of adjustment. An instructor would be necessary at first to explain to the men how it should be adjusted. The waist or ammunition belt, also invented by

* The Hurryhur Committee consider the general style of the "Zouave" dress most suitable for India, and recommend a helmet of "rumdah" in preference to wicker-work. (Appendix, p. 505.) The Bangalore Committee condemn the khakee clothing, and recommend serge or flannel tunics, and holland trousers; also felt helmets, in preference to wicker. (Appendix, p. 332.)

† Mr. Hare deems the waterproofing of great coats and shoes of great importance, and gives simple and effective recipes for accomplishing the desired end. (Appendix, p. 186.)

‡ The Ahmednuggur Committee advise that care be taken that boots and socks fit, when, if the heel and instep be rubbed with common brown soap each morning before march, and shoes and socks taken off before crossing streams, foot sore may be entirely avoided. (Appendix, p. 842.)

DRESS AND
ACCOUTRE-
MENTS.

Mr. Berington, enables a man to carry a greater weight with more ease. It fits nicely on the brim of the pelvis, by which greater freedom is obtained for the trunk. P. 302, Q. 5363-5389.

Serjeant-Major WALKER—, has heard no complaints in reference to the clothing. The khakee dress is most suitable for Indian service, the men often make it for themselves. Flannel shirts and belts are generally worn. The ammunition boot is the best for India. The blue trousers are liked from being easily washed. Canvass leggings are advantageous for drill, and on the march. The best head dress was the Kilmarnock forage cap with padded calico cover and turban fastened round it; it was sword proof, and made a good pillow at night. The wicker helmet, though cooler, is awkward and not so suited for actual service. The stock is discontinued in India, nor is the knapsack used as a general rule. The present equipment is as good as well could be. P. 341, Q. 5984-6013.

Dr. DEMPSTER—, considers that as the variations of temperature between early morning and noon are so great, that both warm and light clothing are requisite on the same day. The thermometer is often 36° or 40° in the morning, and 70° or 80° at two o'clock. The neck especially in such seasons should be perfectly free. If flannel has not previously been worn, it may be dispensed with on arrival in India, but after several years' residence, the system being more sensitive, a light flannel shirt will be a safeguard. The flannel supplied to the soldier is too coarse and irritating; improvement in this respect is desirable. P. 467.

VII.—REGIMENTAL DUTIES.

REGIMENTAL
DUTIES.

Sir R. MARTIN—, thinks the regulations as to drill are good and pretty uniform. P. 3, Q. 71. Recruits generally arrive in robust health, probably too plethoric for the climate. They should be drilled before going out, and be about 23 years old. They should be exempted from over-exertion for the first year after arrival. The saving of life would more than repay the additional cost. P. 7, Q. 179-192. There is no furlough for the men; the officers alone get sick leave and furlough, the latter has recently been extended to non-commissioned officers. P. 8, Q. 207-210. Regiments generally remain about 15 years in India. There is not much difference in the age of the men of the two services. Recruits on arrival should be sent to head quarters at once. P. 17, Q. 271, 272.

Colonel SWATMAN—, stated that at gun-fire, probably five in the morning, the men go on parade for an hour and a half before breakfast; after breakfast they are wanderers, except that the cleaning of arms occupies some time. They have two hours sentry duty. The roll is called after dark, at gun-fire. Ordinarily about one night in 20 the soldier is on night duty. P. 45, Q. 495-501.

Dr. STEWART—, (Surgeon of Warley* Depôt,) considers that many recruits go out to India too young. The usual age is nominally from 20 to 25, but is satisfied many go under 20, representing themselves older than they are. P. 48, Q. 593-601.

Mr. A. STEWART—, thinks that drilling should not take place in hot weather; has often observed injurious effects of this; the men break down and the hospitals are filled. From the middle of October till March drill and field days should take place at other seasons, parades and quiet movements only. Men should be sent out drilled, and not under 20 or 25 years of age. Courts-martial in the hot season, when witnesses, &c. are kept waiting, should invariably be held early in the morning. P. 64, end of Q. 815-826.

Dr. RENNIE—, is of opinion that men of strong constitution alone should be sent to India. Recruits are frequently enlisted of weak constitution. None who have not previously served five years should be allowed to embark for India. For this purpose each regiment should have a second battalion, to be called the Indian battalion, into which the healthiest men may be drafted. But, above all things, habits must subsequently be carefully attended to, as eating, drinking, and smoking are the chief causes of premature death in India. Addendum, No. 2, pp. 72-76.

Dr. McLELLAN—, considers the marches well regulated; 75lbs. of baggage is carried for each man. P. 88, Q. 1217-1219. Recruits should not be too young, not under 21 or 22; 17 is the best age for cadets. Officers only are allowed sick leave from 15 months to 3 years; the men are only sent home when unfit for service. Thinks the plan of paying officers too highly for the first six months of leave only a bad one, as it tends to drive them back before recovery. It would be better to divide the amount over the whole period, and the furlough should be extended to two years. Privates should be superannuated at 40, warrant officers at 50, and commissioned officers at 60, with a dispensing power in exceptional cases. Pp. 93, 94, Q. 1294-1306.

Dr. COLVIN SMITH—, thinks the men are often drilled too long, exposing them to the sun; an hour and a half in the morning and an hour in the evening five days a week, during favourable weather, in the cold season would suffice for made soldiers. There should be little drilling in hot weather; there is guard mounting besides. Pp. 101, 102, Q. 1468-1477. Fifteen years should be the maximum length of service for men in India, commencing at the age of 21 or 22 (they might still serve at home, the Cape, or Canada). Men are seldom seen above 40. It is the drilling of youths of 17 or 18 on the plains which kills them. They should be drilled in England. P. 105, Q. 1611-1620.

Dr. MACLEAN—, advises greater attention to regularity, reliefs, and marches, so as to give the shortest possible journeys, as the fatigue and exposure greatly predisposes to cholera, insolation, and other diseases. P. 144, Q. 2415-2420.

Colonel GREATHED—, has observed that the men of the Indian European infantry worked better in the sun than the Queen's regiments; has heard as a reason that the recruits were rather older; the men with whom he served were, as a rule, very careful and strictly obeyed orders; there were few exceptions. P. 200, Q. 3076-3081. Can suggest no improvement in the regulations, which should be acted up to with strict attention. The check-roll at night is not often called; the men are on guard 24 hours, and are 13 to 15 nights in bed for one out. There is less fatigue duty than in England, as they have sweepers, cooks, washermen, and water carriers. All other followers were got rid of. P. 207, Q. 3251-3260. Does not think the frequent removal of regiments desirable; it involves much expense to the officers; three years should be the minimum, in which time they

* There were 851 persons of all ages at Warley, on 1st December 1859. The barracks are calculated for 1,500 men; every sanitary precaution being provided, and well furnished lavatories for the men. The establishment is extremely healthy; many men bring disease with them (even small-pox), which explodes a few days after arrival. The hospital has 10 wards for 10 patients each, giving 783 cubic feet space per man. Average per-centage of sick is 6.50, more than half being venereal cases. The mortality is very low, only 2 out of 600 last year very soon after their arrival. No better or healthier men could be found than the men who have embarked during the last two years, nevertheless some were returned from India as unfit. Some of the district surgeons are more particular than others. Before 1857 the usual time for keeping men at the depôt was from four to six months, during which time they were thoroughly drilled; it was then (1859) only six weeks. Every man previous to embarkation is specially examined by the depôt surgeon, and may be kept back or discharged. P. 48, Q. 605-611; see also Addenda, p. 51.

may be cleared from debt. European troops do not domesticate by length of residence. It might be unfair to keep a regiment too long at an unhealthy or unpopular station. A change is an advantage in a military view, as a march is a campaign in India. It would be better that recruits should not commence service in India before they are 23, but youths enlist more readily, and we have not men enough to be able to afford to keep them several years at home. They would not enlist for the service generally, but like to have a choice of a regiment. Has seen recruits quite as healthy as old soldiers. P. 208, Q. 3282-3302. After six or eight years' service a man is not so good as he was. Believes the deterioration mainly arises from a life of inaction; this would be improved by gymnasia.

Dr. BIRD—, is of opinion that marches should be arranged under medical regulations; they should commence before sunrise, so as to arrive by eight o'clock or earlier in the hot season. Men do not sleep in the day after night marches. P. 224, Q. 3584-3588.

Brig.-Gen. RUSSELL—, considers from 19 to 22 the best age for recruits, who should embark so as to arrive in India at the commencement of the cold season, and be sent at once to depôts on the hills for a couple of years, until fully set. This would be far superior to having depôts at home; cheaper, with less sickness and debauchery, and no desertion; they would be finer men and longer efficient. At home, diseases of the heart and lungs are contracted by lads from carrying knapsacks, over drilling, and night duty before being fully developed; 23 is quite early enough for full work. P. 232, Q. 3880 and 3895.

Colonel CAMPBELL—, states that the soldier is much better off in India than at home as far as duty goes, and has nothing to complain of; there is nothing in his ordinary service in the least injurious to health. P. 244, Q. 4148, 4149. There is no advantage in frequent changes of station, but if a regiment has suffered much in a place a removal would relieve the men's minds. A march is not injurious, the 52nd marched three months continuously; the men did not suffer, but the removals should be at less distance; *e.g.* this regiment has recently moved from Sealkote to Jhansi. Recruits might begin duty at 20, the length of service depends entirely on the men; some are better after 20 years' service. Men unfit for India might serve in another climate; he would bring home regiments after seven years, sending out no reliefs in the meantime; but rather taking out 1,500 or 1,200, and bringing home whatever were left. Recruits from depôts are sent out, and over the country at enormous expense, do much mischief, and are useless for a year or two in spite of any previous drill. Condemns the volunteering system entirely as bad; it might be as well to allow those who wished, to volunteer into other regiments, but he would preserve the unity of regiments as much as possible. If 700 came home out of 1,200, they would form a good nucleus. Under this system it would become a point of honour with commanding officers to bring back their regiments as complete and unthinned as possible, and it would be an excellent test as to the effect of the climate and management; the men's interest would remain at home, they would retain an object in life, and there would be fewer married. Men would be more likely to re-enlist if they knew they were coming home, and thus remain in the regiment; 10 years' enlistment is too short, would give a pension after 16 years. Would not allow more married men, nor allow marriage with natives; there is caused great discomfort by being obliged to leave the families behind when a regiment is on service. P. 244, Q. 4167-4208.

Mr. A. GRANT—, considers that 10 years is a fair time for service abroad; would advocate frequent removals from unhealthy stations, but not from healthy ones, on account of the expense; the troops should be grouped in healthy stations, where they may remain several years without injury. P. 264, Q. 4536-4538.

Colonel DURAND—, does not think the service unpopular among soldiers in India. Men are always glad to move, as it breaks the regularity of their lives. Always, when regiments are relieved, many, both officers and men, are inclined to remain in India and exchange into other regiments, especially those who are married. P. 283, Q. 5096-5101. The sanitary arrangements in the field are fully adequate and satisfactory. With regard to exposure of the men, hours of drill, efficiency, &c., much depends on the wisdom of the commanding officer, with whom all internal arrangements rest. Circumstances vary so much that it would be better to leave the responsibility upon the commanders-in-chief and adjutants-general to see that commanding officers do their duty well, than to lay down precise regulations. General officers' inspections are very trying to the men, as they are kept standing a long time in heavy marching order, by which they suffer more than when moving. The object would be better attained by placing the knapsack and kit at the feet of each man. Very great discretion should be exercised as to keeping the men standing. P. 287, Q. 5141-5154.

Sir A. TULLOCH—, considers 18 a good age for recruits, provided they be drilled for two or three years at home, where it can be better done than in India. P. 318, Q. 5555-5557.

VIII.—RECREATION AND EMPLOYMENT WHEN OFF DUTY.

Sir R. MARTIN—, considers that exercises and amusements for the soldier should be more systematically arranged, instead of being dependent on the will of officers. Indoor amusements and trades have been sometimes encouraged, with good moral benefit. The soldier should do for himself whatever he can do without injury to his health or discipline.* P. 3, Q. 71-74; p. 17, Q. 273.

Colonel SWATMAN—, stated that the usual outdoor amusements are provided for the men; also libraries, which are much used, and the schools are well attended. There are gardens at some stations—all vegetables grow well. There are no workshops, which might be introduced with the greatest benefit, as well as preventing idleness and *ennui*; the only difficulty would be in furnishing materials at first. P. 45, Q. 468, 485. Frequent changes of station and regular exercise on the march are very beneficial, but on the ground of expense, thinks once in three years often enough for change of station. P. 47, Q. 539-547. Thinks the men do too little, and that more employment would be advantageous in diminishing crime and courts-martial. P. 47, Q. 580-583.

Mr. A. STEWART—, suggests that tables between the beds, where room, should be allowed for reading and writing, should form part of the barrack furniture. P. 55, Q. 681.

Lieut.-Colonel GALL—, states that the amusements provided for the men are cricket, bowls, fives, dancing, theatricals. In the hot season they are not allowed to go out in the sun. The library and school are much used. There are flower gardens at some stations, which are useful and much liked by the men. Workshops would be very advantageous, but the men do not like to risk buying tools; they should be provided for saddlers, tailors, printers, shoemakers. Thinks the men might make money; the danger is how they might spend it. Men who spent their earnings in drink should be forbidden to work, and the sober men encouraged. Many men in every troop had accounts in savings banks; the habit increases. Shady places

* Colonel Robertson recommends that soldiers in the hills should perform all offices for themselves as in England. The experiment was successfully tried in the Sikkim campaign. Addendum (P. 486.)

EMPLOYMENT
OFF DUTY

are not generally provided for the men. In hot weather they are confined to barracks from 9 a.m. to 5 p.m. and suffer from *ennui*. P. 79, Q. 962-981. Covered five courts, gymnasiums, and workshops for the men should be supplied. It is very important that a regiment on a distant expedition should be furnished with artificers so as to be able to supply their wants. Annual exhibitions might be held as an encouragement to workmen and for sale of articles. Except the library, the soldier has usually no day room. Pp. 80, 81, Q. 1013-1020.

Dr. McLENNAN—, states that, except games in the barrack yard and libraries, there are no means of recreation provided at Bombay. There are gardens at some stations; he suggests that prizes might be given for best productions.* Too much restraint has an injurious tendency. P. 88, Q. 1108-1111.

Dr. COLVIN SMITH—, considers that trees for shade should be planted at all stations; has seen no sheds under which men can take exercise, though they exist at some stations. The men might be allowed to shoot, and encouraged to take more exercise. P. 100, Q. 1398, 1405. There are the usual outdoor games, which are generally connected with drink, but the men have not sufficient amusement mentally or physically; *ennui* and predisposition to disease are the consequences. P. 101, Q. 1459-1463. There should be workshops and gardens, also libraries, which are now very deficient, and reading and smoking rooms attached to coffee shops, &c. P. 102, Q. 1478-1486.

Major-General GOODWYN—, is of opinion that arcaded places under the barracks, for amusements, would be of great advantage to the health and comfort of the men. P. 111, Q. 1780.

Dr. MACLEAN—, thinks not half enough has been done to provide occupation and amusement for the men, who suffer much from *ennui* there is a great difference among officers in attention to such matters. P. 141, Q. 2354, 2355.

Dr. McCOSH—, is of opinion that the soldiers would be greatly benefited by being employed on public works or in trades; their wages being deposited in regimental savings banks until they are discharged, or for their next of kin; there are a thousand ways in which they may be employed with advantage at all seasons in the hills, and four or five months in the plains. P. 152, Q. 2620-2628; p. 154, Q. 2685, 2686.

Mr. JULIUS JEFFREYS—, considers that the men might not only be employed in their respective trades with great advantage, but that any artisan might be allowed to take for his own benefit native youths as apprentices, to teach them useful arts, *e.g.*, ceramic, metallurgic, and chemical, of which the inhabitants of India are so ignorant, commencing with fire bricks, pottery, &c. There are no ploughs in India. To superintend various works, an ensign's commission might be given in each regiment to a young man of science, with liberal allowances, so as to obtain the best talent, which would ensure greater and therefore more economical results. P. 188, Q. 2893-2901.

Sir JOHN LAWRENCE—, thinks that the men should be induced to work if possible, but they do not like working. There is difficulty also in selling their productions, being undersold by the natives; carpentering, shoemaking, and tailoring the natives would do as well at a much less cost; if there were a market, it would be a great inducement. Not one man in a hundred cares about reading. Thinks the mortality might be much reduced, and that *ennui* is one of the causes, also careless exposure. Gardening is not liked, nor any work; amusement is preferred. They would work if paid for it. It would be an apparent loss to pay them, but it would be repaid by better health, and the regiments might in some measure be made self-supporting. Thinks there would be an advantage on the whole in paying the men more. They are reckless and unhappy, yet soldiers who had been in India prefer it to home service. Pp. 191-193, Q. 2937-2962.

Colonel GREATHED—, states that libraries have been beneficial, but hopes to see reading rooms in the barracks, which are much needed. P. 204, Q. 3176. Men who cannot read fluently like to hear others read. The men of the 8th regiment were allowed unbounded liberty to shoot, which they did without suffering from the heat,† but they were not allowed to go in the hottest weather; it was their best amusement, and they were encouraged to go; they had also the usual outdoor games; there were 440 subscribers to the library, and about 260 of them attended school,—for which they also paid a small subscription,—besides recruits, who are taught gratis. It depends on the schoolmaster and commander. Gardens did not succeed, Englishmen do not care for gardens. Scotchmen were induced to take up gardening (having prizes offered them) by Lord F. FitzClarence. Men sometimes work at their trades, and might make a good living by it, but they do not work much, being already well off. Active amusement is preferred to work. There are no gymnasia. It would be a great advantage to have them, and they should be made a parade; it would be the best thing ever introduced into the army. The men should not be confined more than necessary. Large sheds should be provided, under which gymnastics could be practised at any hour. Pp. 205, 206, Q. 3203-3237.

Dr. BIRD—, considers covered places for racket and other exercises should be put up annually, as the rain was approaching. Day rooms would be of the utmost importance for chess, billiards, &c., both as regards comfort and health. P. 215, Q. 3465-3469. The men should be encouraged to work at trades by having tools provided by way of advance, to be paid for from their earnings. P. 219, Q. 3549-3556.

Brigadier-General RUSSELL—, states that skittles is the favourite game; men tire of gymnastics; trades were always encouraged in the 84th Regt., tailors, shoemakers, carpenters, and some others were generally in full work, besides clerks. Half the men were employed at Rangoon in levelling a stockade, and 250 at Jackatalla on new barracks; those employed made money and much improved in health and strength; occupation even out of doors and in the plains is better than a listless life in barracks; the erection of workshops would be a great advantage, but their use much depends on the commanding officer. The 84th had a good library, and a reading room crowded daily from 10 till 4, it was supported by voluntary contributions, and well supplied with newspapers, periodicals, and books from Smith and Elder's sent out quarterly. There was a coffee-room. Glee singing, dancing, and theatricals were encouraged and made lucrative to the performers. P. 229, Q. 3766-3778.

Sir P. CAUTLEY—, had understood from Sir Henry Lawrence that men do not take to gardens, they probably regard gardening as work rather than amusement; there is no difficulty with Scotchmen; the question of amusement depends much on the commanding officer. The provision of workshops for the different trades would be an admirable way of occupying the men; the difficulty would be in procuring tools. Probably these might be furnished by, and remain the property of, Government without being removed from station to station; understands from General Tremeneere that every barrack in the Punjab has a workshop and a

* The Umballa Committee recommend that gardening be made an offset against other regimental duties, and all be obliged to take it in turn. (Appendix, p. 236.) Whilst the want of variety of vegetables is generally acknowledged, there is no point on which the station returns show more universal concurrence than that the men take no interest, personally, in garden work.

† The Thyet Myo Committee consider labour and exposure to the sun in Burmah, not in any degree injurious to Europeans. There should be no restriction in this respect, and workshops for different trades should be organized. (Appendix, p. 567.)

reading room. Employment should be encouraged ; at Landour had found men glad to be employed in building, saddlery, &c.* Pp. 235, 236, Q. 3949-3960.

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Colonel CAMPBELL—, states that a fives court is provided by Government, and there must be a school ; beyond that all means of recreation mainly depend on the commanding officer. The men are fond of newspapers and periodicals and new books. The same books remain too long, which makes them indifferent to the library ; they should be often changed. The 52nd Regt. had cultivated gardens, and provided tools, including turning lathes, printing presses, &c., but the regiment was soon moved and kept changing about, so that no result followed the labour, and the tools were all lost by degrees. If spacious workshops and tools were provided and kept at each station they would answer unexceptionably well, the same building well lighted might be used as an evening reading and refreshment room ; deficiency of light is a universal fault in India, and very much felt during the long nights. The same oil used in American reflecting lamps gave a very good light. The care of tools and workshops should be in the engineers' department. The men should manage their own trades union and appoint their own foremen ; the profits might produce a fund for materials after repaying the Government for the tools. The 52nd printed all their own returns, also papers for the civil authorities at Lucknow, and supplied the 81st with 100 pairs of boots, not otherwise obtainable ; the profits were received by the paymasters and divided according to the work done by each man ; they will not work for nothing. Covered sheds should be provided for each company as a protection from the sun by day. Gardens would be profitable in two years ; the 52nd were never more than nine months at a station ; this was accidental. Pp. 243, 244, Q. 4113-4144.

Mr. A. GRANT—, states that the soldiers often complain of weary idleness. The Government might give them contracts for supplying shoes, clothing, harness, beer, &c. Tools should be supplied and gardens provided. P. 261, Q. 4470, 4471.

Colonel DURAND—, considers that men dislike work only when it appears to them to be of no utility, and that those who volunteered might, when not required in the field, be usefully employed wherever there are magazines, which employment would increase their intelligence. They might also be employed in building, but it can only be on work which will bear interruption for field duties. They would be paid for their labour. The establishment of station gardens might be tried, growing crops being handed over by purchase to incoming regiments. P. 284, Q. 5102-5121. The use of gymnastics would prevent much of the falling in of the chest, which is often noticed amongst infantry after long service in India. P. 288, Q. 5173-5177.

Sir C. TREVELYAN—, had proposed the building of a lofty iron shed, like a railway station, at Madras, under which there might be school-rooms, library, reading room, tennis court, and other accommodation for amusements calculated to diminish the depression caused by the monotony of barrack life.† P. 291, Q. 5243. Would recommend such a building at all stations, as the men cannot walk out during the day ; as compared with the object, the expense would be insignificant. P. 291, Q. 5247-5254.

Dr. SUTHERLAND—, describes the reports from India as indicating great deficiency in the means of recreation instruction, exercise, and occupation, the only resource being idleness or vicious indulgence. P. 313, Q. 5494.

Sir A. TULLOCH—, considers the troops would be healthier if they were more employed in public works and fortifications. Workshops of light bamboo might easily be constructed in India, and gardens provided at each station, from which vegetables might be sold to the messes. P. 317, Q. 5551-5554. It would be a great advantage to the army were recruits required to learn to read and write before being discharged from drill. It is an evil that the soldier is not sufficiently trained to fatigue ; there might be less drill and more work of a remunerative kind. P. 318, Q. 5557-5561. In the plains of India the men cannot, owing to the heat, take the exercise necessary to preserve health. P. 324, Q. 5637.

Dr. MOUTAT—, states that the native troops are fond of gymnastic and athletic exercises. P. 332, Q. 5741-5742.

Serjeant-Major WALKER—, considers it would be an excellent plan to give the men the means of working at different trades, as at Aldershott, where they take a pleasure in doing carpenters' and masons' work, &c. Nothing tends so much in India to keep the soldier in health as to keep his mind employed. There are no separate grounds for games, which would be a very good thing. Gardens were attended to by several men who were gardeners, they being let off other duties. This was a great advantage, as good vegetables are the best things in India, but the gardens should be much larger. Sufficient gardeners would always be found, if relieved from other duties, and a few natives could do anything necessary in the middle of the day, and when the regiment moved an allowance would be made. The giving of premiums and public praise for the best gardens would be a great encouragement. P. 343, Q. 6041-6066.

Lieut.-Col. OUCHTERLONY—, proposes that oil gas should be used for lighting barracks made at each station from the common oil of the country and kitchen refuse, by which much better light would be obtained at less cost than is now incurred for lamps, which do not enable the men either to work or read with comfort.‡ P. 482.

IX.—DISEASE AND MORTALITY.

Sir R. MARTIN—, has seen great invasions of cholera and fever and dysentery, which are always most found in the worst stations as regards drainage, malaria, climate, bad ventilation, overcrowding, and filth. The correction of these evils would be the best preventive. Intemperance also is a cause, the prevalence of which in a regiment much depends on the character of the commander. Liver disease, liability to which increases with age, prevails almost everywhere and is often associated with dysentery, is much influenced by the circumstances enumerated, and personal hygiene. There is much rheumatism caused by sudden alternations of temperature, against which warm clothing is the safeguard. There is also mercurial rheumatism produced by cold while under the influence of mercury. Syphilis prevails to an enormous extent§ (for which mercurial treatment is most detrimental, but it is still often resorted to. Q. 163, 164.) Police regulations are uncertain and various. Locks have been frequently established and again abolished. Scurvy has

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* See Addenda, pp. 238, 239, Letters from old non-commissioned officers stating that employment in trades would be the greatest boon to the soldier.

† The Kirkee Committee recommend singlestick as combining dragoon efficiency with amusement. (Appendix, p. 753.)

‡ The Kirkee Committee notice the want of sufficient light in barracks at night. (Appendix, p. 749.)

§ Dr. Macpherson points out the alarming extent of syphilitic disease. Addendum 12, par. 3, p. 34. On the last-mentioned subject strongly recommends legislative enactment, authorizing system of licence and control in cantonments and sea-port towns, to be administered by commandant, senior medical officer, and senior magistrate of the district ; that individuals, and houses open to inspection, should be licensed and registered ; and Locks established. Such an experiment was made at Secunderabad in 1855, with almost magical success. Addendum 13, p. 34. See also results, p. 487.

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been seen in some high stations owing to defective diet and to climate, and guinea-worm prevails in Bombay; this is often referred to impure water. Pp. 4 and 5, Q. 94-128. Fever is by much the most prevalent disease, next bowel complaints and dysentery, after that affections of the liver and cholera. P. 8, Q. 213 and paper appended. The mortality among the British troops varies from 30 to 70 per 1,000. P. 16, Q. 267-269. The money loss during 30 years may be moderately computed at 10,000,000*l.* sterling.* The theory that acclimation renders men less liable to disease has been clearly disproved.

Colonel SWATMAN—, stated that the men suffer extensively from syphilis. Could not see how this was to be prevented unless by the re-establishment of locks, which he thought were discontinued as a measure of economy. P. 46, Q. 532-538.

Dr. DUNCAN STEWART—, does not think that acclimation confers any immunity from tropical disease. P. 50, Q. 615.

Mr. A. STEWART—, says separate hospitals for native followers are required; and Locks are much called for. These cases sometimes amount to one half those in hospital. P. 58, Q. 728.

Dr. McLENNAN—, had seen cholera prevailing among Hindoo soldiers and their families, whilst Mussulmans in the same battalion and lines entirely escaped attack. This was attributed to bad fish, from which the latter abstained. Had heard of several instances of epidemics attributed to the vicinity of nuisances, and one at Hyderabad from the use of stagnant water. Intemperance, night exposure, heat, cold, and moisture are predisposing causes. Cholera is most prevalent among Europeans in hot weather; among natives in cold. Diarrhœa and dysentery also are most prevalent at Bombay in the cold season, but generally in the hottest and wettest months. Dysentery often follows fever and is then most fatal. Sanitary measures of precaution and removal are usually resorted to on any epidemic outbreak; these are embodied in the regulations. Liver disease is very prevalent among European troops, also children and ladies; the natives also suffer more than is generally supposed from liver disorders. Should expect more from abstinence from liquor and avoidance of rich, stimulant, or full diet than from any other change. Rheumatism does not prevail much apart from maladministration of mercury for syphilis. Has seen scurvy from bad diet and exposure on the voyage out. It sometimes occurs among the natives from similar causes. Cause of guinea-worm remains in obscurity; probably introduced from without while bathing or walking in marshy ground. Is of opinion that climatic influence, intemperance, and sexual disease (from which latter a full fifth of the cases in the Bombay hospitals suffer) are the three chief evils affecting the health and life of the soldier in India (Pp. 89, 90, Q. 1221-1231). Thinks there is a gradual adaptation to the change of climate, but the man one year out is better able to bear exposure than those 10 years in the country. P. 93, Q. 1291-1293.

Dr. COLVIN SMITH—, states that the suppression of grog shops and the establishment of a Lock hospital at Secunderabad immensely improved the health of the troops in 1856. P. 99, Q. 1356. The native troops quartered close to a tank four miles long suffered much from fever, and guinea-worm produced by the water. Q. 1363. Had witnessed epidemic cholera in the Madras Rifles on the march, arising from fatigue and bad water, which ceased on the first rain. At Promé also, which is filthy, crowded, and surrounded with swamps in the wet season, had seen cholera among the native population. Considers intemperance, syphilis, and malaria the three chief causes of disease in India, all of which may be much diminished. Locks should be re-established, with good police. Had charge of a Lock at Hyderabad; and the commander of a European regiment observed, "Your hospital has diminished mine by at least one-third since its establishment."† Thinks Locks were discontinued from false modesty, but has heard that there was an abuse of police authority which induced the Government, on the report of the Inspector-General of Bengal, to abolish these hospitals. Little could be done without the police; Pp. 102, 103, Q. 1502-1537. Men suffer from fever and inflammatory diseases for first few years, afterwards from chronic affections. Does not think they become acclimatized. P. 105, Q. 1607-1609. Has seen erysipelas, but not gangrene in hospitals. Q. 1599-1601.

Major-General COTTON—, states that there is always more danger from cholera on the march than at stations. Has been much puzzled to find a reason for the outbreaks. Had found "Warburg's fever drops" invaluable. This medicine ought to be in every hospital and camp. Has known bad fever cured by it in a few hours. P. 129, Q. 2114-2123.

Mr. LONGMORE—, gives the mortality at Dumdum‡ from dysentery, fever, and cholera in five months during the mutiny at the rate of $27\frac{1}{2}$ per cent. per annum among women, and $51\frac{1}{2}$ among children. Pp. 131, 132, Q. 2172-2180. The latrines, &c. were very offensive. Q. 2219.

Dr. MACLEAN—, mentions that Secunderabad was remarkably exempt from cholera during 18 months that it prevailed at Hyderabad; it has since been more crowded, and the epidemic last year was severe. P. 139, Q. 2315. A malignant form of dysentery prevailed there. Q. 2339. The chief mortality in all stations is from dysentery, cholera, liver complaints, and fevers. Q. 2350-2352. The recent sanitary measures adopted by Sir C. Trevelyan at Fort George, Madras, resulted in no case of cholera having occurred among the troops in the fort during a severe epidemic in the town. Q. 2353. The enormous amount of syphilis and consequent loss of efficiency is becoming quite a state question. The ratio of cases to be treated is about 27 per cent.

* See Suggestions, p. 18; and Dr. Balfour's Observations, p. 20. See also Notes on Military Hygiene, by W. J. Van Someren, Madras Army. Epidemic disease is produced by a certain general condition of the body (*e.g.*, induced by bad air and water, nuisances, &c.) plus the specific poison of a particular disease. Instances several well known proofs in England, and points out the prevalence of epidemics at the Indian stations of Kurrachee (where the Rifles lost 76 per 1,000 in one epidemic in 1846); Bellary, Secunderabad, Vellore, Colaba, (the slaughter-house of more thousands of British troops than are destined to win fifty battles,) all mainly arising from overcrowding, bad drainage, and other local conditions. Produces proofs of injurious effects of over-fatigue in India; also intemperance. Gives a formula for production of disease, similar to the celebrated one by Dr. Bone for production of yellow fever in the West Indies. Addendum 10, p. 28. See further remarks on the Hill Fevers of Southern India, by Dr. Heyne. Fever is totally unknown on hills formed of quartz, felspar, and *real* horn-blende; on iron granite it is virulent. This he ascribes to magnetic or electric fluid disengaged in great quantity in the hot season. Recommends avoidance of hills as residence where magnetic irons and is found, or within two miles of such. Addendum 14, p. 35.

† Dr. Macpherson observes, that 688 men of the home force are always in hospital from syphilitic disease alone, and that the money lost to the State is calculated at about 14,500*l.* per annum. (Appendix p. 649.) The officers of the medical service are almost unanimous in recommending the establishment of locks. Dr. Grierson, however (Kurrachee), argues strongly against them on moral grounds, insisting on the expulsion of prostitutes as the proper remedy. (Appendix, p. 821.) Mr. Hare remarks that prostitutes in India are purchased and educated for the trade, and it is only necessary to punish those who profit by the women's earnings, to prevent the spread of disease. (Appendix, p. 183-4.) The Umballa Committee are of opinion that locks might be aided by allowing the prostitutes to select one of their own number as their head; let her be well paid and made responsible that no diseased woman goes undetected. (Appendix, p. 235.) The Chunar Committee (Mr. Tweddell) recommend that the prostitutes, who are a distinct class in India and do not disguise their vocation, should be registered and numbered; and suggests that a small establishment consisting of a native doctor and two or three women, under the superintendence of the sanitary officer and magistrate, would be more suitable to native ideas than a regular lock hospital, and prove more effectual in reducing the amount of disease. (Appendix, p. 90.)

‡ See report of this outbreak, Addendum, note, p. 134.

Locks, with the aid of the magistrates and proper supervision, would answer well. The native people are very obedient to authority. P. 143, Q. 2393-2406. Strongly recommends the introduction of an ambulance system for sick and wounded in India as a measure of economy as well as of relief. P. 145, Q. 2420.

Dr. M'COSH—, states that the debility produced by heat increases with the time of exposure. New comers generally do not feel the heat so much as old Indians. There is an absence of epidemics, cholera, small-pox, and fevers, &c. on the hills; but there is a disposition to diarrhoea, usually not dangerous, often beneficial, though in severe cases liable to run on to dysentery. Men going to the hills in a scorbutic state have suffered considerably from diarrhoea.* Scurvy prevails in Upper India from want of vegetables. Ascribes this hill diarrhoea—1, to reduced pressure of the atmosphere on the bowels; 2, the secretion of bile (the liver being affected) is lessened; 3, reduced perspiration induces extra internal secretion. The natives suffer largely from a disease called mahamurri, referred to their dirty habits. Pp. 148, 149, Q. 2512-2562. *Ennu* is the greatest evil the medical officer has to struggle with. The men rushing with indifference to their graves; he trying to prevent them. P. 152, Q. 2612. Men are never so healthy as when undergoing the fatigues of a long march. P. 154, Q. 2686.

Mr. JULIUS JEFFREYS—, estimates as very great the mortality arising from solar radiation (apoplexy) in India; believes that in particular instances it has amounted to 50 per cent. P. 186, Q. 2875-2886.

Colonel GREATHED—, states that the disease and mortality in the 8th regiment was small at first, and continued so during 15 years. They never had cholera except at Delhi. In the hottest station, Deesa, the mortality during three years was remarkably small. The men were accustomed to take active exercise. A man would walk 14 miles from the barrack, shooting, and be back at night; the well-conducted men always having unbounded liberty. P. 204, Q. 3201-3205. Does not believe in acclimatizing. After six or eight years' service a man is not so good as he was; but the deterioration mainly arises from a life of inaction. This would be improved by gymnasia. P. 209, Q. 3303-3308. Locks should be re-established; but it is a moot question with reference to the tyranny sure to be exercised by the police. Thinks the men are chiefly injured by the climate; yet it is not mere temperature. Pp. 209, 210, Q. 3316-3341.

Dr. BIRD—, states that in Bombay diarrhoea and cholera are the prevailing diseases in May and June; dysentery, gastro-enteric cases, with bronchitis, in June and July; and rheumatism, gastro-hepatic disease, and abscess, in August; and fevers from September to November. The ratio of mortality was from 40 to 55 per 1,000 (1847-1857); whilst at Poona and Kirkee it did not exceed 10 per 1,000, exclusive of reliefs from the low districts. At Belgaum it was 19. Pp. 213, 214, Q. 3418-3420. Does not consider the present army medical statistics of any value. They should be reconstructed and combined with meteorological and medical observations by intelligent medical officers. Conclusions as to healthiness of station can only be formed after residence of six or eight years. It would be better to trace the history of each regiment throughout. P. 216, Q. 3486-3506. Ascribes frequency of solar apoplexy to sudden exposure to the sun, often aggravated by spirits on the march. P. 220, Q. 3574-3583. Cholera is induced by miasmata, heat aided by bad sanitary conditions, improper food, vice, &c. Liver disease at Belgaum was chiefly caused by alternations of temperature; also rheumatism. Woollen clothing, bathing, and temperance are the best preventives. Scurvy is a blood disease analogous to rheumatism, arising from deficient nourishment and damp. Guinea-worm, produced by bad water, may be prevented by the use of filters. P. 220, Q. 3589-3596. Considers that the Europeans can be acclimated, so far as temperature, dryness, or humidity is concerned; but the human system, though it may resist, cannot become habituated to local endemic miasmata; the latter are removable by hygienic measures. It is as bad to transfer men too suddenly from a tropical to a temperate climate as the reverse. Such changes are better borne in youth than in mature age. Pp. 223-225, B. 3650-3672.

Brigadier-General RUSSELL—, states that at Moulmein the men just landed from England suffered a good deal from dysentery, which was attributed to fresh pork and intemperance. P. 226, Q. 3691. Cholera at Fort George was attributed to an open drain close to the barrack-rooms. Q. 3700. Frequent removals to and from the hills would be regarded with some dread, as a regiment seldom moves in Madras without an attack of cholera, generally attributed to bad water and over-fatigue. At Trichinopoly his regiment escaped, owing to precautionary measures taken whilst cholera raged in the bazaar and artillery barracks. P. 230, Q. 3795-3800. In calculating the mortality at stations, deaths among invalids who often die *en route* ought to be included;—not being so, the mortality attributable to the station is generally understated. Accidents, however, are included, which are sometimes numerous. Mere heat, if equable, does not produce excessive mortality. In Rangoon, sickness was caused by insufficient food,—meat, fruit, and vegetables,—the country did not produce them. P. 232, Q. 3851-3860.

Sir P. CAUTLEY—, considers valuable a suggestion of Mr. Acton's,† that as a means of purification from syphilis, jets of water from cisterns, provided for the purpose, should be constantly running in all the barrack urinals, by which means local ablution could be frequently resorted to. P. 238, Q. 4010.

Colonel CAMPBELL—, has no complaint to make of vices among the soldiers in India. Syphilis is not common, not so much as at home. There is great power to check it. The native women frequenting the bazaars are known; a list is kept by the bazaar-master, and if three or four men were found going in hospital, these women would be all examined by the surgeon, and those infected either cured or sent off. It is very easily done; not at such a place as Calcutta perhaps, but at the stations generally. It is completely in the hands of the commanding officer. The sick are usually attended by the native servants, who are very good nurses. The conduct of the natives depends much on the way they are treated themselves. Has known a regiment entirely deserted by them. Considerable mortality took place among the 52nd regiment at Subathoo, caused by a four days' march to escape from barracks in a shaky state at Umballa, in the rainy season. The men were ankle deep, and the regiment lost 12 or 13 a month from fever and ague, for three or four months afterwards. P. 246, Q. 4212-4241.

Mr. ELLIOT—, recommends a scientific commission to investigate the circumstances under which malaria is generated, in order that better precautions against fever could be taken, *e.g.* in the selection of halting-places or sites for stations. An elevation of less than 5,000 feet can hardly be considered safe. Fever prevails chiefly at the foot of the hills. Thinks malaria is sometimes carried up ravines by the wind, so as to affect places in themselves free from it. Geological formation is thought to have an influence. Clearing the jungle appears to have been beneficial at Segoor. Any district once cultivated, and afterwards deserted, appears to be unhealthy, and to improve by being again brought under cultivation. The neighbourhood of rivers seems

* The Roorkee Committee believe that the hill diarrhoea is caused by water loaded with rotten vegetable matter. Mr. Hare has often prevented patients from drinking any but rain water collected in a tub, by stretching a sheet on four poles, and always with the result of stopping the diarrhoea. (Appendix, p. 183).

† See Mr. Acton's observations recommending compulsory ablution and regimental locks, p. 489.

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unfavourable. The wearing of gauze, muslin, or cotton appears to be a protection, as proved by Colonel Blake, in the deadly jungles of Rampa. Places long free from malaria may be suddenly deluged by it. Pp. 247-251, Q. 4242-4288.

Mr. MONTGOMERY MARTIN—, mentions decaying granite as producing malaria, *e.g.* at Hong Kong. Referring to Dr. Heyne, on the same subject, has understood that the limestone formation on the Indus has been productive of fever. P. 252, Q. 4291-4295. The Terrai, along the lower Himalayas, is covered with dank vegetation and forests, yielding at all times a pestiferous gas. There is no great unhealthiness in Tanjore from irrigation and rice cultivation. The fogs in Lower Bengal are noxious, to avoid which the mouth is often protected by muslin. They prevail near the ground, so that it is important that buildings should be well raised, as the upper stories are comparatively out of the fog. At Badulla and other places people may sleep on the ground without injury. Pp. 257, 258, Q. 4380-4406.

Mr. A. GRANT—, states that various sanitary improvements had reduced the mortality in the 12 years prior to 1854, 20 in 100, as compared with previous returns; but that in the sultry and malarious plains the mortality must always be high. P. 260, Q. 4454-4456. At Fort William the mortality is now 69 in 1,000. Cawnpore is bad, and Allahabad worse. The strong men only should remain in the plains. P. 261, Q. 4464-4466. Five-sixths of the mortality arises from abdominal affections, induced by high moist temperature, intemperance, bad food, malaria, overcrowding. P. 262, Q. 4474-4483. The filthy state of ravines, insufficient ventilation, &c., at hill stations, were the causes of diarrhoea, &c.; not cold or damp. P. 262, Q. 4484-4497. Thinks the mortality in India, now upwards of six per cent., might be reduced to four per cent. by proper sanitary arrangements at the present stations; and to two per cent., if only stationed in good barracks, at such places as Rawul Pindi, Sealkote, Jullundur, Meerut, Agra, Hazareebaugh, Bangalore, Poona, and Belgaum, with depôts and reserves on the hills. P. 264, Q. 4539-4556.

Dr. SUTHERLAND—, considers that the zymotic diseases of India are the same as arise in England from want of drainage and ventilation, decaying animal and vegetable matter, bad water, and intemperance; the atmospheric conditions appear to call these causes of disease into greater activity. The ample ration, with very limited exercise, is beyond doubt a cause of disease, and habitual tippling is more destructive to health in such a climate than occasional drunkenness.* P. 313, Q. 5494. The mortality may be greatly reduced even in the plains, in which every sanitary precaution should be carried out. P. 316, Q. 5526-5529.

Dr. FARR—, suggests that the system of recording and analyzing the diseases of the army in England should be extended to India, which would show the mortality in each regiment year by year, and thus test the salubrity of the different stations. P. 316, Q. 5532, 5533.

Sir A. TULLOCH—, states that the statistics of mortality in the army show a considerable excess in warm as compared with temperate climates; but this ratio has been much reduced in the West Indies by sanitary improvement. P. 317, Q. 5534-5543. Doubts whether syphilis, though it undermines the health of the soldier to a considerable extent, is much more common among the military than civilians; the ordinary proportion is about 120 cases per 1,000 men annually. The average mortality in India from 1817 to 1855 was 70 per 1,000 from all causes, including casualties in war. Since the mutiny, the ratio has been about half this mortality. Upon a strength of 70,000 men, the annual loss would be 4,200, which might probably be reduced to 1,400. The mortality among officers of the same average age as the men is about 25, and among civilians 20 per 1,000. The mortality among the troops need not exceed 20 per 1,000 if placed in healthy stations and other favourable circumstances. P. 318, Q. 5562-5596. Fever, dysentery, diarrhoea, and liver disease are the most fatal in tropical climates; syphilis also, which acts more indirectly by reducing the general health, and much increases the amount of invaliding. It has been proved in the West Indies especially that it was erroneous to suppose that men suffered greatly from want of acclimation. P. 324, Q. 5621-5642.

Dr. MOUAT—, states that the natives are liable to frightful outbreaks of cholera, fever, and dysentery. Has known 900 out of 1,000 men in hospital. Up country sepoy soldiers invariably become sick in the lower provinces. P. 331, Q. 5722-5723. The mortality among them is much higher than is apparent from the returns, as men if sick apply for leave, and die at home, when they are not included in the mortality register. The sepoy generally improves much at first after joining the service. Rheumatism, the sequelæ of fevers, and dysentery are the chief causes of invaliding. Among the Sikhs and Mahomedans there is much syphilis; the mortality would be double what appears in the returns, but that would be much under Europeans, as, being in their native climate, and more sober, they suffer less from injuries; inflammation runs a very mild course with them. The Hindoo buys no meat, the Mahomedans, Mughls, and Burmese do. Many of the natives are in capital physical condition. P. 332, Q. 5743-5775. In the prisons, the mortality is high, probably 12 per cent. last year. In damp malarious districts the village population is very unhealthy; but in the elevated districts there is a very fine population. They deteriorate exceedingly from change of climate. P. 333, Q. 5790-5800.

Dr. WALLICH—, states that the mortality among native troops greatly varies. Dysentery, fever, cholera, and rheumatism are the chief diseases. In some of the stations there is much syphilis, men are often sent away when past cure. There is no control over their diet or over their huts, so that there is no power of preventing disease. The men would not object to such proper supervision, if it were made a condition of their employment. Few of them drink. The worst evils are impure water, bad drainage, and ventilation. Would recommend weekly inspection, and the use of prophylactics and gentle medical treatment without sending them into hospital or taking them from duty. They should be encouraged to apply to the medical officer for this purpose, when slightly affected or out of sorts. P. 336, Q. 5861-5922.

Serjeant-Major WALKER—, states that more men are invalided and killed by syphilis than any other disease except fever. It might be diminished by vigilant superintendence of the women by native doctors in native hospitals; those diseased being sent away. The orders of Government are good and well intentioned, but not properly carried out by subordinates. Considers much disease is caused by bad drainage in barracks, and filth in the neighbouring towns, *e.g.* cholera, fever, dysentery;—but the men prefer India to other stations after experience of the service. Fresh troops stand the climate better than old soldiers, but the latter cannot bear the cold in England. P. 345, Q. 6089-6128. The sick are attended by natives and regimental orderlies; there is no ground of complaint. P. 346, Q. 6141-6145.

Mr. JULIUS JEFFREYS—, urges the use of the respirator for weak persons going to the hills. He further recommends the use of external compression of the limbs in cholera; also the use of aromatic oil applied to the skin as a protection during epidemics. P. 499.

* The Rawul Pindi Committee consider that to prevent hepatic disease, soldiers should not be allowed to consume so much animal food in hot climates. (Appendix, p. 256.) The Ahmednuggur Committee condemn health parades as needless and obnoxious. For neglect of immediate application men should have "with delay" marked against their names in the report book, and be obliged to make good all duties missed while in hospital. (Appendix, p. 840.)

Dr. DEMPSTER—, considers that troops are most liable to disease during the first two years in India, *e.g.*, dysentery, hepatitis, remittent fever, and sunstroke. They are afterwards less obnoxious to these diseases. Cholera is exceptional; no rule can apply. A detachment of 300 men landed in the cold season in 1853, and marched straight to Meerut; all had a slight attack of fever in the ensuing hot season, but none died. It is an advantage to recruits to join old Indian soldiers who understand precautions. After 10 years' residence the constitution deteriorates and becomes liable to chronic liver disease, &c. among the men, though the officer will then be at his best. P. 475. Points out the necessity of frequent examinations both of women and men to guard against syphilitic disease, also the enforcement of frequent ablution on the part of the latter, especially after contact. P. 467.

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Dr. EATWELL—, observes that in the absence of a correct census there is great difficulty in estimating the mortality among the natives of India. The only means are the records of the places of interment. Dispensaries, native, and gaol hospital returns may furnish a tolerably correct idea as to the prevalent diseases. Also returns of native regiments, though these have often serious sources of error, recruits being frequently predisposed to disease. P. 480.

X.—MORAL CONDITION OF THE SOLDIER.

Lieut.-Colonel GALL—, states that the soldier cannot marry without consent of his commanding officer, or if he does his wife will not receive the usual allowance of five rupees a month. About 12 per cent. of married men are allowed to live in barracks. There are not many marriages without leave. Native women receive half the allowance given to Europeans. They require fewer comforts indispensable to Europeans. Some of them are well conducted. They seldom leave the country. Generally the man would volunteer into another regiment on his own leaving for England. P. 80, Q. 1001-1012.

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Dr. MACLEAN—, considers that if marriage were encouraged among the soldiers, and they were located on the hills, they would be much better, healthier, and happier in every way than they are now. They would require assistance from the Government, and it is a financial question of considerable importance. P. 144. Q. 2407-2414.

Dr. McCOSH—, states that artillerymen are generally better selected, and they are more careful, steady, studious, and active than soldiers of the line; they look forward to promotion, and they suffer much less from ill-health in consequence of their better habits. Pp. 150, 151, Q. 2567-2581. Good results might follow from instructing the men, especially recruits, as to care of their health; a short manual should be placed in their hands. The soldier should have more inducement to live. Having no motive for the future they regard life very little. They should have the means of living when discharged. They should be employed in public offices and works, &c. The average pension of 29,000 men is 8½*d.* a day. The soldier should have light employment or a better pension insured to him, as after 10 or 20 years in India he returns a broken-down man. Pp. 151, 152, Q. 2597-2620; p. 154, Q. 2684-2686.

Sir JOHN LAWRENCE—, believes the more inducements held out to the men the more likely they are to behave well; he would, therefore, advocate increased pensions. P. 192, Q. 2958-2959. Moral influences should be brought to bear on the soldier to induce him to look more to the future. Marriage should be allowed, which makes them more steady, careful, and manageable. Their pay should be increased to help them. The wives keep them straight. The soldier's wife also should be taken care of and allowed to go with the regiment. The desertion of his wife demoralizes the man. The women should be carefully looked after in cantonments, by a picked officer, when the men are in the field. Widows also should be taken care of, the want of such care shortly forces them into unsuitable marriages or worse. Tickets may be left with the paymaster to secure remittances to families. The men should be made as contented as possible, which would make a great difference in their feelings and fidelity. The practice of abandoning the wives when a regiment goes on service produces terrible results. Pp. 199, 200, Q. 3063-3070.

Col. GREATHED—, states that the moral tone of the men in India is much higher than it is in England. There are no pothouses there. Though there may be much vice, yet the native bazaars do not afford them society in which they live. P. 200, Q. 3082-3084. Has frequently known a fortnight to elapse without one man out of 1,000 (the 8th regiment) being confined for drunkenness. P. 203, Q. 3160. The unbounded liberty given to the good men was never abused; it was quite a point of honour with them to behave well, and there were never any disputes between them and the natives. P. 205, Q. 3208, 3209. It would be a great advantage to have more married men, say 25 per cent., they are more free from crime. If the women were better cared for when the men take the field, much might be done to remedy the present evil; but not unless better arrangements be made for the maintenance of the wives. There is a difficulty when the regiment comes home, for the married men do not volunteer in the same proportion as the unmarried, though admitting they are better off than in England. It arises probably from the loss of their children.

Brig.-Gen. RUSSELL—, considers that the married men quartered in separate huts are better behaved, respectable, and contented. They are more healthy. Would allow 25 per cent. to marry, but the number would seldom be kept up. A man should have at least 50 rupees to start with. The drain on the canteen fund is heavy for the families when the regiment is away on service. It happened more than once that married men, from regiments ordered home volunteered into the 84th regiment, which happened to be stationed near, because of the small expense of moving their things. P. 228, Q. 3748-3765. The soldier should be treated with consideration that he may imbibe self-respect and control. Men are very much what they know your opinion of them to be. P. 230, Q. 3789.

Colonel CAMPBELL—, considers there is a general improvement in the conduct of the soldier of late years, produced by improved discipline, the good conduct warrant, amusements, and encouragement in many ways. P. 243, Q. 4109-4112. The conduct of the 52nd regiment in India was admirable. Q. 4103. Has no complaint to make at all about the vices of the soldier; it would be impossible to get 1,000 men to behave better. P. 246, Q. 4212.

Colonel DURAND—, is of opinion that a larger number of men might be allowed to marry, which makes them healthier and happier; but there are great difficulties in regard to the care of the women, and to the service regulations elsewhere. P. 286, Q. 5137-5140.

Sir C. TREVELYAN—, considers that motives for improving their condition in life should be offered to the soldiers to induce them to exertion, such as the prospect of employment in the police and public works, commissariat, ordnance, and other departments; we should thus improve our administrative system, lighten the mass of the population, benefit the men, and so raise the character of the service as to encourage recruiting. This would encourage a kind of colonization eminently applicable to India. With these views, he had established stipendiary studentships for soldiers at the Civil Engineering College at Madras. Men recommended for good conduct, and having some elementary attainments, were allowed to compete for these, but the number of

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applicants was so great that a preliminary regimental examination was found necessary to decide upon the candidates; and thus 20 picked men were collected for the administrative service. This system might be extended, the men being separated from the army at the end of a fixed probationary period. Such inducements being held out would not only tend to keep the men out of mischief, but to prevent the *ennui* from which their health suffers more than from actual disease. P. 299, Q. 5357-5361.

Sir A. TULLOCH—, is of opinion that in unhealthy stations the spirits of the men break down, and they are often driven to dissipation in consequence. P. 324, Q. 5635.

Dr. MOUAT—, describes the bond of caste among the Hindoos as much loosened; high-caste men will often perform the most menial duties for European officers who treat them kindly. Much of their time is spent in idleness. There is generally little to complain of on the score of temperance among the sepoys, but the Sikhs are fond of drink. P. 331, Q. 5734-5740. Does not think it possible to improve the condition of the sepoy; and they have every advantage and indulgence. They become much attached to those officers who treat them kindly. P. 334, Q. 5806-5811.

Serjeant-Major WALKER—, states that it is difficult to get women fit for soldiers' wives. The married men are much more comfortable in India, and far better off with detached quarters. If the wife be careful he may save money. When on active service the women are left at the depôt. The married men are steadier, not so often in hospital, and less liable to many diseases, and more contented than the single men. If on the hills, more men might be allowed to marry, but on the plains the children dwindle away. P. 344, Q. 6067-6087.

XI.—STATIONS ON THE HILLS.

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Sir R. MARTIN—, considers that altogether heat, with malaria, constitutes the most powerful source of disease in India. Proper sanitary arrangements would effect much improvement, but the periodical removal to mountain stations is also of great importance—a State necessity.* These should not be on the front spurs, which are always wet, but some 40 miles to the rear, where it is comparatively dry—e.g., at Chenee as compared with Simla, where this has been overlooked. In Sylhet and Assam the same oversight has occurred. Believes there are table lands to be found having pasturage, water, shade, and means of cultivation suitable even for cavalry and artillery. The present hill stations are often too high as well as too wet, and injury has often been caused by sudden removal from a dry heat, to cold and damp. The mountain ranges should be used as preservative of health; they are not curative. If troops on arrival were sent to the hills they would be maintained in health and vigour, descending annually to the plains in the cold season for military exercises, and whenever the state of the country required their presence; but no man should stay longer than 12 months at one time in the plains. Of British children residing in the plains of India one in five only survive the fifth year, while in the mountains they thrive as at home. The theory that acclimation renders men less liable to disease has been clearly disproved. Hill stations could be better protected by medical police against intemperance, syphilitic diseases, &c. Pp. 5, 6, Q. 129-163. Thinks that in cantonments in the hills the same immunity from disease might be experienced as in the mountains of Jamaica. P. 8, Q. 201. Sick-leave would also be greatly avoided, and much cost of buildings for treatment of disease saved. Q. 211, 212. (See also Notes on Mountain Climates, p. 11.) The best elevation has yet to be determined; the lower ranges, of from 2,000 to 4,000 feet, have been hitherto neglected. Refers to recently discovered table-land at 3,000 feet near Calcutta. 2,500 feet would probably be above the fever range.† Solitary mountains are preferable when they can be found, as Aboo; and by so placing our troops the idea of Hyder Ali, of keeping our Europeans in cages, ready to let slip, would be realized. It is the general native belief, according to Sir Mark Cubbon, that until these heights are occupied our possession of the country is insecure. Believes such elevated stations may be found in every province, but none such should be permanently occupied until tested first by natives and then by Europeans in huts. Drill may also be advantageously carried on at such high stations. The subject of sites and elevation has to be investigated *ab initio*. Pp. 15, 16, Q. 241-270.

Colonel SWATMAN—, believed that the hill stations at present existing are very confined, so that the men do not appear to enjoy themselves. P. 46, Q. 502-510. Considered acclimation beneficial as a preparation for future service, but many men are lost in the process. Officers are more careful, and occupy better quarters; they have also furloughs of two years after ten years service, they therefore suffer less than the men. If there were space enough and occupation at the hill stations it would be very advantageous to station the men there. Was not aware of any plan having been adopted for investigating the mountain climates. P. 47, Q. 550-572.

* Inspector-general Pearse considers the intermediate climate of Bangalore more suitable for newly arrived Europeans than any hill station, and would recommend the establishment of a large depôt there accordingly. (Appendix, p. 609.) Believes the location of Europeans on the hills (independent of the army) would be productive of the happiest results on the native mind, and afford the means of recruiting. (Id. P. 615.)

† See Dr. McLelland's paper, p. 17; also Suggestions, p. 19, pars. 11-18, and p. 20; and Observations on Myrung, p. 23.

Dr. Brodric, Assistant-Surgeon, Madras Army, reports that Goonah in Malwah on the trunk-road, about half way between Indore and Gwalior, on elevated table-land, latento formation, more than 2,000 feet above the sea, has been remarkably free from cholera, and troops stationed there have enjoyed excellent health. The rains are not very copious; the heat never extreme; hot winds unfrequent, and with little dust. In the cold season the climate is unexceptionable; invalids rapidly recover. There is much syphilitic disease. Thinks this might be got rid of by medical police. Dysentery rare; rheumatism less prevalent than at other stations. Country undulating, with large grass prairies, well watered. Wheat grown largely. Excellent breeding station for horses, and therefore for large body of cavalry. Sipree, on same formation, about 60 miles distant, would be equally well adapted for infantry. Addendum, 9, p. 24.

See Opinion of Surgeon J. W. Fletcher as to healthiness of Morfiong. At the top of the Cossiah range of hills, between Assam and Sylhet, the table-land is about 40 miles wide. Morfiong, about mid-way, has 5,800 feet elevation. Soil rocky and gravelly; surface undulating. There is a great extent of land suitable for buildings, recreation, and military evolutions. Thinks it well adapted, on sanitary grounds, for a station. Scarcely a day in the rainy season during which the men could not get out for exercise. Addendum 11, p. 33.

Also Letter from Dr. Macpherson, pointing out the desirability of various salubrious hill ranges. Troops at Cannanore should be placed on the Neilgherries, at Trichinopoly on the Pulnegs, having a plateau of 15 miles by 30, with abundant water. The Shinags, 5,000 feet high, within a night's run of Madras by rail, where all recruits from England might be placed. Near Vizagapatam, not far from Bellary, also midway between Nagpore and Hoosingabad, are mountain ranges. Addendum 12, p. 33.

Dr. Pinkerton reports that Nynce Tâl has an elevation of 6,400 feet, and is situated in a glen, with a lake or tâl in its centre. All the barrack and hospital accommodation is as bad as well can be; ill drained and damp, no latrines, every kind of surface filth. All these drawbacks should be remedied. The climate, during eight months, is clear, bracing, and invigorating; 219 days generally fine, 68 clouded, and 78 rain, hail, or snow. Average rain-fall 112 inches. Temperature at dawn, 51; noon, 64. There is no diarrhœa or cholera. During the four bad months hepatic complaints, rheumatism, head affections, and intermittent fever are common. But though invalids gain nothing in the damp season they lose nothing, and recover rapidly afterwards. Invalids sent here should be selected with reference to their disease, and proper accommodation provided. Of 599 sick sent thither in 1858-9, 136 were invalidated and 19 died. Addendum 15, p. 37.

See Descriptions of Otley, Pett, and Ramandroog, Addenda 16 and 17, pp. 38-9.

Mr. A. STEWART—, thinks it would be very desirable to station the troops on the hills as far as it can be carried out. P. 61, Q. 781-783.

Lieutenant-Colonel GALL—, considers that it would be advantageous to station the troops on the high lands if it could be accomplished. Railways will facilitate transport. European troops quartered on the lower range of the north-western Himalah would hold India securely, and be prepared to meet invasion from the north-west, and defend the line of the Upper Indus. Military colonies might be established here. Marriage encouraged, and inducements held out to settle. Children born in these regions grow up healthy and strong. Believes Europeans generally would be as healthy there as in Europe. Troops are generally kept five years at a station; sometimes three, or even two in Sind, which is very hot and unhealthy, except Kurrachee, which is healthy, being on the sea coast, and visited by the south-west monsoon. Believes there would be fewer applications for leave were the troops stationed in the hills. Expenses of officers on sick leave are paid by Government. P. 80, Q. 987-1000.

Captain J. E. T. NICOLLS—, describes the hill stations as all situated on the ridge or spur of a hill. P. 81, Q. 1024. These stations are decidedly favourable for the preservation of European health; situations in the rear would be far preferable as being less exposed to the monsoon. Thinks police regulations may be better enforced than in the plains, but that natives would not be kept out by want of roads, as they would resort to bye-paths if they desired to get at the station. Temporary huts might be used whilst such situations were being tested. Supplies would chiefly have to be carried up from the plains at considerable expense, and roads constructed of great length. Vegetables could be cultivated. The soldiers would be by so much removed from the scene of action. The hills are not liked from want of space for moving about, and less freedom for intemperance and debauchery. Vegetables could be cultivated; cattle might also be raised, the herbage being good. Pp. 83, 84, Q. 1108-1151.

Dr. McLELLAN—, does not think that any great advantage would be gained in point of health by stationing the soldiers on the hills, except for better police. The general presence of invalids on their way home increases the mortality at Bombay, nevertheless the policy of removing troops from low stations to mountains within a moderate distance is advantageous; is quite recognized in Bombay, as at Poona, where supplies are easily obtained, and will be more so on completion of the railway; but there are deadly fevers in the Deccan; at Poona even there is fever and cholera. At Aboe the monsoon is heavy, being in the front. Inland from the Ghauts it becomes much drier. Pp. 90-92, Q. 1232-1281.

Dr. COLVIN SMITH—, is of opinion that the stations are sometimes too high, especially in Bengal, *e.g.*, Sinchul, on a spur where it always rains or snows; there are medium ranges available both in Madras and Bombay. Ramandroog in Mysore, at 3,000 feet, is very healthy. Had seen invalids at Darjeeling soon become robust and strong; others suffering from dysentery, chronic disease and phthisis, were made worse by the cold and damp. Stations in the mountain ranges are the most healthy, and should be greatly increased in number to maintain the troops in ordinary health. There would be a great saving in the long run by preserving men's lives and prevention of sickness. Considers men previously living in the plains more capable of bearing the heat than those fresh from the hills, though the troops from Simla were remarkably healthy before Delhi, with the exception of cholera. They should not remain in the hills during the cold season, but descend to the plains for drill, &c., for which there is not room, *e.g.*, at Darjeeling. Believes there is no want of good and extensive positions in India on high lands; there has been no systematic inquiry. There should also be coast stations. Pp. 103, 104, Q. 1543-1580.

Major-General GOODWYN—, considers that it would be advantageous to place more troops at hill stations, reducing the number in the plains, *e.g.*, at Jullundur, Umballa, Delhi, and Meerut. With rapid means of communication there would be no difference in a political aspect. The late Major Abercrombie agreed in this opinion. Building might be more expensive on the hills, as carriage would be greater, but does not know the rate of labour there. Pp. 111, 112, Q. 1789-1804.

Major-General COTTON—, believes the Neilgherries will be found the best home for Europeans in all India; not being precipitous, but everywhere level and habitable, roads can be opened with facility. Jackatalla is out of the rainy portion of the district, and troops are stationed there all the year round; the men first stationed there, though very confined in temporary thatched mud barracks, were remarkably healthy, and none died except amongst those who came up invalids. Pp. 124, 125, Q. 2014-2025. The distance from the plains to the south is 20 miles, to the north 40, to the west 70. Good roads have to be made. There is unhealthy jungle intervening from 20 to 30 miles wide on all sides. Does not think the cost of maintenance will be greater, when things are settled, than in the plains. Provisions can be obtained on the spot, and there is a large extent of country capable of cultivation. Temporary buildings and huts should be used for testing a new climate, but this is not required in the Neilgherries. Pp. 124, 125, Q. 2017-2037; also P. 128, Q. 2024-2029. Inquiries should be made wherever hills can be found. Europeans should be placed there (first in huts) if troops are required in the neighbourhood. There is hardly a province without hills within two or three days march from any existing station, *e.g.*, Mysore, Travancore, the Deccan, &c. Thinks malaria is often very local, probably confined by trees, as in a tank, or the form of the ground where there is no outlet. A new hill site should always be tested by Europeans, a few would suffice. The health of the natives is no certain guide. Any elevation of 6,000 feet might boldly be tried, or even to 2,500 feet. Mischief sometimes follows the first turning up the ground; a site should not, therefore, always be hastily condemned on a first failure; local knowledge is the only guide. A good opinion may be formed as to the probable healthiness of a site. Pp. 126, 127, Q. 2055-2086.

Dr. MACLEAN—, is of opinion that it is possible to remove most of the plain stations to neighbouring hills, *e.g.*, the Neilgherries; Beda, 2,000, and Ramandroog, 3,500 feet, near Secunderabad, and two or three days from Hyderabad. Bangalore, 3,000 feet, is a healthy station; the men enjoy themselves there, as at Poona. The Neilgherries are a day and a half from Trichinopoly, and are available also for Cannanore, going by sea to Naguputun; the Annamallay hills also. Troops concentrated on the Neilgherries might act in any direction, so that very small garrisons need be left in a few important forts, such as Madras. One season is not a sufficient test. Pp. 137, 139, Q. 2239-2305. Booldana has not been used for troops, but people are remarkably healthy there. Q. 2323. Chindwarra is four or five days from Nagpore, where the heat is excessive. The Bombay railway will pass by Nagpore. Both Jackatalla and Trimulgherry were at first unhealthy, from the neglect and filth of large bodies of workmen during the erection of the buildings; this should be better regulated. P. 140, Q. 2321-2337. The hills will not restore health, the sea coast must often be resorted to, *e.g.*, Waltair; severe cases must go to sea. P. 142, Q. 2356-2363. The cost of maintenance may be greater on the hills, but the saving of life will much more than repay it. Q. 2372.

Dr. MCCOEN—, believes that at Ahnorah (5,600 feet), Kumaon, in the Himalayas, 10,000 men might be comfortably cantoned, and very perfect sites might be found on the Deo Dhooa range, 6,000 or 7,000 feet. Also at Lohoghaut, 5,500 feet. Thinks the latter the best elevation. Most of the hill stations are too high.

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During the cold season troops might encamp on the Terrai, which is then healthy, for exercise, and be employed in clearing the jungle, so as to make its passage safe at all seasons. A railway to the foot of the hills from Kanouge would place the troops in one day on the Ganges, but with a proper amount of clearing he should not apprehend danger from marching from Bareilly to Almorah. It is very desirable that the troops should be quartered in the hills; it would be very conducive to their effective strength. During the mutiny, the men fresh from the hills went through the campaign at Delhi better than those from the plains. Pp. 148, 149, Q. 2488-2528.* The hills generally are more valuable for prevention than cure, and consumptive, dysenteric, liver, and rheumatic patients should not be sent thither. Yet under most diseases men benefit largely by the change; or when suffering from *ennui*,—as a preparation for service. P. 150, Q. 2553-2556.

Mr. JULIUS JEFFREYS—, is of opinion that permanent quarters for troops should not be higher than 4,000 or 5,000 feet, and that, therefore, there should be stations at two different elevations, some being at 7,000 or 8,000 feet for persons suffering from particular forms of disease. The heavy rains would be avoided by going further into the hills. P. 187, Q. 2887-2892.

Sir JOHN LAWRENCE—, has no doubt the men would be healthier in the hills, though it does not agree with some constitutions; but there would be difficulty for financial, as well as military and political, reasons. The bulk of the troops should occupy the best strategical positions. One regiment will hold a country which would require ten to recover it if lost; it was so in the mutiny; had more troops been stationed at Delhi and Cawnpore, those places would not have been lost. Each cantonment should be held in sufficient strength to be able to assume the offensive at any time, if ready to do so the occasion may never arise. The Europeans are few and at a long distance from their resources. In times of danger there is a kind of panic apt to create confusion, increasing the difficulty of bringing up reinforcements. The native chiefs have considerable power, though it is much exaggerated. Railways would modify these circumstances, but does not believe they will enable us to leave the plains unprotected. The weakly and delicate men should be sent to the hills every year, and the robust kept below; thus 300 out of 1,000 might be in the hills, and form a reserve in emergency. In Madras the natives are more gentle, so that there is less occasion for holding strategical positions, and these also are nearer the healthy stations. It is different in the north,—e.g., Agra, itself a capital, watches the whole of the Gwalior district; the best arrangement there is for all the regiments to be in the plains, having 200 or 300 men from each in the hills, which should be thus used as sanatoria. The natives about Peshawur, for instance, are very observant, and the whole valley might be lost in twenty-four hours. It is not possible to foresee when and how danger may arise. It is a question of numbers; with 80,000 men, 20,000 might be in the hills; with 70,000, 10,000. In the event of an outbreak railways may be broken up. The troops must be on the spot to overawe and prevent disaffection. Disarming the population can only be effected to a very limited extent. It requires great management. There are greater difficulties on all these questions than people can conceive. The troops should be chiefly placed where the natives are most warlike. Except at Calcutta, many are not required in Bengal. 5,000 in Bengal would go further than 10,000 in the upper provinces, where some of the stations are, perhaps, as healthy as the hills. In Madras and Bombay there is no difficulty in making hill stations available, but it would not be possible to place the majority of the troops on the hills in Upper India. Having open field works might enable us to economise the force to some extent. P. 193-196, Q. 2963-3000. Children thrive well in the hills. Thinks the mortality is less than in England, whereas in the plains they die at a fearful rate. They all wither and die, chiefly after five or six years old. Q. 3072, 3073. The women also suffer immensely. At the Lawrence Asylum, and similar institutions on the hills, the children all flourish, they run about all day. The fathers do not get on so well because the stations are confined, and there is great difficulty and fatigue in communication with neighbouring places, therefore they do not get enough exercise. This would not apply to extensive table-lands. P. 198, Q. 3042-3062.

Colonel GREATHED—, thinks the mortality among regiments quartered in the hills is not less than those on good plain stations; no doubt the hill-men look much better. Where there is no table-land, e.g., Mussourie, there is great difficulty in carrying out sanitary arrangements, and filth lies in all directions; when the rain falls it is intolerable. The only hill station he had seen where the men were perfectly healthy was on a table-land at Mahabeshwur, but they cannot be kept there during the rains; it catches the south-west monsoon. There is also a difficulty in the want of ground for drill. This does not apply to the Neilgherries. P. 207, Q. 3261-3272. Considers it of the first importance to keep bodies of troops at the main strategical points. It would be a great thing to have the men in the hills, could it be done with equal advantage, politically considered. By railways they might be quickly brought down, but the plains should not be neglected. P. 210, Q. 3341-3351.

Dr. BIRD—, found the climate of Mahabeshwur at 4,500 feet less beneficial to sick than had been expected, especially in affections of the lungs and bowels. It is cold and temperate; residents were in good health, but suffer more on transference to the plains. The air is rarefied and light, unpleasantly dry in fair weather, and surcharged with moisture in the rainy season. P. 213, Q. 3421-3425. Considers table-lands of 2,000 feet, exposed to the sea-breeze and protected from dry land winds, the most healthy, and are far preferable to hill stations. Diminution of atmospheric pressure counteracts the invigorating effects of higher ranges. The confined space in some of the hill stations is a great drawback. Greater elevations from 3,000 to 8,000 may be advantageously used for change of air for debilitated men from the upland plains. Places open to the ocean breezes with no great rain-fall, as the Neilgherries and Newera Ellia in Ceylon, might be found advantageous for the residence of troops. Would use such places as Mahabeshwur as prophylactic stations during the hot months, and in that way all the benefit may be had that can be obtained from hill stations. The hill climates have been more beneficial to children than adults. Danger at high elevations is caused by underrating the power of the sun, and consequent exposure. People while on the hills will be more healthy than in the plains, but suffer more in again descending. There is acclimation to temperature, but men quartered in hot malarious plains would suffer more in a campaign than men from the hills under the same circumstances. P. 221-223, Q. 3597-3648.

Brig.-Gen. RUSSELL—, is of opinion that the withdrawal of the troops from the plains would render a larger force necessary. The sheathed sword must always be in view of the natives. Probably 100 men in each regiment would suffer from the change. P. 230, Q. 3791. Considers that 800 men on the principal road or near a large station would have more effect on the native mind than 2,000 upon the hills, and soldiers are unproductive labourers. In case of disturbance the men would suffer in coming down by forced marches. Stations have been selected at too great an altitude; for six months the men are living in the clouds. P. 230, Q. 3801-3809. The danger during the mutiny arose from the native troops rather than the population.

* See also P. 153, Q. 2635-2642.

The health of the army is most important ; would place the troops where they would be likely to enjoy the best health, provided the security of the country was not sacrificed. P. 232, Q. 3867-3879.

Sir P. CAUTLEY—, states that at Landour, which is very elevated, there are many ravines and hollows, into which refuse and filth is thrown, so as to be extremely offensive. To this cause may probably be ascribed much of the diarrhoea which prevails at these hill stations, often attributed to the water. P. 235, Q. 3941-3946. Considers that troops are sent to India to be usefully employed, but if they are too much out of the way, in the Himalayas, they would be of no use. Elevated plateaux, easily accessible and escaped from, are very different. There are such elevated spots, but covered with jungle, and the difficulty would be how to test them. Probably the plan would be to send up natives to clear, dig, plant, and fence in a spot, and then leave it for a time, and send up again at intervals. A new station cannot be fairly tried in one year ; Harris' valley in the Gallicondah range, Madras, was too hastily abandoned. Pp. 237, 238, Q. 3993-4009.

Colonel CAMPBELL—, would say that a regiment should go to the hills first rather than afterwards, and be brought gradually into the plains. They are better for preserving than restoring health ; but it is beneficial to send certain invalids thither as a sanitarium. In Cashmere, about 30 miles from Sealkote, Dr. Graham and others had visited a beautiful plain 16 miles in circumference, with good water, and a temperate climate, calculated for any number of troops ; there is not generally sufficient space for troops. If stationed in the hills they should be brought down for exercise in the cold season, and to show themselves. It would not be safe to leave the great cities without garrisons. Railways might make a difference. Has no doubt from the number of troops in India that a great reduction might be made in plain stations without abandoning really important parts. They could be better kept in bodies not too large, as reserves. P. 244, Q. 4150-4166.

Mr. ELLIOT—, thinks there would not be the slightest difficulty in Madras in administering the police of the country, so that a considerable portion of the troops might be quartered in the hills, leaving comparatively small garrisons at the plain stations. The principle has been largely acted on by withdrawing the whole military force from all the provinces, except three or four principal stations, and with the best results. Is convinced that the natives are intelligent enough to understand our power, and to be aware of its existence, though they may never see a soldier. There is ample room on the Neilgherries, also on the Mahabeshwur range. Such stations should be used, both for recruits on arrival and for sick in a majority of cases. Pp. 248, 249. Q. 4269-4286.

Mr. MONTGOMERY MARTIN—, considers it advisable to place the troops above the rain gauge limit, which varies in different parts of India from 3,000 to 4,000 feet ; moisture being most inimical to health, whether conjoined to heat or cold. Badalla in the interior of Ceylon is a valuable spot for the preservation of European health, and in a strategical view well calculated for the concentration of troops to be moved on any part of the Indian coast. Elevations near the sea have a great advantage. Considers Mussora Point near Kurrachee very eligible. Calcutta is highly insalubrious, and the seat of Government must sooner or later be placed higher up. In Bengal the Rajmahal hills are accessible. There is a healthy region in Bundelcund. About Malwah the rajpoots, as a race, have maintained their vigour. In the Deccan the people are more vigorous than in the valley of the Ganges. P. 252, Q. 4296-4379.

Mr. A. GRANT—, states that there is nothing which would render it inexpedient to station a large body of troops on the Neilgherries. The locality is very accessible ; there is plenty of room, open to the sea-breezes, and by moving from one side to the other the rains may be altogether escaped. All patients are benefited there, except those suffering from affections of the heart and brain. Has not seen any diarrhoea there, nor scurvy ; vegetables and water are good and abundant. European labourers might be employed there without injury, and with their families might occupy that country. Would not recommend Newera Ellia, Ceylon, as a station for troops ; it is far inferior to the Neilgherries, and very expensive. Every regiment should have a convalescent dépôt on the hills, to which the weakly men and officers may be sent, who would soon be set up and ready as a reserve. There might be the regimental records, workshops, gardens, &c., and recruits might be sent thither and drilled. One-third or half the whole force might be in the hills. Pp. 259-261, Q. 4407-4469. Considers the hills of great importance for the cure of disease, as well as the preservation of health. New stations at first unhealthy have proved healthy afterwards ; *e.g.*, Pegu. Cholera has not been known at Darjeeling or Nynce Täl. Pp. 262, 263, Q. 4498-4521.

Colonel DURAND—, thinks it would endanger the security of the country to place large bodies of troops permanently in the hills, but that the dépôt system spoken of by Mr. Grant would be exceedingly useful. Any surplusage or reserves beyond what are necessary for the quiet occupation of the country may be stationed in the hills, especially when the railroads are completed ; but the key-points, *e.g.*, Allahabad, must not be given up, the country being held practically by the sword, and small posts should be avoided. It is not possible to keep the population disarmed. P. 285, Q. 5122-5136.

Sir C. TREVELYAN—, considers that the plain stations must be held, and troops occupying these stations are in some degree acclimated and better able to act effectively than they would be if suddenly brought down into the plains. In the hills the men complain of want of society and amusement, and of a market for their labour, if disposed to work ; they are therefore more difficult to manage, and are better both for their own sakes and the public service in the plains. All efforts should be brought to bear on the conditions of health there. Would recommend that the Wellington barracks be made a sanitarium for the south of India for weakly men wanting change of air in time to prevent sickness, and they should have the same freedom to resort to the sanitarium as officers have. Strong men prefer being in the plains. The railways will facilitate transport to the sanitarium ; they will also enable smaller garrisons to be kept at the present stations by the concentration of a large force at healthy stations within easy reach, *e.g.* at Bangalore, which commands the whole of Southern India. Believes small posts, *e.g.* Vellore, to be a source of weakness, and for this reason had removed detachments from Dindigul and Masulipatam. Thinks the employment of the hills as sanitarium for the whole army would promote colonization there, as all the men would become acquainted with the hill climates, and many would be induced to settle there. P. 296, Q. 5319-5357.

Dr. HUGH FALCONER—, thinks no station would be favourable for European troops under 5,000 or 6,000 feet. Experiments might be made at lower elevations, but it would not be taking advantage of the conditions within our grasp. The forest should be thinned in low elevations before sending up troops. The information already obtained would determine the climatic characteristics of the different elevations. P. 310, Q. 5480-5489.

Dr. SUTHERLAND—, observes that sanitary considerations which have hitherto been overlooked must be equally attended to in the hills as the plains ; otherwise hill stations will be of very doubtful benefit. P. 313, Q. 5495 ; P. 316, Q. 5528-5530.

Sir A. TULLOCH—, considers the placing of troops on high ground is very important as far as it can be done consistently with purposes of defence. P. 317, Q. 5549-5551. Troops at unhealthy places, *e.g.* Allahabad, might be frequently moved to more elevated stations. A large proportion of the troops might now be concentrated at elevated stations, now that railways are being laid down. Military authorities should be called

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upon to state what number of men it is necessary to keep at unhealthy stations. P. 322, Q. 5597-5610. The strictly tropical diseases are not found to prevail in the hill stations, except dysentery and diarrhœa, which probably originate in other localities. P. 324, Q. 5621-5626.

Serjeant-Major WALKER—, states that the soldiers like hill stations, they invigorate the men. To mass the main body of troops on the hills with turns of service with the natives in the plains would be a great advantage to the army. The men have no energy in the plains. Confinement in the barracks from 8 till 4 is irksome to them, they would rather be out in the sun. P. 342, Q. 6014-6023. In the hills all disadvantages of climate would be avoided; the men could be out all day. It is in the plains that thousands of men die. P. 343, Q. 6030-6037.

Dr. DEMPSTER—, agrees with Sir R. Martin that newly-arrived troops should be stationed in the hills, say for three years, descending only occasionally to the plains during the cold season. Meteorological observations have hitherto been very loosely made in India, except at Darjeeling, and by the German brothers Schlagintweit, whose observations may doubtless be found at the India House. P. 463. The course of the seasons at the Landour Convalescent Depot is as follows:—March is often cold with sudden showers. With April begins summer weather till 20th June, when the lesser rains set in. Heat in shade seldom rises above 74°, but the heating power of the sun is almost as great as in the plains; there is no accumulated heat, however, so that the slightest shade secures a cool retreat, and the cool "Dhoon breeze" sets in about 10 a.m. till sunset. There is a variable interval between the little rains and the regular rainy season, which continues till the middle of September. These are followed by a cool bracing and transparent atmosphere, which is highly salubrious; and the temperature becomes gradually cooler until December and January, when it sometimes freezes and snow frequently falls. Sound European adults and children retain their health here, and the young reduced by illness rapidly recover, but the old and worn usually find their complaints aggravated in the hills. Diarrhœa is the endemic of these regions, arising, he believes, chiefly from suppressed perspiration by sudden change of temperature. Thinks flannel the best prophylactic. Sickly regiments sometimes lose numbers of men on being transferred to the hills. Thinks it would be preferable to send these to such a station as Meerut. Recommends that the change from the plains to the hills should always be gradual; there should be a halting-place half-way, where clothing should be changed. Points out objections which may be urged against adoption of hill stations, but is convinced they may be overcome, and many eligible sites discovered by proper search. P. 463.

Dr. EATWELL—, considers the question of elevation most important; some are of opinion that elevations of 5,000 or 6,000 feet are preferable to 7,000 or 8,000. He would regard any site below 3,000 with extreme suspicion, except in well-cleared table-land. The deadliest fevers prevail about the bases of, and at low elevations in, hills. This in India attributed to jungle, but on the hill sides at Hong Kong and Amoy, which are bare of trees, the malarious fevers during his three years' residence exceeded in malignity anything he had witnessed in Bengal. Has learned to regard the bases of hills within the tropics as dangerous. Though Bengal is a rice swamp, severe fevers do not generally prevail; but enlarged spleen and agues are common. In China saw an immense amount of fever. Is satisfied that what is called jungle fever may occur independently of the presence of forests. Should insist that mean temperature did not exceed 60°, and that a station should have at least 7,000 feet elevation. The character of the flora is also a good guide. Thinks that the diarrhœa prevalent in the hills depends on local agencies unconnected with elevation,—as dampness, defective ventilation and nuisances, diet, &c. P. 480.

XII.—SANITARIA FOR THE SICK.

SANITARIA.

Sir R. MARTIN—, thinks that for restoring the health of invalids in India a foreign climate should be sought. Australia has been highly recommended.* P. 6, Q. 148-153.

Dr. RENNIE—, has served six years and a half in Western Australia, where the average temperature is 60° in winter and 75° in summer. There are no extremes; seldom hot in summer more than three days consecutively, and the winter resembles the English summer. The whole colony is healthy. At Fremantle the soil is a light sand; in other parts a light loam, not much cultivated, but capable of being rendered highly productive. There is no part unhealthy. North-westerly winds from the Indian Ocean are most prevalent, from May till October. The rainy season is short, in June and July, the water percolating rapidly through the soil. Swan River, an estuary 14 miles inland, is the only river of any extent. Provisions are plentiful and cheap, both vegetables and cattle. The climate is very exhilarating. The convicts, who are much crowded and over-fed, suffer in the hot weather. There are no diseases peculiar to the country, and the convicts were made healthy by sanitary measures, reduction of diet, and disuse of tobacco, which he considers highly injurious in warm climates. The people attain to great age. Children born in the colony lose their teeth early, which he attributes to their being over-fed on the English system. The natives are rapidly disappearing, their health being deteriorated by change of habits. They now hunt by means of dogs, and have no physical exertion as formerly, and have formed habits of repletion, dram-drinking, and smoking. There were only seven aborigines remaining in Tasmania. The English troops are very healthy. Had addressed a letter to the Army Medical Department, recommending the formation of a sanitarium at Fremantle for invalids from India.† There is a large convict establishment not needed for that purpose, which might easily be converted into a sanitarium. Steamers from India would occupy from 14 to 21 days in the passage. Pp. 65-71, Q. 827-895.

Dr. COLVIN SMITH—, is of opinion that no foreign sanitarium is required. If men would not recover at the sea coast or hill stations they should be sent home. P. 104, Q. 1581-1582.

Mr. ROE—, considers Swan River well adapted for a sanitarium. It is about three weeks from Calcutta by steam. Regular communication must be first provided.‡ The temperature is equable; in 1839 the lowest was 45°, the highest 97°. The cost of maintaining a convict is 22*l.* a year; in England it is 28*l.* Provisions are becoming more abundant and cheaper; labour is costly, but roads, &c. are made by convicts. There is plenty of water for domestic purposes, also materials for building. The port and anchorage are good, at all times.

* See letters by Dr. Jones and Dr. Fergusson, recommending Western Australia as a sanitarium for troops invalided from India, pointing out the peculiar salubrity of the climate, and the general absence of disease; *e.g.*, no fevers, epidemics, or even syphilis. Addenda 3 and 4, p. 21, 22. See also No. 18, p. 39.

† See Addendum, No. 1, p. 71.

‡ See letter from Sir James Stirling on the climate of Western Australia; contrasting the high temperature, varied by sudden chills, and the moisture prevailing in India, with the comparatively temperate, dry, and equable climate of Western Australia, which is within 14 days from the nearest Indian ports, and therefore suggesting establishment of a sanitarium, from which troops may readily be recalled by telegraph. Addendum, No. 8, p. 120. See also various statistics and opinions, Addenda 1-7 and 9, 10, pp. 117-121.

The company of troops now stationed there might be dispensed with, were the duty performed by convalescents. There is no opportunity for desertion. The sun is never dangerous; labourers work in it. The rain in winter is abundant. The mortality is remarkably low. Water is obtained from wells and streams. Any amount of ground is available for sites and for exercise. The convict establishment at Fremantle might be converted into a sanitarium. Thinks the climate of King George's Sound not so good as Swan River, and it is not so easily approached by sea. Children born in the colony are not so stout as English children. Among classes not remarkable for temperance children are perhaps neglected, and medical advice is not easily procured. P. 112-121, Q. 1805-1922.

Dr. JONES—, thinks the climate of Western Australia the finest in the world, the air being dry, with no continuation of great heat. There is no malaria. Considers it important, men being enlisted for 10 years, to secure their services for the whole period by removing them for a short time from the influences inducing disease in its earlier stages at any period of the year. Much of the expense of invalid depôts and home transport could thus be saved. The mental relief and sea voyage (crossing the line) would greatly assist the cure, and more than compensate for the extra land journey, in preference to removal to the hills in India. The climate of the Cape is similar, but epidemics occur there which do not in Australia. The higher proportion of mortality among children may result from carelessness and the absence of medical assistance in the rural districts. There is a powerfully astringent gum in the colony very effective in diarrhœa. Changes of temperature are not noticed there. Has seen many men in India whose lives might have been saved by removal to Australia. The convicts are over-fed and the cooking is bad. Thinks men might be comfortably conveyed from India to Fremantle for 10*l.* to 15*l.* each. P. 121-124, 1923-2007.

Dr. MACLEAN—, considers Waltair, on the coast of Vizagapatam, admirably adapted for a sanitarium and station for that part of the country, being open on three sides to the sea and protected by mountains on the fourth. The climate is equable, and there is no fever there. P. 138, Q. 2296-2300. In severe cases the sick must be sent to sea. Has a high opinion of the Cape. Has no experience of Australia, but many cases would be cured in such a place, and a sanitarium of that kind is required. It is lamentable to see the number of lives lost for want of it, "waiting for death" in hospital. The probability is, that a large majority of such would be rendered efficient merely by the voyage, if ships be properly provided.* P. 142, Q. 2363-70.

Sir JAMES STIRLING—, has had twelve years' experience of Western Australia. The climate is exceedingly healthy. Screw steamers would make the passage from Calcutta in 14 or 16 days. King George's Sound is the finest climate, but Swan River would be the most accessible. The heat is never injurious to health as it is exceedingly dry; the people labour in the fields without injury. For building, convicts would be available, or coolies from India. Provisions might be supplied to meet any demand. Fruits and vegetables would be excellent and unlimited. Two companies were formerly stationed in the colony; believes the number has been increased; convalescents from India might perform their duty. The cost of transport would be about 10*l.* per man, and vessels should be specially devoted to that service. Sick might be landed in Australia at all seasons, and would recover their health even in the heat of summer. The voyage would be lengthened and more boisterous by going round to King George's Sound, though that is the best climate, wonderfully equable. Large vessels might not feel it. There would be no difficulty in the landing at all times at either place, but King George's Sound has the best accommodation perhaps. It is a very fine harbour. Pp. 211, 212, Q. 3352-3412; see also Addendum 8, p. 120.

Dr. BIRD—, considers that debilitated men from malarious and coast districts should be sent to maritime sanatoria, as Vingorla, Bassein, Poorbundhur, and Kurrachee; and probably the Sandheads for Lower Bengal. P. 221, Q. 3602. Remittent fevers and inflammatory visceral cases should be sent to sea or a coast station; or the Cape, Prince of Wales Island, or Western Australia. P. 223, Q. 3649. Invalids should be landed at the Cape as an intermediate station. A sanitarium should be established for the complete restoration of men sent down to the coast, who are often sent back to their regiments too soon, and die in consequence. P. 224, Q. 3669, 3670.

Brig.-Gen. RUSSELL—, thinks that if men proceeded to sanatoria as officers do it would be a great advantage. They go only once a year, and when the time comes it is often too late. A regiment on arriving at Trichinopoly from the Cape suffered considerably from dysentery. It is now admitted that the Cape is a bad preparation for India. P. 230, Q. 3791, 3792.

Mr. A. GRANT—, would use hill stations as sanatoria in moderate cases of organic disease. Severe cases should be sent to sea. P. 261, Q. 4472, 4473.

XIII.—DISINFECTING AGENTS.

Dr. ANGUS SMITH—, states that by the use of antiseptic disinfectants the decomposition of organic matter may be prevented, so that manure, &c. may be preserved without giving off injurious gases. Instances experiments on sewers in London and at Carlisle, by Mr. McDougall, of Manchester. This would be invaluable in camps and military stations to prevent nuisance previous to the removal of foul matters. If applied to land, antiseptics will also arrest all animal and vegetable decomposition in the soil, without which malaria will not arise. The destruction of insects is another result; limited districts of country might be disinfected by this means with greater ease than corn is sown. The best disinfectant is McDougall's powder and fluid. The true discovery of the chief ingredient (carbolic acid or creosote) belongs to Baron Reichenbach, who obtained it from wood. Runge got the same from coal. The extension of its use to sewage, &c. was due to himself (having no commercial interest in it) and Mr. McDougall. It is exceedingly cheap; a few pence would provide sufficient for an acre of land. If used in India it might be prepared there from wood. Thinks the soil to which it was applied would soon get into a more wholesome condition; for surface impurities the effect would be instantaneous. This differs from Condry's disinfectant, inasmuch as it does not oxidize or destroy the manure, and is much less expensive. Considers that for 15,000*l.* a year the whole of London, including streets, sewers, and the Thames itself, might be completely disinfected. The powder made by Mr. McDougall had been used very beneficially in the transport of horses to the Crimea; but some sent to the army there was not allowed to be used, being returned, and sold as old stores. Camps may be readily disinfected by this means. It might also be useful on turning up fresh land, *e.g.*, for railways or clearing jungle. Pp. 155-162, Q. 2687-2741. The air test which he uses will determine the amount of organic

* Dr. MACPHERSON—, strongly recommends Curlew Island, in the Bay of Bengal, for a sanitarium, Addendum p. 483. The Chittapoonjee Committee remark that sufficient attention has not been paid to the salubrity of the roads leading to sanatoria. (Appendix, p. 147.) The Ahmednugur Committee consider good sanatoria along the Bombay coast to be a great want. These would often be preferable to hill stations. (Appendix, p. 838.) Mr. Hare recommends that invalids from India should often be drafted into regiments serving in cold climates, for three or four years, after which they might return to India. (Appendix, p. 183.)

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matter in any given atmosphere. There is putrefying matter deposited on the walls and glass of ill-ventilated rooms, which may be detected by this means, and by which the chief evil of overcrowding is occasioned. P. 164, Q. 2769-2772.

Dr. LETHBY—, states that Condry's fluid (permanganate of potash) has a very good effect for disinfecting purposes in barracks and hospitals, although it is rather expensive when used in sufficient quantity for such a purpose. P. 267, Q. 4608. There are several disinfectants that will stop putrefaction and enable sewage to be removed without danger, McDougall's fluid being the most useful, which has been tried in the London sewers with a good effect. It is very inexpensive, and prevents putrefaction without destroying the organic matter, which Condry's solution does. P. 269, Q. 4690-4703.

Mr. SIEBE—, describes Harrison's ice-making machine as capable of producing from 10 to 20 tons of ice per day, at 10s. per ton. Ether and salt are the articles used. The air of rooms may also be cooled by this process. P. 326, Q. 5659-5672. The machine is already used in some of the Bengal hospitals, on which a report from the Calcutta Gazette is appended.* P. 327.

XIV.—TRANSPORT OF TROOPS.

TRANSPORT.

Sir R. MARTIN—, states that the climate traversed between England and India, being the finest in the world, if the ship be under proper regulation, the soldier ought to arrive in the best health. The overland route is rapid, and has not these advantages, so that as regards health the Cape route is preferable. The diet on board ship might be improved. Pp. 7, 8, Q. 193-200. Railways in India will be of great benefit to the health of the army by affording speedy transport to the hills. P. 8, Q. 203. Neither recruits or invalids should be detained at Calcutta, but sent direct to or from the river steamer, from or on board the home-bound vessel; much drunkenness and injury is caused by their detention. P. 17, Q. 277-280.

Dr. DUNCAN STEWART—, states that recruits for India embark in detachments of from 200 to 350 having enlisted generally for cavalry, infantry, or artillery, and they are distributed to regiments and localities on arrival. P. 48, Q. 605. Upwards of 4,000 recruits are sent from Warley annually. The Cape is undoubtedly preferable to the Suez route for recruits. The arrangements for the voyage are excellent; nothing can be better. 6,189 men, 144 women, and 99 children went out, divided into 29 embarkations, in 1858. Considers it would be disadvantageous to stop the men at the Cape for drill. P. 50, Q. 612-626 a.

Dr. McLENNAN—, considers the Cape route the best, except that in the autumn troops for Bombay might advantageously go by the Red Sea; it is too hot in the summer. Men should arrive in December and January, having first been drilled in England. P. 93, Q. 1286-1290.

Dr. MACLEAN—, has known much suffering among sick soldiers on board ship from such an apparent trifle as mal-position of waterclosets. P. 142, Q. 2370.

Dr. BIRD—, thinks great improvement might be effected both as to diet and clothing on board transports to India. Diseases are caused by salt provisions, spirits, and unsuitable dress; porter is also objectionable. P. 218, Q. 3541-3548.

Colonel DURAND—, is of opinion that suffering and loss might be reduced by attention to the countries from which troops are sent to India; the period of arrival in India; and the mode of conveying troops from the points of debarkation.† P. 287, Q. 5162.

Sir A. TULLOCH—, states that at the present rate of mortality in India, and to maintain an army of 80,000 men on the ten year relief system, it will be necessary to find passages for about 30,000 men annually, at a cost of 300,000*l.*; but if more healthy stations be selected, more relief men would volunteer into other regiments, and time-expired men would re-engage. P. 323, Q. 5611-5620.

Dr. DEMPSTER—, is of opinion that on the voyage spirits should not be allowed, and a moderate allowance of light malt liquor substituted. Europeans should arrive in India during the cold season; the middle of November being the earliest period, which allows three and a half months for moving up the country, either on the march or by railway. Strongly objects to river transport, over-crowding, productive of cholera, being the result. P. 463.

XV.—THE MEDICAL SERVICE.

MEDICAL
SERVICE.

Sir R. MARTIN—, says the Indian medical service is well ordered for the purposes of cure, but the sanitary department is altogether wanting.‡ Candidates should pass through a good school of military hygiene in England. Has advised that they should have the benefit of instruction at Chatham. There are no sanitary regulations, and medical officers have at present no power to enforce attention to such matters. Describes the medical organization generally. Pp. 14, 15, Q. 216-240. Instruction is required as to invaliding rules for officers and men. The old invaliding boards are unnecessary. P. 17, Q. 275, 276, 281.

Col. SWATMAN—, observed that medical officers can only suggest sanitary improvements, but the suggestion would be attended to whenever practicable if not expensive works on a large scale must go through the usual routine to the higher authorities. Commanding officers frequently consult surgeons as to marching and halting of the men, but it is not done by order. P. 46, Q. 517-531.

Dr. McLENNAN—, describes the Bombay hospitals as having a very full and efficient establishment; recommends a slight addition in the allowances made to the warrant officers, and that the ward attendants should be permanently enlisted. P. 92, Q. 1284. Medical officers report daily as to sanitary state of the regiment; weekly, monthly, and yearly to medical superiors; besides special reports. Medical officers cannot be appointed presidents of committees under the regulations; an unnecessary indignity which ought to be removed. P. 94-95, Q. 1307-1313.

Dr. COLVIN SMITH—, states that cleansing is well attended to in the hospitals and the dressers' department in Madras is very good. The artillery had a female hospital with a good matron; bad lying-in cases were admitted. P. 105, Q. 1602-1606. Thinks the medical officer should have more authority on sanitary questions; and there should be sanitary committees at all stations, presided over by a sanitary or medical officer of health. Pp. 105, 106, Q. 1,621-1,635.

Mr. LONGMORE—, states that new "temporary" barracks at Barrackpore were about to be erected in a wrong position, against the advice of the medical officer, until by his own interference a medical committee was

* See Mr. Julius Jeffreys' remarks on the ice-making process, and plan of water mill for working same, pp. 495-6.

† The Rangoon Committee advise that the soldiers on the passage out should be partially drilled and made to assist the sailors in various ways, to keep them in exercise. Major Haly refers to bathing-parades which he had enforced on board ship, the men being placed in ranks and washing each other according to systematic drill, described. (Appendix, p. 537.)

‡ See Suggestions, p. 19, "Lastly," &c.

assembled and the matter set right, it not being considered necessary to consult medical men as to temporary arrangements. P. 132, Q. 2186-2188. The appointment of a sanitary officer at Calcutta was producing much good ; reports were made weekly and immediately attended to. This office having been abolished on reduction, there is no one who can attend to the work, and it is not done. Pp. 133, 134. Q. 2209-2216.

Dr. McCOSH—, considers that Indian medical officers should be promoted earlier. There are now assistant-surgeons of 17 and 18 years' service. There is not a due proportion of surgeons. In every other branch of the service there is a comparative increase in the higher grades. Another grievance is that the surgeon-major receives no higher pay than the surgeon. In no other service does an officer remain 17 or 18 years in the first grade. The average in the English army is seven or eight years. These things have promoted chronic discontent, and no eagerness is shown to enter the service. Again, no assistant-surgeon can obtain a pension under 17 years' service. The subordinate branch of the medical department is in a satisfactory state. Medical officers have not sufficient power to ensure attention to sanitary recommendations when commanding officers are not alive to such matters. Gives an illustration. This, however, is the exception. Pp. 153, 154, Q. 2647-2683.

Colonel GREATHED—, states that in case the commanding officer did not attend to the recommendation of the medical officer, he would report to his superintending surgeon, who can bring it before the general of division. The suggestions of the medical men are usually attended to very implicitly. Has never seen any difficulty, or a medical opinion trifled with. Pp. 207, 208, Q. 3273-3281.

Dr. BIRD—, is of opinion that a medical officer should be sent down to the coast with invalids in order that the medical board might have more knowledge of the cases, and the men should not be delayed at the presidency. Would not dispense with the final board, who should be selected by the Commander-in-Chief. Does not think that officers who have served with natives only, unless very intelligent, would be as well suited to supervise Europeans as officers of experience with Europeans ; but that the medical officers with native troops are very intelligent. P. 225, Q. 3673-3684.

Mr. A. GRANT—, considers that experience in India is necessary to enable a medical officer to become familiar with the diseases of the country. Knows of no more responsible charge than the care of a British regiment in India. The medical officer requires friendly advice and assistance from experienced medical superiors. Pp. 263, 264, Q. 4527-4535.

Sir C. TREVELYAN—, had succeeded in establishing a school for dental surgery at Madras, in connexion with the hospital,—considering the care of the teeth, which has hitherto been neglected, of great importance to the soldier. A tooth-brush should be added to the kit. P. 293, Q. 5285-5288. Suggests that a manual should be prepared of the conclusions arrived at concerning the sanitary state of the army in India, so as to be available for every medical and military officer, as it is very difficult to extract the existing state of knowledge from lengthy treatises and reports, &c. Every officer who serves in India should be expected to master this treatise. P. 301, Q. 5361-5362.

Dr. SUTHERLAND—, observes that according to the returns the Indian medical officers have hitherto had no definite powers as to sanitary matters. The medical regulations issued by Lord Herbert, 7th October 1859, would effect immense good in India. To the absence of any sanitary system is to be attributed much of the great prevalence of disease and high mortality both among Europeans and natives, the surgeon generally not having been educated for such duty. The sanitary administration should be a special one ; a separate one for each presidency, which should be also applied for the advantage of the population. P. 313, Q. 5495-5507.

Dr. DEMPSTER—, states that the subordinate hospital assistants are generally "Eurasians" of low moral character, and considerable peculation is the consequence. These men usually prepare the returns and indents for supplies, whereby much fraud is practised. Youths educated at the Lawrence Asylum might well be substituted for those at present employed in this service. P. 477. The Bengal dooly is superior to that used in Bombay ; but ambulances should be provided for conveying the sick. P. 478.

By Order of the Commissioners,

(Signed) T. BAKER.

MINUTES OF EVIDENCE

TAKEN BEFORE

THE COMMISSIONERS APPOINTED TO INQUIRE

INTO

THE SANITARY STATE OF THE ARMY IN INDIA.

Friday, 25th November 1859.

PRESENT :

THE RIGHT HON. SIDNEY HERBERT, M.P., IN THE CHAIR.

SIR RANALD MARTIN, C.B., F.R.S.
THOMAS ALEXANDER, Esq., C.B., D.G.A.M.D.
Colonel E. H. GREATHED, C.B.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

SIR RANALD MARTIN, C.B., F.R.S., Physician to the Council of India, examined.

Sir R. Martin,
C.B., F.R.S.

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1. (*Chairman.*) How long have you been in India?
—Twenty-two years.

2. Have you served with Queen's, Indian, or native troops?—With all three. First of all with two regiments of Her Majesty's troops of the line, and afterwards with several native corps both infantry and cavalry.

3. In what presidencies have you served?—In Bengal.

4. At what stations have you served?—Chiefly in Lower Bengal. My first services in the field were in hill campaigns in Orissa and Gondwana. I was ordered on a special mission to Hyderabad in the Deccan, and I served in Burmah during the first Burmese war, in two campaigns.

5. In what part of India did you serve the longest?
—At the presidency, Calcutta, where I held a military staff appointment, and held various appointments besides.

6. Will you describe the stations with which you are intimately acquainted with reference to the healthiness or unhealthiness, more especially as regards climate, local position, natural means of drainage, soils and sub-soils, vegetation, nullahs, irrigation, ravines, ditches, broken ground, proximity to native dwellings, &c.?—I am very well acquainted with the stations throughout India statistically and topographically by the constant perusal of official reports about them during the whole course of my service, and very much since I came home. They comprise every variety of locality, climate, &c. They have been selected generally without care, the structural arrangements, as to barracks and hospitals are very deficient, and many of them have been abandoned on account of their unhealthiness, and I believe that many more must be so abandoned. The proper selection of our stations constitutes one of the prominent features in a paper which I shall have to read hereafter.

7. Speaking of the stations with which you are personally acquainted, were there any sources of malaria in the neighbourhood of them?—No station which I have ever visited in India was exempt from malarious influences which were perceptibly detrimental to the European troops in occupation.

8. Were they, in situations where the soil was damp?—Yes; a damp soil and a low situation, ill drained, with an irregular surface retaining the water in saucers, spread throughout the cantonments, and generally in low jungly ground.

9. Are they subject to flooding?—Some of them are subject to floodings.

10. Generally speaking what would you say of the character of these particular stations as to the precautions taken with regard to latrines, urinals, ablution houses, and the means of removing their contents to a distance?—Generally speaking there has been a great neglect of those matters.

11. Have you any reason to believe that much improvement has taken place in these matters since you left India?—I think hardly any, or certainly but very little.

12. When did you leave India?—At the end of the year 1840.

13. You would say that the drainage of the stations was insufficient for the purposes of health?—Almost universally.

14. With regard to the water supply, was that generally abundant with good tanks or wells?—It is generally supplied by tanks and from rivers in the stations that I am personally acquainted with, and I believe it is generally so throughout India. The water in both wells and rivers requires attention in the way of being purified.

15. (*Col. Greathed.*) What means have you of knowing the state of the cantonments?—From a constant perusal of the topographical and statistical reports from the stations, and the evidence of medical officers with whom I am continually in communication. It is the only way to obtain knowledge over so wide a field. Personally, I have examined the barracks and hospitals of Fort William, Dum-Dum, Chinsurah, Berhampore, and Dinapore in Bengal, and those of Fort St. George, the Mount, and Masulipatam in Madras.

16. (*Chairman.*) Can you suggest any improvement with regard to the water supply generally, as to the sources from which water is derived, the means of storage in use, and the means of distribution to barracks and hospitals?—The recommendation ought to be, that the utmost care should be exercised in choosing pure water and in storing it, so as to prevent decomposition. Iron pipes are preferable for conveying water to barracks and hospitals.

17. Is not that already done?—No, it is usually done by hand carriage; that is the system throughout India generally; it is done by the natives.

18. With regard to storage, I believe the water is always stored in tanks?—Yes; but the tanks have been very much neglected. They were not in my time, and they are not now, I believe, sufficiently well looked after. Their preservation and the construction of the bottoms and sides of the tanks was a

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question that came before the Sanitary Commission of Calcutta, which I originated; and the engineers upon that occasion gave evidence upon the mode they thought best, although I forget the technical mode, of making the sides and bottoms of the tanks; but what they recommended has not been done.

19. Will you describe generally the construction of the barracks in point of materials, also the temporary huts and tents used for barracks and hospitals in your time?—The materials have been always of brick and mortar, and some of them are well constructed, as at Berhampore, in Bengal, which, however, was subsequently abandoned on account of its unhealthiness. Both the structure and arrangements are defective almost universally, except in the very newest barracks; and there only with regard to the cubic space of air allowed per man. This remark applies to both barracks and hospitals. Temporary huts, and tents used for barracks and hospitals, are only used in war, and vary with the scene of operation. At new stations officers and men are sometimes huddled in a hurried and imperfect manner.

20. What is the cubical space allowed?—It varies infinitely; there is no fixed standard.

21. The native troops hut themselves, do they not?—Yes, they do; I believe an allowance is made by the Government for the expense of the original hutting.

22. Upon what plan are they huddled? How many are there together?—Very few together; one and two in a hut.

23. With regard to the barracks,—are the floors raised above the level of the ground, so as to have a circulation of air underneath them?—None that I have seen have been constructed upon arches, which ought to be everywhere the universal principle; neither have I ever seen in India a roof constructed as it ought to be, double.

24. Have you ever known the floors of barracks and hospitals damp?—Continually, so as to render the ground floor unfit for occupation by Europeans.

25. In the stations that you are acquainted with, have you found a difference in the health of the soldiers in different barracks which you could trace in any way to the construction of the barracks?—Very largely. The inspector-generals of hospitals of Her Majesty's army, with all of whom I was intimately well acquainted in India, spoke universally in the language of complaint upon that subject. I may mention, as a specially obnoxious example of a barrack and hospital, Secunderabad, near Hyderabad, in the Deccan, which for 30 years was condemned by every well-informed medical officer and by every superior staff officer who served there, and I am afraid that the improvements made were really not improvements, and so the station remains still most unhealthy; whereas in the case of the Company's artillery, located within a very short distance of this barrack and hospital, which has been occupied by the Queen's troops, were always healthy.

26. Will you describe the peculiarities of the barracks? Are they built generally in India as they are in England?—Too much so; that is, narrow, low, and confined.

27. (*Dr. Farr.*) Are they built in stories?—Generally of one story, sometimes two, and even of three.

28. (*Chairman.*) Have they generally a verandah?—Yes, generally they have.

29. But not with double walls or a double roof?—Never.

30. (*Col. Greathed.*) With a verandah all round? Occasionally it is so, but generally to the east and west.

31. (*Chairman.*) About what breadth of verandah is there?—The breadth varies very much; 14 feet on the average.

32. Did you ever know of a verandah being used as sleeping accommodation for the troops?—Yes, when the hospitals have been over-crowded.

33. Do you think that that is a dangerous practice?—It is really a question of whether it may not some-

times be a benefit to the men, as compared with their being in the over-crowded inside; but still it is an undue exposure of the men, and ought never to be done.

34. Are the verandahs generally wide enough to enable the men to move about and take exercise in the heat of the day?—Yes, they are so very often, when the verandahs are unencumbered.

35. You have stated that there is no fixed rule as to the cubical space. I suppose that there is none as to the area on the floors?—There is no established rule.

36. Some of the barracks are very lofty inside, are they not?—Some of the recently-built barracks are very high.

37. Some were built, I believe, by Sir Charles Napier?—Yes; one that was ordered by him to be built in Sind is a very fine barrack, but the locality is considered unhealthy.

38. His theory was, that the only way to secure sufficient cubical space for the men was to build an apartment so high and so narrow that it was impossible to add to the number of the beds?—Such a theory is unfortunate.

39. What are the means of ventilation used in the barracks?—Natural ventilation always.

40. Are the windows in about the same proportion, or are there more or fewer, as compared with similar buildings in this country?—There is no fixed plan as to the window or door construction.

41. Are there any means of cooling the air?—The punka, for agitating the stagnant air, is the one generally employed, and I believe it is the best. It removes from around the body of a sleeping soldier, or a sick soldier, as the case may be, the stagnant air which is apt to become corrupted. There are also wetted tatties, which are used during the hot winds, for cooling, by evaporation.

42. Are the windows always provided with jalousies?—Generally.

43. I suppose you have been in barrack-rooms at night?—Yes.

44. Are they offensive?—Those of Fort William used to be very much so.

45. I suppose they must have much more open space in them than in similar buildings in England?—Yes.

46. They therefore would be sweeter?—Yes. In hot weather, and in the rains, they open the doors and windows, which is a matter of necessity, owing to the rarification of the air, and the necessity for breathing room.

47. Have you any remarks to make with regard to the prison cells?—I am only personally acquainted with those in Fort William, in which I served as a garrison surgeon, and they were very confined indeed. I thought they were desperately bad.

48. Are there generally good means of cleanliness in the way of washing places and ablution rooms?—Not in any organized and systematic way; but water, through native agency, is generally not difficult of procurement throughout India; labour is cheap, and native labour abundant.

49. It is cheaper, I suppose, to get it through the natives than through pipes?—I suppose it is, except that in the one case,—the pipes,—the supply would be constant, and open to the immediate wants of the soldier and his family when he has one.

50. (*Col. Greathed.*) Do not you think that if you were to do away with the water-carriers, as a part of the permanent establishment of a barrack, the greatest possible inconvenience would be found in the case of moving or marching a regiment for the want of these men being regularly employed with the regiment, and always moving with it?—I think generally, throughout India, labour is so easily procured that that description of person along with the dhoolie bearers, and the drivers of carts, could always be obtained at a large station within a few hours' notice; they are generally glad to be employed by the Government in any shape. It may be a question whether, in every description of establishment, some should be retained

permanently on the musters; I think that a portion of every establishment might with advantage be kept up permanently.

51. Do you not think it of the greatest importance that the men who go into action, as these men do with the soldiers, should personally know the soldiers, and be well acquainted with them?—Assuredly, it is of the greatest importance, in reference to field service.

52. (*Chairman.*) Have you any remark to make with regard to the means provided for cleansing and draining the bazaars, and whether they are in a satisfactory state?—They are quite as deficient as the stations of which they form a part.

53. What would you suggest for the purpose of improving them?—Systematic arrangements under a medical police, which are now well understood by all intelligent medical officers.

54. (*Col. Greathed.*) Are there not sanitary officers in every cantonment?—Not yet.

55. (*Chairman.*) Of what material, and quantities, did the ration consist in India, in your time?—It contained a sufficient quantity of animal and vegetable matter, good bread, and generally good meat, in my time, so as to give satisfaction to the soldier and to his officers.

56. Are the men supplied with food as in this country, and is a stoppage made from their pay, or how is it done?—They are supplied by the commissariat in Bengal with everything, except certain vegetables and little comforts, which the men are allowed to procure for themselves.

57. The ration, I believe, is of a very different nature from that which is issued in England?—No, not very different. In India it has been improved of late years.

58. Are bread and meat issued in the same quantities?—Yes. The bread is still not what it ought to be.

59. The commissariat issues other things besides?—Yes, it does.

60. Does the commissariat issue tea, coffee, and sugar?—Yes.

61. Do the men get their vegetables as they do elsewhere?—Yes. As you are referring to that subject, I may mention, that in the Madras presidency an attempt was made to give a money ration to the soldier, and it proved injurious.

62. The intention was to enable the man to feed himself?—Yes; under his non-commissioned officers, and captains of companies, but it was abandoned. I heard so when I served in Bengal; but in the case of married and steady soldiers, I should think it an excellent plan.

63. I suppose, the reason why the experiment failed was, that when the money ration was issued, it was expended very much in spirits?—Very much so.

64. Is there a spirit ration issued to the soldiers in India?—Yes, or they are allowed to have it at the canteen, which amounts to the same thing; in the field it is issued.

65. Is there any restriction imposed upon the sale of spirits to soldiers in the bazaars?—Restrictions are always attempted, but then the evil of open cantonments throughout India, is the difficulty of maintaining a proper system of medical police, especially in regard to the use of the pernicious bazaar spirits.

66. I suppose, in your opinion, the use of spirits is eminently disadvantageous in a climate like India?—I think, with respect to the young soldier, it is very injurious to him, and that beer or porter would be far preferable, and, indeed, the same rule applies to the older soldiers. We know that on the march the soldier can get no dram ration but what is issued to him, and I do not think that that is injurious.

67. Are measures taken to provide them with beer and porter?—Yes, and at some of the hill stations it has even been brewed of tolerably good quality, but it does not keep.

68. And successfully?—Yes, with the exception stated.

69. Are there any other drinks that it might be advantageous to supply to the soldier?—The malt

liquor I conceive to be the best, and the free issue of tea and coffee I think is highly desirable.

70. They are issued, are they not, as part of the ration?—Yes, tea, coffee, and cocoa.

71. Will you be good enough to state whether proper regulations are in existence with respect to the hours of drill, and also whether there are sufficient means of amusement provided for the soldiers?—With respect to the drill I apprehend that the regulations are generally good throughout India, and are pretty uniform; but with regard to exercises and amusements they still depend too much upon the locality and upon the general officer commanding a division, and upon circumstances other than what I apprehend they ought to be; these matters should be systematically arranged, for they are matters of great importance.

72. And they must vary according to the part of India in which the soldier is placed, as the temperature may vary?—Yes, and the season of the year.

73. (*Col. Greathed.*) Are the means of recreation very deficient in India?—They are generally deficient and too much dependent upon the will of persons.

74. (*Chairman.*) That is necessarily so in a hot climate, is it not, where you have to deal with men having very little notion of amusement apart from necessary exercise?—Yes. But in some regiments I know that in-door amusements have been carried to a very great and beneficial extent, and the prosecution of the trades of the men encouraged for their own benefit. In the 3rd Bombay Fusiliers, of which we have a health history extending over seven years, by Dr. Arnott, there are remarkable instances of improvement in the men's moral character from these indulgences; courts-martial and crimes diminished in proportion as the men were occupied for their own benefit. I may mention upon that subject that it has been the opinion of some of the most celebrated of the army surgeons at home, for instance the late Dr. Robert Jackson and Dr. William Fergusson, that it should be a principle to permit a soldier to do for himself whatever he can do without injury to his health or discipline, and I believe it is a sound principle.

75. With regard to the dress and accoutrements, do you think that any improvement could be made, or is there any improvement that you could suggest?—Most enormous improvements in all that concerns personal hygiene.

76. But a great deal has been done in late years, has there not?—It is being done day by day, but it requires to be done systematically and by order.

77. At present the men wear linen instead of cloth, do they not?—They wear very much the cotton fabric dresses of the country, which are better suited for them than linen.

78. And they wear wicker helmets instead of metal?—Yes, and that is a very important question which every person would like to see determined, namely, what is the proper head dress for a soldier in the various climates in which he has to serve.

79. With regard to the under clothing, there has been great difference of opinion as to whether the men should be dressed in flannel or cotton?—I think the general opinion among army surgeons, and I believe the general opinion of commanding officers, is that flannel is an essential part of a soldier's dress in the field. It is a question whether it is necessary for him in cantonments; but considering his reckless habits and well-known carelessness, I believe myself that it will be a protection to him even in time of peace. I think also that a complete flannel dress, to be worn immediately on coming in from the march, would be of great use in preserving health.

80. (*Col. Greathed.*) Do you not think that a cholera belt is a good thing to wear, and as good as a flannel shirt?—No; I think the evaporation from the surface of the body is so great in India, that it is necessary there should be a slow conducting material in the body dress of the soldier, and cholera belts are superseded by flannel shirts, and I think properly so.

81. (*Dr. Farr.*) How long is the flannel shirt

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worn?—That is another point that has caused the rejection of it hastily, both by officers in command and by surgeons; but in India there is no difficulty about washing; labour is so easily obtained.

82. (*Chairman.*) Suppose a man had issued to him two shirts, both of flannel, but of different colours, by which you could always secure that they should be washed once a week, would not that be sufficient?—Yes, for cleanliness.

83. (*Mr. Alexander.*) Do you think that the soldier should wear it night and day?—Most assuredly, for the diseases of India are in a large measure contracted by exposure during sleep. I may mention one station, and that an eminently healthy one, Bangalore, where a soldier upon lying down and falling asleep in hot weather, and during the rains, in a state of profuse perspiration, suffers from a sudden change of wind or a cold gust from the mountains, and he rises with a shivering fit, and with acute inflammation of the liver, and a flannel shirt there would be a great protection. Dysentery and all the tropical diseases result from sudden chills and exposure.

84. (*Chairman.*) What weight does a soldier usually carry in India?—He does not carry a knapsack, that is always carried for him; otherwise I believe he carries 60 rounds of ammunition, or 40.

85. And a native carries the knapsack?—Yes.

86. Or are they not carried in waggons?—They are carried in the carts of the country, or on camels, where they can be obtained.

87. The marches in ordinary times are conducted at hours which save the men from exposure to great heat?—They are usually conducted in the night, and that ought to be the case, except in the very northern parts of India, and in the very coldest weather.

88. When a new station is to be selected, what is the process that is gone through; who are the persons who are employed to make the selection?—Speaking of a great majority of the old stations, they have been selected by the general officer of a division for the time being, aided by any person whom he might think it proper to consult.

89. Generally speaking, I suppose they have been selected rather with a view to convenience in a strategical point of view than with reference to the healthiness of the site?—Presumptively it is so; but chance had much to do with it.

90. Is any distinction made between the stations of the barracks with regard to the Queen's troops and what were the Company's troops?—None whatever.

91. They interchange?—Yes.

92. Are there not certain stations appointed for the one, and certain stations or barracks appointed for the others?—Never.

93. You do not know what is done now as to the selection of stations?—It remains, I believe, exactly as it always has been.

94. Was there much epidemic disease when you were on service?—Enormous invasions of epidemics, chiefly of cholera and fever, which infested certain stations at intervals of time.

95. Could you at all trace them to any preventible causes?—It has always been found that epidemics fastest most firmly upon and remain longest in the worst stations. That observation applies to cholera, fever, and dysentery.

96. And has reference to questions of position, drainage, malaria, and so on?—Quite so, and all the local circumstances in fact, which go to constitute climate.

97. But in addition to that, you would say the condition of the barracks and bazaars, and the overcrowding, and the want of cleanliness?—Quite so.

98. And a good deal would arise from the different habits of various regiments, more or less addicted to intemperance, night duties, and so on?—Yes; I think that very much depends upon the individual character of the commander, which has ever been held amongst military surgeons to be of the utmost possible importance.

99. These would comprise a list of the causes to

which you would attribute the prevalence of epidemics at particular stations?—Yes; but of all the causes that go to foster and maintain epidemics, the ill selection of localities, the structural defects as to ventilation, drainage, cleanliness, and the personal habits of the soldiers, are the important questions.

100. When an epidemic breaks out, are there any precautions taken universally by regulation, or is it left to the discretion of the officers commanding, aided by their medical men?—It is left entirely to the discretion of the officers commanding, aided by such medical advice as they may call in, but there is nothing systematic.

101. Are there any regulations bearing upon that?—I do not think there are.

102. Could you suggest any improvements in that respect, or might not a code of regulations be formed?—A great deal might be done in that way, but a permanent result is to be obtained only by placing every selected station in a position of defence, if I may so call it, against the invasion of epidemics, by the application of all known sanitary appliances.

103. Such, for example, as draining?—Yes, cleaning, draining, and levelling, having a supply of pure water, improved structural arrangements, especially with regard to ventilation, and good habits of life in the men.

104. And proper space provided for them?—Yes.

105. Have you witnessed in the stations where you have been a great prevalence of liver disease?—Almost everywhere, but more in particular stations. I may mention Bangalore, which, although a healthy station, is one that is obnoxious to that disease from the circumstance that I have mentioned; but it is much more prevalent in Lower Bengal, for instance, than in the North-west provinces,—in the country of the great waters, the country of heat and malaria.

106. But the precautions which you would take against disease of the liver are not the same which you would take against an epidemic?—The precautions taken against disease of the liver, in addition to being of a general sanitary nature, ought to be very particular with reference to personal hygiene.

107. (*Dr. Farr.*) Have you generally found liver disease connected with dysentery?—Liver disease and dysentery are continually associated with each other, so as to be a most marked point of observation with all medical officers in the East Indies especially.

108. Do you think that liver disease is the secondary affection?—It presents itself as associated *ab initio* with dysentery; and it presents itself as a secondary circumstance in the form of abscess, either from purulent deposit in the liver, or from absorption from the ulcerated surface of the bowel.

109. (*Chairman.*) With regard to rheumatism which is not produced by the same causes, what precautions are taken?—Rheumatism is chiefly caused by sudden alternations of temperature.

110. There the flannel shirt would be beneficial?—Yes; there personal hygiene is necessary and warm clothing. But there is another form of rheumatism which I saw a great deal of in India amongst the troops. I was both assistant surgeon and surgeon of the General Hospital in Calcutta, which was filled with European soldiers of both services, many of whom suffered from rheumatism, produced by the application of cold to the system while under the influence of mercury. We used to term it mercurial rheumatism, a most detrimental form of disease, which causes the invaliding of a great number of men.

111. Is there much venereal disease in India?—An enormous extent.

112. I should have thought that in that country it would have been almost extirpated by police regulations?—Such were formerly enforced at the stations; and courses of inspection and locks were established, but they have been established and abolished, and established and abolished over and over again, so that I do not know what is now in existence, or whether there is anything in existence on the subject. It is in the same state of uncertainty that all the other sanitary arrangements are.

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113. (*Mr. Alexander.*) Amongst what class of men, as to length of service, did you find the largest proportion of cases of hepatitis, from seven to 10 years' service, or from 10 to 15?—I have generally observed that the liability to disease of the liver as well as to all other diseases in India has increased with the age of the soldier.

114. Are deaths from hepatitis rare after the first year's service?—Not rare. I have seen detachments of recruits of all the arms arriving in Calcutta, and generally a proportion of them has suffered from inflammation of the liver, fever, and bowel complaints as well.

115. (*Chairman.*) With regard to another disease, is scurvy common in India?—It has been seen in some of the mountain stations, owing, I believe, principally to defects in diet, but in some degree to climate.

116. Still there is an ample ration, and a great variety in the ration in India?—Generally, it is ample and various, but sometimes deficient in respect of fruits and vegetables.

117. Does the climate tend to produce that disease by exhaustion?—It is supposed that some of the hill stations have favoured the advance of scurvy along with deficiencies of diet.

118. (*Col. Greathed.*) Is there a deficiency of vegetables in the mountain stations?—That has been alleged to have occurred on the occasions I have referred to.

119. (*Dr. Farr.*) Vegetables are produced in gardens which often do not exist in the mountain stations?—Quite so.

120. (*Chairman.*) Where does the disease called guinea-worm prevail?—Very largely in the west of India, in the Bombay presidency, and in the central parts of India.

121. Is it not supposed to arise from the use of impure water?—It is often referred to that cause.

122. And do you think with truth?—It has been alleged as one of the probable causes; but in reality, the worm, when very small, penetrates the skin, and effects a lodgment in the cellular tissue.

123. Do you think it is at all increasing?—I have seen a great deal of it amongst officers within the last two years, more than I had ever seen before, owing to the large influx of European troops; but they were all from western or central India.

124. You see them when they come home here?—Yes.

125. Does the change of climate assist them?—The improvement in the general health helps the cure, the use of cold water seems to paralyze the guinea-worm and to favour its extraction.

126. Can they extract them in England?—Yes, under the influence of a jet of cold water I have extracted several.

127. In India I believe it is supposed that the natives are peculiarly adept in extracting them?—The delicacy of the native hand is very well adapted to it.

128. If the worm breaks what happens then?—It causes a halt in the cure merely; the remaining portion of the worm is sure to advance towards the surface, so that you can obtain a portion of it to be coiled round a little roll of plaster, which is the usual way of doing it.

129. Taking all the causes together which may be supposed to influence the health of the soldier in India, the climate, the local position of stations, the defects in drainage, proximity to marshes, bad construction of barracks, want of sufficient space, intemperance, unsuitable clothing, and exposure, which should you say is the one which has the most generally detrimental effect upon the health of the army?—Taking any one cause I should say that the union of heat with malaria constitutes the most powerful one in destroying the integrity of the European soldier's health, and conducing to his fall by disease.

130. Then it would appear that that which is the most effective in injuring him is also the least remediable?—Excepting the neutralizing effects to be obtained from purity of soil and purity of water and improved structural arrangements in barracks and

hospitals, and care in diet. These circumstances, where enforced carefully, go as far as can be to neutralize the effects; but a certain amount of destruction and deterioration of European health must result from a residence at the stations on the plains, even if the soldiers were put into palaces.

131. Still you think that there is a certain amount of precaution which could be taken, which would have a considerable effect in reducing disease and lowering mortality?—Yes, which would have the effect of greatly reducing them, particularly if in aid of the arrangements which I have ventured to suggest, the soldiers were periodically, I should say annually, removed from the stations in the plains to selected stations on the mountains.

132. Is there a difference generally speaking between the health of the officer, and that of the private?—A very great difference, and always in favour of the officer.

133. Is there a difference between the health of the officer and the civilian?—Yes. The civilian life is the selected life in Bengal, so much so that a comparison has been made in England by Mr. Edwards the actuary, between officers of various ranks and lengths of service, and civilians of various ranks and lengths of service, and the comparison is always in favour of the civilian.

134. Both of those facts tend to show that precaution has a very great effect in the result upon the climate?—Unquestionably.

135. You say that the true thing to do, is to give very frequent access to the hills?—Yes; and that is what I have stated in the paper I have drawn up as of the first necessity always in India, I look upon it as a State necessity.

136. Have you visited the hill stations yourself?—I have seen some of the mountains in various provinces.

137. Which of them?—I have not been up into northern India, and I have not resided at any hill station. I have merely seen that there are mountains everywhere, of avail for our purposes; and the daily observations of our medical officers all over India, since my time, go to establish the fact.

138. They are very wet, are they not?—Unhappily, the stations selected by the Government in India, have often been in the front ranges of the mountains, receiving the brunt of the south-west monsoon, and in the eastern portions of Bengal the rain-fall is counted by fathoms; but it has happened there as elsewhere, that at some distance in the rear of these foremost ranges, 40 or more miles farther back, the rain-fall is that of temperate regions, where the climate is comparatively dry and salubrious. Unhappily, the foremost spurs of these ranges of mountains have too often been selected, in neglect of those in the rear. Those who selected the stations were incompetent.

139. Are not those ranges in the rear a good deal higher?—Taking the elevation to be the same, the climate is greatly better in the rear, and that is proved by comparing Simla in the Himalayas to Cheenoo, which is far inland, and where the climate is said to be better than that of many European countries. The same oversight occurs in Sylhet, and in Assam.

140. Generally speaking, as these are spurs from very high ranges, the farther you go in the greater the elevation you are forced to go to?—Perhaps so, but even with a lower elevation, the inmost range would be preferable, or with the same elevation the inmost range would be preferable, certainly, on account of its lesser degree of humidity.

141. It would of course increase the expense of getting there, the further you went in?—It merely implies so many more miles of road.

142. Does it imply the same facilities for procuring food?—I think so, generally.

143. Is there much pasture there?—Many of them have good pasturage, where there are levels.

144. Generally speaking, I suppose, the hill stations are supplied with food from the plains?—Always those which we have selected; but there are table-lands in India, which I apprehend to be suited

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for artillery and cavalry, where there is pasturage, water, shade, and means of cultivation.

145. At what sort of elevations do you consider these stations are most to be found?—The stations which have hitherto been occupied by the order of the Government of India, have been at a very considerable elevation, and I think in that matter we have committed an error; by carrying the soldier to so great an elevation as 6,000, 7,000, and 8,000 feet; it is very certain that we have removed him from the foci of malaria, but it has too often happened that we have carried him into the focus of another class of disorders, namely, bowel complaints.

146. Would not the change of temperature alone bring you within the range of bowel complaints?—It is the temperature and the humidity. This applies especially to Himalayan ranges.

147. If you take a man from the hot plains, where the whole emanations of his body passed through the pores of his skin, and suddenly transport him to any station on the hills, where there is a lower temperature, the pores of the body will become closed, and nature will seek another outlet?—That is true, and that also applies to a great mistake which has often been committed, namely, the removal of troops whose health has been damaged in the plains to the cold damp mountain ranges, which are only applicable to healthy men, and for the preservation of health. The mountains of India cannot be called to bear upon the cure of disease; they are not curative, but they are to a great extent preventive of disease.

148. What would you do for the purpose of restoring health?—I would seek a foreign climate, the best that could be found.

149. Australia for example?—That has been spoken of as a wonderful climate, particularly that part of it which is nearest to India, namely, Western Australia, respecting which medical officers serving in Her Majesty's army have made some very remarkable observations, as have Admiral Sir James Stirling and others.

150. Do you refer to King George's Sound?—In that quarter.

151. A proposal has been made to establish a sort of sanitarium for India at the Cape of Good Hope, and that invalided troops should be brought to that place?—The question will be one of comparison as to which is the better climate; no doubt there are good localities at the Cape of Good Hope, but the accounts from Western Australia are of the most remarkable character, as reported by the officers mentioned.

152. The sea voyage has of itself a very good effect, has it not?—Yes, the removal from the hot pestilential plains in India is in itself a vast gain; indeed, many stations on the seaboard of India, and probably some of the islands off our coasts, will prove curative of minor diseases, and preventive of graver forms of diseases.

153. (*Mr. Alexander.*) Australia is more out of the way, is it not more distant?—It is within a much shorter distance. By steam I think they talk of going to Western Australia in 14 days; it would be a question in both cases for the cure of disease, and I apprehend that the question would be settled by ascertaining carefully which was the best climate of the two. Medical officers state that Europeans only get ill in Western Australia from over eating themselves, which produces a severe form of dyspepsia, and others from lying drunk on the ground, from which they contract mild forms of rheumatism.

154. (*Chairman.*) Your notion is to make use of the high hill stations in India, not for the purpose of sending invalids thither to recover, but to send men in sound health for the purpose of preventing disease?—Solely and exclusively with those objects.

155. Would not that be a very expensive process?—I think not. I think that if troops soon after landing in India were placed in elevated positions which had been carefully selected and prepared for them beforehand, they would be maintained in a state of health and vigour, and they should descend into the

plains only for the purposes of exercise in cold weather, and for the purposes of the march in order to perfect the lower and the upper extremities, and to improve the general health.

156. Do you think that a large portion of the military force might be maintained permanently in garrison in the hills, but at stations from which it would be possible to bring them down to places where their presence might be required?—That is the very plan that I ventured to suggest to the late Commission on "the organization of the Indian army," and further than that, that even at the best selected and most carefully prepared stations on the plains no British soldier should remain longer than twelve months, and at the end of that time he should go for refreshment and invigoration to the nearest mountain station.

157. Taking him up first, I suppose, in the summer?—Taking him there by the end of February, or the beginning of March.

158. Would it be an advantage to send a regiment to the hills, upon its first arrival, before it went into the plains?—Assuredly; that would be the best of all; that a regiment, arriving from a temperate climate, should be placed there upon its first arrival, without any injurious intervention. Nor are the benefits to be derived from a pure and cool air in the mountain regions of less importance to the health of susceptible infancy—the stage of life in which, on the plains, tropical influences are most fearfully exemplified. Dr. Burke, late Inspector-General of Hospitals, states that Fort William, Calcutta, is one of the worst, if not the very worst, of the military stations in India for European children—the average annual mortality being above 160 per thousand. But wherever placed on the plains of India, the soldier's child is observed to droop, to become pale, and to decay. The Principal of the Lawrence Asylum says that the children of British soldiers in the plains die so early that only about one in five is found surviving the fifth year of Indian sojourn, while in the mountains they flourish like children in healthy English districts.

159. You do not believe in the theory of acclimatization, that you may accustom a man to heat by keeping him in it?—No; all statistical observations go to disprove anything like acclimation in the East Indies. On the contrary, the disposition to disease and death increase by length of service and age.

160. The acclimatization theory seems to rest upon the supposition that if a thing is unwholesome, the longer you are exposed to it the less harm it will do you?—That is the theory, I suppose; but there is one thing which a soldier does acquire by a long residence in hot climates, and which was supposed to have become of considerable practical utility in the old European battalions of the company, namely, that the old soldier had learnt a certain amount of personal hygiene, which he imparted to the recruit when he joined, and that was considered to be especially the case with the artillery battalions.

161. That would account, would it not, for the better rates of disease and mortality in the Company's army, as compared with the Queen's troops?—Quite so, and conversely for the non-acquaintance of regiments with these traditional circumstances of precaution upon their arrival from England.

162. You would, if it were consistent with the military occupation of the country, distribute the troops upon consideration of health, selecting a station upon high ground, in preference to the plain?—Yes; and also that no soldier should serve at all on the plains, excepting at such stations as had been carefully prepared beforehand, such as the Government considered necessary for political and military purposes.

163. Is there greater facility for obtaining native spirits in the hills than in the plains?—One of the great advantages, which I venture to suggest, to be derived from the occupation of the hill ranges would be from the application of strict rules of medical police applied especially to prevent the introduction of spirits, and the impure intercourse of the sexes, which goes to increase the syphilitic and other venereal diseases to an enormous extent,—indeed, to an

extent to injure the British army in India in an inconceivable manner, for the men are injured not only by the disease, but by the treatment they receive, so as to render them thereafter doubly susceptible of all tropical diseases. The mercurial treatment, even when mildly and moderately used, is most detrimental.

164. (*Dr. Farr.*) Is that mode of treatment continued now in the army?—For syphilitic disease. I apprehend that it is not abused as it was, but it is still administered.

165. (*Chairman.*) Is there much difference in the hospitals in India, as compared with those in England, with regard to the accommodation provided in them?—There is the same want of strict attention to ventilation as there is almost universally in England.

166. Do they use the same kind of beds and bedding?—There is a very good form of cot used having a rattan bottom to it.

167. How are they arranged, are they placed between the windows or along a dead wall?—They are placed against the wall, whether there are windows or no windows.

168. Is the provision that is made for medical attendance and nursing different from that in England?—It is different in this respect, that there exists in India a subordinate medical department in every European hospital; one is a steward, who represents the commissariat of the hospital, and another is the apothecary who prepares and administers the medicine as it is ordered in the case book. They are a class of warrant officers who are carefully trained and well educated in the first instance, and they are so important, that in fact, no European hospital in India could do without them.

169. Is there not also a class of native attendants?—Yes; who are most useful.

170. Who take the place of orderlies in this country?—No, hospital servants; there are orderlies as in England.

171. Men who are taken from the ranks?—Yes.

172. Are not there attendants upon the sick natives too?—Yes, natives who attend the sick, and very useful they are.

173. Very handy, are they not?—Remarkably so; they are very attentive, sober, and industrious.

174. Should you say upon the whole, that the military hospitals in India are equal to those in England, or are they better or worse?—I believe that they are not surpassed by any hospitals in the world as to personal care and attentions.

175. Are the buildings ample?—The buildings are generally defective.

176. In what conditions are the latrines and drains?—They are deficient generally.

177. Is there much cleanliness, and are precautions taken in the way of lime washing, and so on?—There are ablutions; water is to be had generally, and it freely used by the native sweepers.

178. Do they limewash the walls frequently?—The walls are whitewashed periodically by order of the quartermaster general department—the barrack department.

179. Have you ever gone out to India with recruits from England?—No; but as first assistant and afterwards as surgeon to the general hospital at Calcutta for the reception of Europeans, and as garrison surgeon at Fort William, I had frequent opportunities of seeing and of often inspecting batches of recruits as they arrived from England.

180. What character of men were they, better or worse than those who enter the service here?—They appeared to be always of an excellent description for the artillery service. The recruits for Her Majesty's regiments, and for the Company's European battalions, both of which arrived together, were treated together, and their physical character appeared to depend upon commercial and manufacturing prosperity at home; they were sometimes better and sometimes worse.

181. I suppose the voyage out strengthened them very much?—They all arrived in improved health,

probably too robust and plethoric for so bad a climate as Calcutta.

182. (*Mr. Alexander.*) At what ages should you recommend that men should be sent out?—I think that no recruit at all should be sent to India, but that every man should go out as a thoroughly drilled soldier, and the nearer he was to the age of 23 the better.

183. (*Chairman.*) You think that the whole of his military instruction should have been given to him before he was sent out?—Yes, in a temperate climate. I know that this has occurred very recently, that boys who were sent out for the European cavalry regiments,—the permanent local force,—were most materially injured by the riding school, and the drill being carried on throughout the entire year, rainy season and hot season, as well as in the cold season; and those men ought never to have been subjected to such a drill in so unfavourable a climate, they should have undergone that drill in this country.

184. (*Mr. Alexander.*) As a general rule you would exempt men on their first arrival in India from a good deal of the drill which they have at present to undergo?—Yes, I would exempt them for the first year from any over-exertion of any kind where the circumstances of the service permitted it.

185. (*Chairman.*) According to your plan, no recruiting drill would be requisite, as they would have been made regular soldiers before they came out?—Yes.

186. And you would keep them at the dépôt from one to two years?—Yes.

187. Would not that add very much to the public cost?—Yes; I am of course confining myself to the sanitary point. It is a great question for the Government to determine; but I believe, referring to the age of 23, that in the French army, where these questions have been minutely entered into, it is held that no soldier is fit to encounter any hard work until he has attained the age at least of 23.

188. Men are taken here at the age of 18?—That is very well for the purpose of training and drilling in the climate of England; but I apprehend that he should not be sent out of that climate until he has been perfected in his drill, and confirmed in his bodily health.

189. Would not the expense of the additional drill at home be repaid, if the result was that there was a smaller degree of disease and mortality in India?—Most assuredly; but that is a point that is hardly at all considered by the general mass of observers. It is a most important one, and I believe it illustrates a truth of universal application, namely, that sanitary improvement all over the world, more than repays its own expenses.

190. (*Mr. Alexander.*) Are you aware of the mortality which takes place from the age of 20 to 23, and from 24 to 26? Can you give the proportions?—No; but I believe the law is of universal application both in tropical as well as in temperate climates, that disease and mortality increase with age.

191. (*Chairman.*) At present, do you know the length of time for which men are drilled before they are sent out?—The time I apprehend is very uncertain, and always too short.

192. It varies with emergencies?—Yes, quite so; with the call of service.

193. So far as the transit to India goes, you are of opinion that it certainly is a source of improved health to the men?—The climate, which the soldier has to traverse from the shores of England to those of India, is about the finest in the world; it is neither too hot nor too cold, and provided sanitary circumstances are attended to during the voyage, such as ventilation and cleanliness, and a regular system of watch upon deck, the soldier ought to arrive in India in the finest possible health, going round by the Cape.

194. (*Dr. Farr.*) What is your opinion with regard to the overland passage to India?—That has the disadvantage of being a rapid transit, without having

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the equable and improving climate that I have mentioned.

195. (*Chairman.*) You think that a man going to India by the long sea voyage would probably arrive in better condition than a man going by the overland route?—Yes.

196. (*Mr. Alexander.*) Is there not a great advantage in being able to transport the men rapidly, in case of necessity?—Upon the military question there can be no difference of opinion as to the superior rapidity of the one route over the other.

197. (*Chairman.*) Is there anything that you would suggest as an improvement in the mode of treatment while the men are on board ship?—The chief attention, I think, ought to be paid to ventilation, cleanliness, and diet. I apprehend that the diet has generally consisted too much of animal food, the salt ration in particular, and too little of vegetables and soft bread, which latter article ought never to be wanting to a soldier anywhere.

198. But could they have soft bread on board ship?—The French have it. They bake it; and I apprehend that, with the same attention on the part of the commissariat, it might be done.

199. (*Mr. Alexander.*) You would give more vegetables in lieu of a certain portion of animal food?—Yes.

200. (*Chairman.*) Lime juice is supplied on board ship?—That is always supplied; but it ought never to be required. I may mention, in reference to that question, that generally throughout India the arrangements for the cure of disease are admirable, but they are not at all so for the prevention of disease; for this greatest purpose they are almost universally wanting.

201. You have stated, that 23 is an age before which you think men ought not to arrive in India, can you state after what age he should come back again, or how long you think that a man can safely remain in India before the climate will have a visible effect on his constitution?—I think that if a soldier was treated as I have suggested, that he should not come to the plains, except for the purposes of exercise in the cold weather, and that he should for a large proportion of his time occupy the mountain ranges and the table lands, which are everywhere to be found throughout India, he might at least expect to be on a footing of health and longevity that has been found to exist in the mountain ranges in Jamaica, where the health of the British soldier has been compared with that of the same men in England, and where the mortality, I believe, has been under 22 per thousand per annum. I believe that the same amount of immunity from disease, and the same prospect of length of service by residence in the mountain ranges, may be secured in almost every province in the East Indies, and the daily reports from India on the newly-discovered mountain ranges go to establish that fact.

202. Have you ever accompanied troops during their transit to the interior by the rivers?—I have only seen that in respect to the army in Burmah. I saw British troops conveyed up the Irrawaddy on the occasion of the Burmese war. That is all the experience I have had of river communication.

203. Is that a matter that is well arranged with regard to the fitting of the vessels, and so on?—It is not so well done as it ought to be, nor so well regulated. It is often done under the pressure of circumstances, the service demanding the presence of troops at different places, without reference to the season, and without many comforts which the soldier ought to have. I believe in that respect that the introduction of railways in India will be an enormous benefit to the health of the soldier, by transporting him speedily to the colder regions in the north-west.

204. Are not the banks of the rivers in India extremely unhealthy?—The banks of the rivers where they are low and marshy, are extremely unhealthy, but generally speaking the banks of the Ganges, with which I am best acquainted, are not of that character, and the soldier very soon gets out of the country of

the great waters, namely, Bengal proper, and gets into the central province of Behar.

205. The men during their transport on the rivers are not exposed to any unhealthy influences?—No, excepting on landing: when they are on the water it is all very well provided, the accommodation on board is generally suitable.

206. (*Dr. Farr.*) Where do they obtain their water from?—Generally from the rivers, allowing the sandy particles to gravitate to the bottom of a vessel: when they land they usually have the benefit of tank water.

207. (*Chairman.*) What length of furlough are the men usually allowed in India?—There has been no systematic furlough at all for the European soldier that I am acquainted with.

208. Nothing but sick leave?—Hardly that, I think. None but the officers got sick leave in my time. I do not think that any system of sick leave has been established, until the other day, when non-commissioned officers were permitted to come home on furlough.

209. (*Dr. Farr.*) Does that refer to the two services, both the Queen's and the Company's?—I think it applies to both. It has been too much the custom in India, in chronic states of disease which follow upon acute tropical affections, to keep a soldier in hospital or to send him to mountain ranges which were very unsuitable for him.

210. (*Chairman.*) Do you know what proportion of men and officers are usually absent on furlough or sick leave?—I do not.

211. Upon your principle of moving the men periodically to the hills, you would avoid the necessity for so much sick leave?—Quite so, and there would be an enormous saving in the cost of buildings and the treatment of disease.

212. You would not suggest any improvement in the present practice as to furlough, but you would endeavour to make it, comparatively speaking, unnecessary, by moving the men to healthy stations before their sickness, instead of afterwards?—I would dwell in the most emphatic manner upon the importance of every measure of prevention so as to secure the utmost amount of health to the men consistently with the service in the country. It is the duty of the State to place the British soldier in the best climates to be found within our Eastern dominions.

213. What are the diseases on account of which men are principally invalided from India?—Of all the diseases in India, by much the most prevalent is fever. Remittent and intermittent fevers are the great diseases: next in frequency and importance come the bowel complaints and dysenteries of India: after that diseases of the liver and cholera. These are the great divisions of tropical disease, and from their immediate results or from their remote consequences arise the sicknesses and deaths of European soldiers in India, and it is for the treatment of chronic affections, structural and organic affections, that I apprehend some climate beyond the shores of India is necessary for the cure of a great number of our soldiers, and cures to be aided by a climate which India does not possess.

214. You have, I believe, put upon paper a resumé of your opinions upon all these subjects?—Yes.

215. Will you have the goodness to read it to the Commission?—Before proceeding to place before the Royal Commission the questions suggested in the paper I am about to read, I beg leave to state that it refers to the following subjects:—1. The selection, for occupation by European infantry, of the best mountain stations to be found, on careful examination, within our eastern possessions. 2. The selection of the best table lands for occupation by the European artillery and cavalry. 3. The careful selection and improvement of all such stations on the plains as must, for political and military purposes, be occupied by British soldiers.—N.B. These subjects have reference to the preservation of health, and conduce to the promotion of military efficiency. 4. The selection of the foreign climate best suited for the cure of the sequelæ to the acute

tropical diseases in Europeans.—N.B. This last has reference to the cure of disease only, and is supplementary to the first subject; while all the subjects taken together, constitute the first and greatest considerations which can engage the attention of the authorities. The circle of investigation will thus be completed, in so far as the all-important questions of the prevention and cure of disease depending upon climate and locality are concerned.

On the CANTONING of BRITISH TROOPS in the MOUNTAIN RANGES throughout INDIA.

"1. The recent military and political disturbances in India, and the enormous increase, consequently, of the European forces there, have given additional interest and importance to all the questions affecting the preservation of the British soldier's health, while they suggest many grave and cautious measures of general policy for the future. In the first rank of sanitary precaution most assuredly stand the removal of the great bulk of our forces to the elevated ranges throughout our eastern possessions. The real strength of the British empire, as depending upon the health of the European forces, has never, in India at least, been either appreciated or economised with sufficient skill. The science and art of military hygiene must be brought into full and free operation in our armies at home and abroad, and then it will be found that a much smaller number of recruits than has ever yet been reckoned will sustain our musters up to the required points, both as to numbers and efficiency.

"2. Setting aside for the moment the urgency of hygienic precaution on the score of humanity, and of financial considerations, I question whether, as matter of fact, an European army of eighty or even of fifty thousand men, can, in the present manner of recruiting, be effectively maintained under an annual decrement, by all causes, of 120 per thousand, such as has hitherto resulted from the occupation of the plains of Hindostan by British troops.

"3. Facilities for recruiting will not increase at home with peace, commercial and manufacturing prosperity and plenty, not to mention the annually increasing inducements to emigration into our various colonies. In time of war, I question whether the smaller garrison could be maintained in India under the present rate of mortality.

"4. The influence of the press too, both at home and abroad, is not to be overlooked, as affecting the question. For one man who read newspapers at the beginning of the present century, five hundred read or are read to in our day, and the results on the economy and discipline of our land forces, silent though they proceed, are sure, ere very long, to become of vast importance for our good or evil, just as the ruling powers of the day may direct and guide the event. We have educated the masses, and they have learnt to organize strikes and other associations. To judge aright on this question, we must look carefully back to the condition of our army in former times, and watch the simple and silent character of the changes it has undergone, before we can hope to arrive at safe conclusions respecting the future.

"5. I venture to throw out a suggestion, which, to some, may appear irrelevant, but which in reality is closely connected with my subject, namely, that the influence of the press on the recruiting of the European army of India is likely to become very powerful. I am thoroughly satisfied that if our British battalions are made to serve and to suffer unnecessarily on the plains of India, there to die as hitherto, the recruiting for that branch of the national force will speedily come to a stand still, and that mainly through the influence of the press.

"6. I have said 'unnecessary' service on the plains, because I hold that nothing short of a proved necessity can warrant the condemnation of the British soldier to a residence on the hot and pestilential low grounds of India. It is by reducing our garrisons on the plains to their minimum, by placing them in field works open to the winds, in stations of proved salubrity comparatively, and by relieving them at the end of every year, and removing them for mental and bodily refreshment and invigoration back to the higher grounds, that their health and contentment may, in my view of the case, be preserved. Hitherto under the ramparts of our old forts and in our badly selected and ill-arranged stations and open cantonments, our men have sank away at the well-known rate already mentioned. But I may here observe that the constant and familiar spectacle of such unnatural losses of men, is as prejudicial to the moral improvement of the individual soldier, as the aggregate loss is destructive of endeavours to maintain or to augment our forces. As it is, the time expired men from the British regiments in India are beginning to return

home in annually increasing numbers, owing, it is said, to dislike of the country, and to service in the unhealthy plains. To prevent the continuance of a habit so injurious alike to the efficiency of the garrison of India and to the progress of Indian finance, both officers and men should be made to feel contented by removal to the healthier localities of the country; a beneficent object, to be promoted on every ground of sound policy. If the natural wants of the case, involving only a pure and cool air, with the means of exercise and amusement, be not anticipated, the moral and physical necessities of the European garrison will settle the question by the arrest of recruiting for India, and by the premature return to England of the limited service men, two rapidly exhausting courses, for the prevention of which the remedy is now at hand, if we would but apply it. By persisting to confine our British soldiers to the dreadful monotony and endless miseries of barrack life in the plains of India, we shall burn the candle at both ends, and leave the ultimate settlement of an important question, now very easy of being settled, to be concluded in a manner injurious to all authority.

"7. In order to render military exercises conducive to health and efficiency we should bring down our battalions upon the plains in every cold season, there to be perfected in the march and in the fire, the two requisites, according to the highest authority, which go to make a complete soldier. Another advantage of the hill stations will be that the young recruits may there be drilled and trained without injury to health. It is by combining the sanitary with the political and military requirements of our position in India that we may hope to maintain our rule in the East;—a circumstance hitherto overlooked in our administration.

"8. And let us hope that antagonism of races and unworthy animosities may soon give place to peace and good government, to a general disarming of the people throughout Hindostan, so that thus our European troops may not be any longer required for purposes of overawing and coercing armed subjects. Were it only for the repression of turbulent action in religious fanatics and the outbursts of opposing creeds, disarming should at once be carried out universally, as a measure beneficent to the people beyond all others.

"9. That which has been done so easily and effectually in the warlike kingdoms of Lahore and Oude may surely be done, even with greater facility, elsewhere. But however this may be, it can never serve the purposes of the Government to destroy British troops by endemic and epidemic diseases contracted in the performance of duties which ought not to fall upon them. To employ Europeans thus in India is but needlessly to throw away our strength. This sacrifice, if unhappily it must be made, will have to be proved, not only to be necessary to us as the rulers, but also to be useful to the natives of the country. England will be reconciled only to sacrifices which are shown to be inevitable. The Turks, who are far outnumbered in the European portion of their Empire by their Christian subjects, have for ages mastered the latter populations, simply by the act of disarming; and we are not unfamiliar with temporary disarming Acts, even within our own free United Kingdom.

"10. By locating the main bulk of our European forces in the hill ranges, on the other hand, we obtain advantages so great as to assure at once the safety and security of our eastern empire with the least possible deduction from our strength. The measure of precaution suggested, then, appears to me to be a State necessity.

"11. We know that in Jamaica the simple act of removing British regiments from the plains to an elevation of some 2,500 feet has been attended with the most beneficent results, the annual mortality, which used for ages to be 130 per 1,000 and upwards, having sunk at once to 22 per 1,000, or about the average of the troops serving in the United Kingdom, while the survivors, unlike their comrades on the plains of India, enjoy an European condition of health. If it was necessary in former times to retain 20 out of the 30,000 British soldiers, forming the then garrison of India, in the plains, it cannot be necessary to keep 60 or more thousand men there now under conditions with which, unhappily, we are but too well acquainted. Can we indeed spare men so well as to be able to afford to sacrifice them at such rates?

"12. The simple enumeration of such facts as these will render a lengthened detail of advantages unnecessary; and that India possesses all these geographical advantages in larger measure, and to a greater degree of protective influence, perhaps, than our West Indian possessions, no one can reasonably doubt.

"13. The truth should be every day repeated by us, that it is really the climate, and not internal or external enemies that we have to dread in India. What, indeed, has the British power to apprehend from the natives so long as we retain our recollections and our common sense?

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The suppression of petty emeutes, and the chasing of refractory chiefs,—employments the most destructive to health,—must therefore be committed to other than European hands. If we pursue a policy of justice, we shall not require European soldiers for purposes of coercion or repression. It is by good laws, by a well-ordered military police, and not by an European army of repression, that our native subjects are to be held in order. If we are to retain our hold of India to any good purpose, we must have the people and the climate on our side.

"14. I have in my letters to the chairman of the late Court of Directors, of dates the 12th of August and 1st of December 1857, indicated the details of investigation necessary to the establishment of permanent camps and cantonments in the mountain ranges all over India, and I believe they will be found sufficient. But there is one other very important caution which I would here beg leave earnestly to impress on the authorities in reference to this subject, and it is, that no hill station be permanently occupied or founded until its salubrity shall be tested and proved by years of actual residence, first by natives and then by Europeans; the men being meanwhile placed under cheap and lightly-constructed huts. The neglect of this simple precaution, obvious though it appears, has occasioned much unnecessary disappointment, sickness, and death amongst our European troops; not to mention much inconsiderate and unfounded disparagement of the very mountain climates of which we stand so much in need. It has also caused a waste of the public money.

"15. Medical police is of more importance in tropical climates than in any others, owing to the more violent, acute, and rapidly destructive course of disease in such countries; and the importance of the subject, together with the difficulties attendant upon its details of execution, have been most painfully manifested in all our open cantonments all over India. We may take it for granted, however, that in most hill stations the difficulty of approach, excepting by the authorized public road, would greatly facilitate the exclusion of two, at least, of the greatest banes of cantonment life on the plains, the poisonous spirituous liquors of the bazaars, and the venereal infection.

"16. A few sentries ought to be sufficient to guard a well-chosen hill station from these great evils; while our sad experiences on the plains prove that no amount of police establishment, no number of sentries, has ever been able to protect our old, ill-chosen stations. It is by those medical officers only who have watched the causes of destruction to European health in India, and who have studied its topographical and medical statistics, that the grave national importance of this subject can be justly appreciated, in reference to syphilis especially. But the resulting evils are not confined to the individual, or even to the existing generation. Were there no considerations which recommend the selection of hill stations for British troops in India, other than those here referred to, I venture to say that they would yet be paramount. If the mountain climates of India did not possess that which they are known to enjoy, namely, a pure, cool, and bracing air, still, I repeat it, the two considerations named ought to give them a preference. The strength of the British army of India must be counted not by the muster-rolls, but by its soundness of health and its consequent real efficiency, both on moral and on sanitary grounds.

"17. I would here observe, that two circumstances of neglect or oversight have hitherto materially retarded the useful application of the mountain climates to the wants of the British soldier in India, and led to hasty and erroneous conclusions respecting their advantages, namely: first, the sending regiments into the hills which had been seriously damaged in health by fevers, and bowel complaints especially, while serving on the plains; and secondly, the inconsiderate and hasty construction of barracks and hospitals upon hills the salubrity of which had not been practically tested by some years of previous residence—stations which, through original ignorance and neglect, it may be necessary to abandon. It cannot be too often repeated that it is to men in health, and as a means of preserving health, that the mountain ranges throughout India can be beneficial."

"18. Supplementary to the question of the mountain climates, as preservative of health in India, I beg leave to call attention to another requisite, second only in importance to the other, namely, the curative influence in the sequelæ to acute tropical diseases of certain climates to be found in Western Australia—places of resort in sickness, for the want of which our soldiers have perished annually in India in large numbers.

"19. When the acute disease, whether it has been malarious fever, dysentery, or inflammation of the liver, has been arrested in its progress, so as immediately to save life, there still follows but too often chronic visceral diseases, for which

the climates of India, whether of the plains or the mountains, offer aggravations rather than cures.

"20. Here, then, we must seek for foreign aids, for aids which are not to be found in the climate of England. Under the physical, social, or moral circumstances of the soldier, he still requires the assistance of the State in a climate which shall not be too cold or too warm. The winter and spring seasons of Europe, even if placed in a well ordered general hospital, must prove prejudicial in many of the secondary forms of disease above mentioned, as compared with a milder air; not to mention the remoteness of home, with the costs and the trouble of a double passage.

"21. The climate of Western Australia, so far as my inquiries and those of qualified medical officers who have served there have extended, affords advantages of unequalled character and extent for the restoring the health of invalids suffering from the sequelæ to tropical diseases of every kind; but as ample information on this most interesting and important subject will be obtained from the best informed quarters, I need not offer further observation on the subject. The mountain ranges of India present the highest means of preserving health, while the climate of Western Australia furnishes, probably, the highest curative means to be obtained from climate.

"22. It will be seen, then, that four means of vast sanitary importance conjoin to the proper disposal of the British garrison of India, viz: first, the careful selection of such stations on the plains as must, for political and military reasons, be occupied by Europeans, implying proper structural arrangements of every kind; secondly, the occupation of table lands by the artillery and cavalry; thirdly, the permanent occupation by the infantry of stations on the hill ranges throughout our eastern possessions, for the preservation and maintenance of health; and, fourthly, the selection of the best convalescent stations beyond sea for the care of such invalids as may not regain their health in India. On this latter subject I would observe, that if the reports of the medical officers who have served in Western Australia be confirmed by future experiences, we shall there have obtained a climate as nearly perfect as can be hoped for in any quarter of the globe.

"23. I would again beg leave to urge the establishment in our Indian armies of a well supported sanitary department separate and distinct from that ordered for the cure of disease and wounds. Personal hygiene, which must be left to the care of the regimental surgeons and the medical staff of general hospitals, ought necessarily to be separated from the general military hygiene—the preserver of armies. Not to go further back, it was owing to the absence of a reliable and influential sanitary staff that our armies perished at Walcheren, at Rangoon, in China, and in the Crimea. It has been through the want of such officers as I have proposed to introduce into our armies that, in all our expeditions, and in all our foreign possessions, our soldiers have melted away, destroyed by sanitary neglects in our camps, by unwholesome stations, and by defective barrack and hospital accommodation; stations selected by ignorance and which would have been condemned at the first glance of experience by a qualified medical officer of health.

"24. It would appear, from tables prepared by Sir Alexander Tulloch of British soldiers discharged from the Company's service, during six years antecedent to 1857, that the average period of service of those admitted to pension was 15 years 10½ months; while the average length of service of those discharged without pension was eight years and six months. The service of those who purchased their discharge, again, was but seven years one and a half months; making the general average 11 years and six months. Here we have a remarkable illustration of the deleterious influence of the climate of the plains on the European constitution.

"25. A return should be called for of stations on the plains that have been abandoned on account of their unhealthiness, and also of the number which ought to be abandoned on the same grounds.

"P.S.—I have not spoken here of the depressing influences on the mind and body, the loosening of the bonds of discipline, resulting from the constant observation of sickness, suffering, and death, if even existing but for short periods; for the subject would lead me into lengthened disquisition. I believe, however, that such a course of deteriorating service is even more detrimental to military discipline than the continuance of active warfare, as signalized by Napoleon.

"2. It is perfectly well ascertained (and I witnessed the fact on a large scale at Rangoon) that scenes of death harden men; indeed, there is a peculiarly desperate and horrid callousness, 'a brutality *sui generis*,' which is fostered by them. It is surely not well that our soldiers should be made on so many occasions familiar with scenes of unnecessary distress. These are considerations of a

purely moral nature; but they are eminently deserving the careful regard of Governments.

3. I have also abstained from referring more directly to the disposal of the corps of artillery and cavalry, as obviously they cannot be placed upon very high grounds. But we shall find almost as many table lands as mountains throughout India; in the former of which localities, many of them of proved salubrity, the two great arms referred to can be well placed, so as both to secure their sanitary welfare and their influence as parts of the great garrison of India.

4. In the experiences of the French army it was found in the wars of Napoleon that soldiers, the natives of the southern and middle departments of France, sustained the heats of Egypt and Syria, and also the frosts of Russia, better than soldiers in the same ranks, the natives of the northern departments of France, of Germany, and of Holland.

5. It was said at the time, and it has since been recorded by the first Baron Larrey, that the French soldiers of the middle and southern departments of France, stood the Russian winter on the retreat better than the pursuing Russians.

6. Robert Jackson declared that English soldiers, and Highlanders wearing kilts, bore the frosts of Holland better than the Dutch and the Russians with whom they served.

7. All circumstances go to prove that soldiers bred in temperate climates are better able to sustain great heats and excessive colds than such as are born and bred in warm or in the colder latitudes.

8. All the known experiences, French and English, tend to the conclusion that a residence in the temperate mountain regions of India, while preserving our men from sickness, would render them less susceptible of the effects of the heats of the plains.

9. The natives of Central Asia, of Persia, of Afghanistan, of the Punjab, and such as inhabit the mountain regions of those countries, are more healthy and vigorous when brought into the plains of India than the inhabitants the plains themselves.

10. The Goorkah battalions in our service have always been healthy when serving in the plains.

11. The Nipāl force recently employed in our aid on the plains of India, was in an effective condition of health.

12. The contrary supposition of all this would, indeed, go to prove that the keeping men in good health, in the first instance, tends only to make them more liable to sickness afterwards, and that men rendered sickly on the plains of India must become less sickly by being made to continue there."

NOTE ON THE MOUNTAIN CLIMATES OF INDIA.

Robert Jackson, who appreciated the value of the mountain climates of hot countries, says that "The choice of a proper position for the establishment of military quarters is not obscure or difficult. It is known to the scientific by a view of locality, and to the ignorant by experience."

It has been found in Jamaica, by the removal of British troops from the plains to an elevation of only 2,500 feet, that the annual mortality amongst them has been reduced from 147 and 130 per 1,000 to about 22 per 1,000 per annum.

2. There is nothing known in the climate of the East Indies which need preclude the expectation of similar results from the adoption there of similar measures of precaution. Several of the mountain climates of India, as that of the Neilgherries and others, are described by British planters as "the finest in the world." Dr. Hooker says of Darjeeling, that "its climate cannot be exaggerated for healthiness when compared with the plains of India." Mr. Hodgson, late Resident in Nepal, says of the central elevation of the Himalaya: "For months the thermometer hardly ranges 5° day and night, and that about 'temperate' of Fahrenheit, or the perfection of temperature; and altogether, the climate is one of the safest and most enjoyable in the world." Dr. McCosh, speaking of Kumaon, says: "The elevation above the sea is 5,000 to 6,000 feet, with a climate and vegetation almost European; and a residence here makes one forget he is in India."

3. But even in the table-lands of India, as those of Poona and Bangalore, some 2,000 and 2,800 feet in elevation, to which many more may be added, the annual mortality of British troops is reduced to about 30 per 1,000, although the regiments in question conveyed into those higher grounds the diseases of the plains in which they had previously served. In 13 years of the present system, according to General Tremeneere of the Bengal Engineers, 27,267 Englishmen have passed away, a large proportion of whom might have been saved, had they been placed on the mountains which nature has placed in our very path.

4. If such be the case, and Sir A. Tulloch has given

statistical proof of the fact, it is reasonable to anticipate that if we place healthy Europeans in stations of still higher elevations than the table-lands of Poona and Bangalore, we shall obtain still greater reductions in mortality.

5. Irregular and imperfect as have been the trials hitherto made of the mountain climates throughout India, they have demonstrated, on the whole, that European health and life may be greatly promoted and preserved; to a degree, indeed, nowhere to be obtained in the plains. General Tremeneere declares that, "in a military point of view, the access to the hills is one of the chief wants in India."

6. Mr. Grant, of the Bengal Army, Surgeon to the late Governor General, after relating the results of some of the least satisfactory of the experiences about the Simla group of hills, declares, nevertheless, "that the sanitary advantages of a mountain residence are not problematical, but have been real and important."

7. It is proved, for instance, that while the children of British soldiers stationed in Fort William, Calcutta, perish at the annual rate of 160 per 1,000, they are made "to flourish like children in healthy country districts in England" when placed in the Lawrence Asylums in the mountains.

8. The Principal of the Lawrence Asylums, above quoted, declares that "the children of British soldiers in the plains die so early that only about one in five is found surviving the fifth year of residence there."

9. On the other hand, hill ranges have been so misused and mismanaged as to produce only their worst influences, taking but little advantage of their best.

10. In 1844-45 the 9th foot and 1st Bengal Fusiliers, also the 29th foot and 2nd Bengal Fusiliers, were sent to hill stations, the two first named having been severely sickened by fevers, diarrhoea, and dysentery in Afghanistan and at Kurnool; and the two last by service in Sind, and by a scorbutic taint for years before. All four regiments, as might have been expected on removal to the hills, suffered severely from diarrhoea and dysentery.

11. "Of late years, as observed by Mr. Grant, regiments in a less unhealthy state have been sent to the hills, and there has been a very great improvement in barrack accommodation, as well as in the conservancy department."

12. The diarrhoea, termed in India "the white flux," when not contracted in the plains, would appear to be confined to certain stations in the Himalayas, as the Simla group of hills; for at Landour, Murree, Darjeeling, the Neilgherries, and Mahabeshwur, bowel disorders do not prevail. This circumstance, together with the existence in the Simla group of local sanitary neglects, has given rise to the expectation that some at least of the causes of disease in these last are of a removable nature.

13. Mr. Grant observes, justly, that in the plains "protracted diarrhoea of a malarious origin, associated with scorbutic taint, is by no means uncommon;" an important fact in relation to the subject here under consideration. When regiments thus tainted are removed to mountain regions, perhaps of doubtful eligibility originally, the results cannot fail to be disastrous. Here we have the high grounds used so as only to produce the worst influences.

14. Another fact related by Mr. Grant, and deserving of serious notice, is, that "he witnessed no evidence of this scorbutic affection among the hill people."

15. The elevation of the several hill stations occupied by the British troops on the northern frontiers of the Bengal presidency are stated by Surgeon Tritton to be as follows:—

Subathoo	-	-	-	4,200 feet.
Simla	-	-	-	7,400 "
Landour	-	-	-	7,300 "
Almorah	-	-	-	5,000 "
Kussowlie	-	-	-	6,200 "
Dugshai	-	-	-	5,400 "
Nynece Tāl	-	-	-	6,200 "
Sunawur	-	-	-	6,000 "

16. "Almorah is perched on an isolated hill, while Subathoo, with reference to surrounding mountains, is in a hollow, both being almost barren of trees."

17. "Sunawur has a southern, Kussowlie a northern aspect, both being abundantly wooded."

18. "Simla is in the heart of the mountains, its air all mountainous; while Landour has the expansive valley of the Deyra at its feet, and derives from it daily refreshing breezes."

19. The greater amount of cold and dampness, the greater amount of sanitary neglects, in one station as compared to another, will go some way to account for their relative unsuitableness for persons suffering from bowel disorders; but the whole question demands the most careful revision and consideration.

20. One thing seems to be ascertained, namely, that hill stations too closely surrounded by higher hills, and stations

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forming spurs, or situated on front ranges that border on the plains, thus bearing the brunt of the S. W. rainy monsoon, are not eligible for occupation by Europeans.

21. At Chenec in Kunawur, less than a hundred miles inland, and in rear of Simla, "the climate is dry, elastic, and invigorating; the sky is generally of a clear azure blue;" and while the Simla group of hills received a rain-fall of 45 inches in three months, that at Chenec was, Mr. Grant "felt sure, under two inches."

The Neilgherries are of the receded class of mountains, and have moderate rain fall, while the Western Ghats beng in front, receive the brunt of the S.W. rainy monsoon.

22. But although "it were difficult to find a climate more congenial to the feelings or more calculated to restore the invalid" than that of Chenec, yet Kunawur is regarded by Mr. Grant as "not adapted for winter residence, the cold being far too severe and penetrating, and the country being then unapproachable from the roads being blocked up with snow."

23. Mr. Grant, after presenting certain numerical returns, sums up his experiences as follows:—"The return No. 1 shows that, adverse as were the circumstances of the 29th regiment as regarded its state of health on arriving in the hills, and its accommodation there, still the mortality was reduced in the first year to nearly one-third of what it had been during the two previous years in the plains; and in the second year it became still further reduced, amounting scarcely to more than one-half of what it had been during the most favourable year from the arrival of the regiment in India."

24. "By the return No. 2 of the 60th foot, the comparison of results is not so decidedly favourable; yet the improvement in the first year of residence in the hills is remarkable and gratifying, so is the diminution of the admissions, especially as regards periodic fever in the second year; but with a singular and lamentable increase of mortality arising, probably, from concealed relapses of diarrhoea, passing into hopeless chronic flux."

25. "The return No. 3 shows results that are remarkably favourable to the climate of Dugshai, even as regards the mortality from bowel complaints; and I have added the return No. 4, to prove that this new station will bear comparison with Poona, reputed to be one of the healthiest, if not the most healthy, cantonment in India."

26. "It has been already remarked that children, although they suffer from hill diarrhoea, experience a singular immunity from its dangers. It may go on for a long time apparently not injuring their constitutions, and rarely running into dysentery; they look easy, and are stout and lively, although their stools are of a chalky whiteness. So far as my own observations extend, the hill climate is very conducive to the health of children, and I believe that this fully accords with the experience of others." General Tremenhare says, "they eat as much beef as children in England."

27. "I may here notice the success of that noble institution, the Lawrence Asylum; and I can offer no better proofs of the healthiness of the site at 'Sunawur,' and of the admirable internal economy of the institution, than are offered in the following extracts and returns from the last published report of its able and humane principal and secretary:—"The health of the children during the past year has been unprecedented in any former period. It is, of course, impossible to account for the great difference which is sometimes found to exist in the health of the same community at different periods; but it is not unreasonable to believe, that in the case of the Asylum, the precautionary measures employed may have tended to the desirable result. Boarded floors, warm covering for the feet, seclusion of the children in inclement weather, attention to ventilation and diet, improved intellectual status and physical constitution, and prompt medical care, all may have had their share, more or less."

28. "But, to the thoroughly English climate of Sunawur must be accorded the chief place among the causes contributing to health. Sheltered on all sides by higher ranges, yet open to the breezes from the various gorges in the surrounding hills, its climate is a happy medium between the winter cold of Simla and Kussowlie, and the summer heat of Subathoo, whilst, in a most important point, it has the advantage of most hill stations, that of an abundant supply of water."

29. "On the whole, it would, perhaps, have been impossible to have selected a locality better adapted for the purpose in view,—the raising a population thoroughly English in habits, in physical constitution, and in mental vigour." "The appearance of European children at Darjeeling," says Mr. Hodgson, "might alone suffice to prove the suitability of the climate of the Himalaya at 6,000 to 8,000 feet for European colonization, confirmed as such evidence is by that of the aspect and health of such

adult Europeans as come here with uninjured constitutions, and have led an active life since their arrival. Finer specimens of manly vigour the world could not show."

30. "Since the first commencement of the Lawrence Asylum in April 1847, a period of five years and nine months, in which the annual average number of children maintained has been one hundred and six, four deaths only have occurred. Of them, one girl died of consumption after one month's residence, she having arrived in a dying state. The second, a boy, died of quinsy, caught on his way up, on the third day after arrival. The third, a girl, died in a fit of epilepsy, in the first month of residence, her mother having died of the same disease. The fourth, a boy, died of whooping-cough acting upon a malformed chest; which last is, in truth, the *only* case in which death can be said to have ensued from disease contracted in the asylum, giving an annual average of death to strength of '0015. The general appearance of the children is fully equal to that of well-reared children in our healthiest rural districts in England."

31. "It was at one time supposed that children of mixed parentage could not be likely to derive the same benefit from a cold and bracing climate which might be expected in the case of pure Europeans. But this opinion has proved to be erroneous, as this class is found to improve in muscular strength and bodily and mental activity equally with their European compeers; and it is confidently hoped that, from their amalgamation with these last in the institution, they will, in process of time, lose all traces of native habits and feelings; and that at no distant date a race of Anglo-Indians will issue from the Himalaya hills, who will prefer claims to the confidence and respect of the Indian public, before which existing prejudices against this numerous and important class will gradually disappear."

32. The Principal of the Lawrence Asylum then furnishes "Medical Returns," of which the following is the summary:—

1850, ratio of sick to strength	-	-	4.11
1851, " " "	-	-	5.95
1852, " " "	-	-	3.02

33. Mr. Grant, recurring to the military experiences, says: "It ought further to be more particularly noticed that no healthy corps has yet been sent to any of the hill stations, on the contrary, almost all the regiments were in an inefficient condition, the constitutions of the men having been more or less broken down or tainted with malaria, and numbers of them suffering from intermittent fever and its sequelæ, enlarged spleen and liver."

34. "We know with what unequal force a morbid atmosphere will affect a body of men so predisposed and one comparatively healthy, located there rather to maintain health than to renovate it; and doubtless, therefore, with regiments in an efficient condition, the saving of life and constitution will show a proportional increase, as in the 22nd foot, which was comparatively healthy when it arrived in Dugshai."

35. "The real auxiliary agency of the hill climates in states of disease has yet to be determined; the best established facts are—the diminution in the admissions from fever, the general mildness of type, and the diminished mortality compared with what occurs on the plains."

36. "My own impression is, that to render the sanitary experiment completely successful, we must advance further into the interior of the Himalayas; and instead of confining the stations to mountain ranges that border on the plains, where the climate and vegetation have much of a tropical character, we must advance beyond the influence of the periodical rains to the vicinity of the snowy ranges, where we possess a climate as bracing and as healthy as that of Switzerland, with a soil equally productive and scenery equally grand."

37. "At a distance from Simla of less than 100 miles in a direct line, and only 140 by the old route, we find in the interior of Sunawur elevated and temperate slopes, on some of the vast mountain ranges which skirt the right bank of the Sutlej, and these sheltered and comparatively fertile spots are now being made accessible by means of the new Hindostan and Thibet road; instead of an atmosphere super-saturated with moisture, gloomy and depressing, we have here throughout the whole hot and rainy season of the plains a climate dry, elastic, and invigorating, and when mists arise they are attracted by the lofty snow-clad peaks, and rarely descend into the valleys; the showers of rain are few and gentle, and besides the almost complete absence of humidity, there is no evidence of miasmal contamination."

38. "The climate is powerfully tonic; appetite and digestion are improved, the languid pulse increases in force, the tone of the mind is restored, and there is a buoyancy and elevation of spirits, and a lightness and freedom about the chest which we seldom feel in the plains;

instead of the slow and uncertain convalescence at Simla, where we experience all the disadvantages of humidity in excess, there is immediate and manifest relief from the change; we are stimulated to bodily exercise, and so dry is the climate, and so modified the temperature by the proximity of the snowy ranges, that we may expose ourselves both by day or by night with impunity; even the shade of a tree forms a cool retreat, and most travellers have no other protection than a small flimsy tent, which when rolled up does not form a coolie's load."

39. "In fact, it were difficult to find a climate more congenial to the feelings, or more calculated to restore the invalid, and as yet the results of experience fully warrant the warmest eulogy of it. For cases of chronic bowel complaint, and that large class of rheumatic syphilitic affections which is rarely benefited, but often aggravated by residence in our present hill stations, it is admirably suited; so also with cachectic subjects, and those suffering from periodic fevers and their sequels. The only exceptional cases would be diseases of the heart and a few affections of the lungs, for which the stimulus of a rarified atmosphere is injurious; but all such cases are unfit for a mountain climate, and they ought never to be sent to the hills."

40. "When this magnificent region, as yet but little frequented, shall have been made easy of access, it is much to be desired that a convalescent depôt may be established in it. There are few obstacles really in the way of such an experiment; the additional expense incurred on account of its remote position would be fully counterbalanced by the favourable results to be confidently anticipated."

41. "The soil is rich and productive of as fine vegetables as I have ever tasted. Supplies, which are now dear, will be cheapened by the opening of the new road. Wood is plentiful on the spot; water is good and abundant, the rivulets being numerous, and never drying up, as at Simla."

42. "Some of the mountains have a moderate slope towards the Sutlej, and are laid out in terrace cultivation; here every variety of temperature is within easy access, for in the lower lines of terraces, near the banks of the river, the climate is as warm as in the plains, and thus in the ascent of one mountain side there may be observed the vegetation of two zones; the plantain at the lowest level, about the centre the vine, higher still the apricot and the peach, and highest of all the brambleberry, the strawberry, and the rough whin-bush, which last spreads its prickly arms on the verge of the snow line."

43. "The vine grows luxuriantly in the open fields, and, considering how little care is bestowed on its culture, it is surprising that the grapes should be so large and luscious as we find them; there are about ten varieties, and they are so plentiful that a basketful may be purchased for a few annas. For the invalid they would be a valuable article of food, and it would not be difficult to prepare from them a very tolerable wine for ordinary use."

44. Mr. Grant concludes a very able and truthful report on the stations in the Himalayas by "the expression of his opinion that it would be scarcely possible to overrate the boon, both to officers and men, of the establishment of a sanitarium in Kunawur, as an auxiliary agent in the cure of many cases of functional disorder and chronic disease, for which the humid climate of our present hill stations has been found, after many years experience, to be wholly unsuited."

45. Out of some ten or twelve different mountain regions and hill stations in southern India described by Captain Ouchterlony and Dr. Baikie, in their evidences before the Committee of the House of Commons on Colonization and Settlement in India, I will here confine my notice to the Neilgherry mountains, being as yet by far the best known, and "standing unrivalled in the entire range of southern and central India." Captain Ouchterlony not only recommends that "the mass of the European force for the protection of southern India shall be located in the hills," but that they should be made the "seat of government," the climate being described by many as "far superior to that of England."

46. "From tables of the temperature on these hills," says Dr. Baikie, "it will appear that the mean temperature of the year, the mean maximum and mean minimum, bear about the same relation to each other as in England, but are about ten degrees higher, while the daily range is somewhat less. The highest observed temperature in England, and the lowest, are greatly above and below respectively the corresponding points on the Neilgherries; that is to say, the extremes in England are greater. The power of the sun's rays, another most important point, is considerably less on the Neilgherries than in England."

47. "The average mean temperature is 58 degrees," while

"the comparative lightness of the S. W. rainy monsoon is such, that although prolonged, the quantity of rain is very small; it is only about 44 inches in the year, against 120 inches on the Western Ghauts."

48. The rain-fall diminishes as we proceed eastward, that is, as we recede from the exposed western front. This "difference is so great that, within 15 miles 'Maha-bleshwur' there is only 57 inches against 300."

49. "Their adaptation for stationing European troops is, I should say, the very best in India, from their great facility of access, the mean rate of temperature, and their great healthiness for Europeans."

50. "The men we had on the Neilgherries," says Captain Ouchterlony, were highlanders of the 74th regiment, fresh from England, and we never had a sick man; sickness was unknown among the men; they were able to drill any time of the day; pieces of garden ground were given to them, and they were the happiest men I ever saw. The engineer had large working parties of these men, and gave them two shillings a day; they became most useful servants of the State as well as trained soldiers; they are now building their own barracks."

51. "Before quitting the subject, I would beg leave to suggest the importance of establishing a school on the Neilgherries for the education of the children of the European troops serving in the Madras presidency, similar in plan and principle to those in operation, and I believe with the greatest success, on the Himalayas, and on Mount Aboo in the Bombay presidency. The mortality amongst young children nurtured in low-country barracks is fearful; and I believe I am within bounds in stating that scarcely one child in four reaches maturity."

52. There are considerations of a general nature attaching to this subject, and which I think ought not to be omitted. Colonel Lloyd and Major Herbert, of the Bengal Army, the officers who first visited the Darjeeling range of mountains, were so struck with the advantages presented by the climate, that they declared that settlements in the hill districts generally throughout India would tend more than any other circumstance to attach English families and capitalists to the soil of India. "That the Himalaya, generally speaking," says Mr. Hodgson, "is a region eminently healthy can be doubted by no competent judge, and is demonstrable at once, and readily, by pointing to the finely developed muscles, pure skins, cheerful countenances, and universally well-formed, strong-boned bodies of the native inhabitants, whose health, strength, and capacity of enduring toil and carrying heavy burdens, are as notorious as are their exemption from bodily malformations and from most of the direct diseases to which flesh is heir, as well in the tropics as in the high latitudes of Europe; results owing to the pre-eminent equability and temperateness of the climate, added to the simple active habits of the people."

53. Dr. Hooker, speaking of the same range, adds, that hill settlements generally have had already a great effect in civilizing the natives of India, and he thinks that this influence will go on increasing. The civilizing effect became apparent "at once;" the people from the surrounding countries having "come in to take service as police and domestics, and settled as cultivators; they brought provisions for sale, they aided in building houses and erections of all kinds, and they assisted in conveying things from the plains to the hills." Formerly "there was hardly a person there; it was all but uninhabited." Now it has increased with a "rapidity similar to that of an Australian colony."

54. Referring, finally, to the question of strategic points, I would only observe that, as yet, their very numbers, and their positions, are not agreed upon by the civil and military authorities in India; a circumstance which may be ascribed to the difficulties inherent to so great a subject. But strategic questions, in their more ordinary sense, will soon be settled by the establishment of railway communications, when everything will depend on time.

55. All I would venture to say as a professional man, and confining myself to the question as affecting health only, is, that the reasonableness, if not the necessity, for the occupation by British troops of certain given stations on the plains ought to be proved to the satisfaction of the ultimate authorities, before any such stations be ultimately occupied.

56. I would further urge that, in all and every station on the plains, the European garrison be of the very smallest, consistently with security, and that it be relieved and sent to the higher grounds at the end of each year. We should thus inflict the smallest possible amount of evil upon our British garrison. Upon a long and careful consideration of the subject here submitted to the Royal Commission in all its relations, I have come to the settled conclusion that,

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whether in civil or military affairs, the cause of good government and the cause of humanity are one.

57. "It has been said that the climate of the West Indies is so unwholesome that a residence in it is fatal to most of those who go there. Without disputing that fact, I may safely assert that it is not more unwholesome or unfavourable to European constitutions than the climate of Bengal." So wrote the Duke of Wellington during his service in India; and even now, after a century of possession, we count our British settlers there by tens.

58. If we would avoid the dangers of another army of treacherous and trained mercenaries, we must find suitable stations for our European troops, where they may enjoy health and vigour, and be at all times available for service. If this is not done, England will not be equal in time of war to meet the drain of men and money of keeping up a garrison of eighty, or even of fifty thousand men in India. "We must build barracks or lose Sinde," was the constant declaration of Sir Charles Napier.

59. The natives of India may at certain times and on certain occasions like to see their garrisons, and this they may do every cold season, when the British forces descend upon the plains for military exercises; but I am strongly disposed to conclude that, like other people in other countries, they will exaggerate that which is unfamiliar and remote. The little European party of General Neill struck terror, it is true, at Benares and Allahabad; but it was not so much the little party or its astonishing leader that terrified the people, as the contemplation of the great forthcoming European army, of which General Neill's party was imagined to be but the advanced guard. The people of India, like other people, respect that which is unfamiliar and remote. Napoleon has said that there never was a general who did not cry out for a large army; but there are others besides generals who are given to raising the same cry.

60. To dispute the advantages to the British soldier of recourse to the mountain climates of India, is to dispute the advisableness to him of avoiding illness. Certain it is that well-paid functionaries, who have lived long and in luxury, on the plains, are, without any ill intention, the worst possible judges in this case; so much so, that the difference between these gentlemen and the soldier, without reckoning the absence of sympathy in the former, constitutes a distinct phase of existence; the one does not understand the desires or the wants of the other. Europeans who have lived in wealth and luxury on the plains are scarcely incommoded by the hot and rainy seasons, and the cold weather is one of much enjoyment to them. Besides these considerations, they do not know the miseries of the barrack life.

61. It has indeed been said, but on grounds purely theoretical, that soldiers when placed on the hill ranges must fall sick if suddenly brought down to serve on the plains; as if making men healthy were the sure way to make them sick thereafter. All the ascertained facts and all the reasonings from them are directly opposed to this theory.

Officers and their families have during many years been visiting the various hill stations throughout India, with the view to refresh and invigorate them, by avoiding the heats and the fevers of the plains; and the results have been everywhere generally satisfactory, even under mistaken arrangements at times.

62. Captain Crofton, of the Bengal Engineers, assures me that the practice of the officers in charge of the Trigonometrical Survey has been to remove the European portion of their establishments to the nearest hill stations for the hot and rainy months, and always with a beneficial result. Even the removal for a month or two has been found of advantage in obviating fevers, and in removing such fevers as had seized on the men in the plains, where they worked with more good will and vigour after their temporary and refreshing absence.

63. In an able article on the reorganization of the Indian Army, in the Calcutta Review for 1859, the author advocates the fixing of European brigades, by way of reserve force, in the Himalayas, "where these troops would be kept in a healthy and efficient condition, ready for employment whenever or wherever their services might be called for."

"In 1857, when the Mutiny broke out, the European Brigade quartered in the hills about Simla, was the only force ready for immediate action, and formed the nucleus of the small but gallant army that laid siege to Delhi and saved India. This is a lesson that assuredly ought not to be forgotten, but rather to be improved upon." With exception of an outbreak of epidemic cholera, this force is said to have arrived before Delhi, through the arid burning plains, in a remarkable state of health.

64. Under the double aspect of a political and military necessity, this great hygienic consideration of the occupation of the mountain regions throughout India, must at all

times invest the subject with an extraordinary degree of interest and importance, whatever may be the temporary neglect of it by the authorities in India. It is an assured question in the eventual military arrangements for our Eastern possessions, being founded on the pressing wants of our armies there.

The relations of the army surgeon to this paramount question must every day become more intimate; and the medical departments of the three Indian presidencies must prepare themselves for this closer connexion.

65. In a country such as ours, the climate of which must have made a residence in the higher grounds and hills anything but agreeable to the natives of the south of Europe, the Romans nevertheless, the better to overawe and control the various peoples inhabiting the plains, fixed a great number of their stations, throughout England and Wales, on high grounds; occasionally, as at Malvern, Seaford, and other districts, upon the highest hills within the respective circles.

66. There is one circumstance of a social, but most important character, which entitles the British soldier in India to the special consideration of authority. In all other of our possessions, but especially in our colonies, the soldier finds companionship in civil life; but in India, if he would have any associates out of the barrack, he must fall into the snares of the vilest of natives, whose sole business is to plunder him and minister to his worst vices. Officers in command in India should have more regard to this most sad condition than it has hitherto received. The State authorities would then consider the question in all its bearings.

Lastly.—It is hardly necessary to say that in common with all localities, in all climates, the hill stations throughout India will require for their sanitary improvement careful and persistent attentions; for, however good the mountain climates, they cannot be regarded as independent of the labour of man, without which no climate can be perfected.

216. (*Chairman.*) Do you exact from your candidates for the medical service any knowledge of military hygiene, or any knowledge of precautionary science?—None whatever. I think that the medical department in India is well ordered for all the purposes of cure, but that the sanitary department is altogether wanting in it.

217. You take from the medical schools of the country the best of the candidates possessing a fair knowledge of medicine and surgery?—Quite so, as taught in the civil schools of the country.

218. Do you take any steps after their examination, and after they have come from the medical schools, to impart to them any peculiar knowledge, which would be useful to them in their profession as military surgeons in a tropical climate?—None whatever. All their knowledge of sanitary science must arise from the future course of the service, and too often at the expense of the soldier.

219. Should you not think it an advantage if they were passed through some professional school of army medicine and surgery before they left England?—Unquestionably, and the subject has long been present to the minds of army medical officers. So far back as the year 1798, Mr. John Bell, of Edinburgh, on witnessing the sufferings of the wounded arriving from the battle of Camperdown, recommended that a school should be formed, under the orders of the Admiralty, for the training and instruction of naval surgeons, and Dr. Robert Jackson recommended the same for the army.

220. At Calcutta, when a young assistant-surgeon comes out, is he not passed through the hospitals?—They serve by regulation, three months at the general hospital of the presidency.

221. A military hospital?—It is so in the case of four-fifths of them, but we took in the townsmen from Calcutta. It is a large general hospital.

222. There, I suppose, the young surgeon would see something of tropical disease?—Nothing beyond that. They are placed there to observe the course and the progress of cure of tropical disease, and nothing else.

223. Do they see much of tropical epidemics there?—Yes, they do, a great deal, and of both acute and chronic diseases—cholera especially, as breaking out

among newly-arrived batches of recruits, and seamen in the river.

224. You are aware, probably, that a school is being established at Chatham with a view to compensate for this deficiency in the Queen's army?—I am aware of it, and I consider it the greatest boon quoad the medical department of the army that has ever been granted.

225. And the Indian Government are now consenting that their candidates for service in the local army shall likewise pass through that school?—The matter was referred to me by Sir Charles Wood, and I reported most urgently that our officers should have the same privileges of instruction.

226. Is there any regulation with regard to the employment of sanitary officers in India, with camps or with armies?—None whatever; but I have a letter from Mr. Arnott, the principal medical officer of the division under Sir Hugh Rose, informing me that on their capture of Jhansi and Gwalior, Sir Hugh Rose, at his suggestion, appointed a medical officer of health, and that the results were most beneficial in the European camp, under the excessive heats of the season and the arduous course of the service.

227. There are sanitary reports made as to the sanitary state of regiments by every medical officer in India?—Yes, of the European battalions. They are expected to give a topographical sketch of the climate and the locality, but nothing of a sustained nature was ever done until Sir Charles Metcalf ordered a plan, which was submitted by me to the Governor-General, to be carried out generally throughout the three presidencies of India; and that is still the rule.

228. Have those officers who make reports any power to carry into effect their suggestions?—None whatever; it rests with the authorities, civil and military.

229. How is the medical department of the Government in India carried on; as well upon the whole as in this country?—It used to be in my time governed by a board, which was composed of the three senior officers of the older surgeons of each presidency—the three oldest of the old—formed into a governing and administrative board; and I believe it was owing to the representations which I made to the Government of India and the Government at home, and especially owing to Lord Dalhousie, that it was altered. There is now a director-general, a selected officer, at each presidency, who conducts the duties of the department.

230. Is there any common head over the three presidencies?—No, each acts in his particular presidency.

231. Are there not besides medical boards at the presidencies?—Those were the old seniority boards which I mentioned.

232. Do they not exist now?—No. They were abolished expressly by a minute of Lord Dalhousie.

233. There is a director-general of each presidency?—Yes.

234. But no medical board?—No; that has been abolished, because it had been a seniority one, and useless.

235. Are there inspectors and inspectors-general of the Queen's troops, and what duties do they perform?—They perform the same duties that they do at home, and as the rank prescribes. There are also superintending surgeons to every division in the army.

236. To whom do those different authorities report to the three medical heads of the whole department?—The superintending surgeon reports to the medical head, and to the general of division.

237. The head of each presidency, the director-general, is always a local officer?—Yes.

238. Do the Queen's officers report to him?—No, I think not; I think they report to the director-general at home.

239. Have you any wish to state anything with regard to pay allowances and retirements, or are you satisfied that they are on a good footing?—I think that all those matters have been very liberally ordered in all times by the old East India Company. There have been recent differences in respect to the royal

warrants which have been issued for the Queen's medical department in India, in which inequalities and restrictions are complained of, and with justice, by our officers, but that is a very recent matter.

240. Having reference, I think, to the inspectors-general?—It has reference also to the retiring allowances, and certain differences according to rank and length of service.

241. (*Dr. Farr.*) You have frequently referred to the hill stations, will you be good enough to state precisely what you mean by them?—I mean such hill stations as shall secure to the European the absence of malaria, with as much coolness as can be obtained in that climate, along with purity of air and ventilation at that elevation. It has yet to be ascertained where we can find the different degrees, or even the best of them.

242. You have mentioned the effect of the hill stations in Jamaica, are you aware that the character of the hill stations in the West Indies is the same as the character of the hills and mountain ranges in India?—I can anticipate no difference. The climate of mountain ranges is found in all parts of the world to have strict relation to the elevation, so that, I believe, you obtain a reduction of one degree of temperature for every 350 feet of ascent.

243. Are not the stations in the West Indies often on the summits of the hills?—I believe they are at Newcastle and other stations in Jamaica, and being on the tops of those ranges, they have been found extremely salubrious, although the elevation has not been half that at which stations have been occupied in the East Indies.

244. Many of the stations that would be called hill stations in India would be on the sides of the great mountain ranges, which are covered with perpetual snow, and therefore of a totally different character?—Yes, they would be of a different character. The character of the mountain climate depends very much upon the character of the neighbouring ranges, and whether they are or are not covered with snow. It is only in the Himalayas that you have anything like a permanent snow range; in the other ranges they have not any at all, and the question that I submitted to the Chairman of the Court of Directors was a careful examination of the several elevations, in order to ascertain which was the best. Hitherto I believe that we have, without due attention to the matter, neglected the lower ranges, namely, the ranges of from 2,000 to 4,000 feet in elevation; we have not condescended to look at them, and yet it may happen that they would prove of eminent value. I may mention that a medical officer in the province of Orissa found, only the other day, a very fine table land of about 3,000 and odd feet in elevation, with a delightful temperature, within reach of the sea breezes of Bengal, and close to Calcutta. It had never been looked at before, so that it shows that the very agitation of the subject publicly is now drawing the attention of medical officers to this important question of medium elevations.

245. (*Chairman.*) Is there not a very great rain fall at the place you have referred to?—It will have the rain-fall simply of the province of Orissa, which is the adjoining one to Bengal; it is close to the bay of Bengal, and it will of course have to meet the south-west monsoon just as the district around has.

246. (*Dr. Farr.*) You prefer the innermost stations, such as Chenee, to other stations, such as Simla, which are on the sides of the hills?—Yes. I apprehend that they will be found preferable to the more advanced ranges, because these last have to meet the brunt of the south-west monsoon against which the violence of the long rain-storm impinges; and there the rain-fall is found to be double or treble what it is 30 or 40 miles in rear of the front ranges.

247. As a general principle would you not expect that hills of a moderate elevation would be more likely to afford good sanitary sites than the sides of very lofty mountains that are constantly wetted by the descending snow?—Assuredly, and hence a pre-

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ference is to be given to solitary mountains, when procurable; but where they are discovered, as in the case of Mount Aboo in the west of India, they are eminently desirable on account of the coolness which belongs to elevation, and the freedom of ventilation which appertains to isolation.

248. Such are the hill stations which you would recommend as stations for the troops in India?—Yes; and by placing our British soldiers in them, we should realize the idea of Hyder Ali, the father of Tippoo Sultan, and founder of the kingdom of Mysore, and keep our Europeans in cages, ready to let slip on occasions of necessity. The late Major-General Sir Mark Cubbon, the celebrated commissioner of Mysore, stated that a general belief prevails amongst all classes of natives of India, that until our European soldiers are in military occupation of the mountain ranges throughout the country, our possession of the empire is not secure.

249. And those stations may be found perhaps without removing the troops the same distance as you would have to remove them if you sent them up on to the Himalayas?—My belief is, simply from a careful examination of the map of India, that there is not a great province in our possession that does not contain a mountain range available for the troops in that province.

250. Is Mount Aboo capable of being made a permanent station from what you have heard of it?—I believe it is, but that is only an opinion. I have ventured to suggest that no hill station should be occupied permanently until its salubrity has been tested by occupancy for so many years in the wood huts of the country.

251. How high does malaria generally ascend in India?—That point in the East Indies has not been ascertained, but in the West Indies it has been presumed never to rise to an elevation of 2,500 feet, so that that small amount of elevation would appear to raise the soldier out of the fever range.

252. There are no observations made in India?—No accurate ones, but I believe that the same principle will hold in the east as in the west with regard to elevation.

253. Which of the hill stations do you consider objectionable as invalid stations, or is it a general objection that you entertain?—It applies unhappily to most of the high elevations which have hitherto been chosen by the Government of India for the occupation of European troops.

254. Can you briefly compare the chief sanitary characteristics of the hill stations with those of the stations in the plains, and state in what they differ?—They must necessarily differ in three great points. First, in the coolness, which is obtained by elevation, and, secondly, which is hardly of less importance, the absence of malaria; and, thirdly, in the purity of the air, as compared to that of the plains. The securing of these three advantages alone should give to the mountain ranges a preference everywhere, because the long continued application of heat to the European system degrades the constitution, even without the intervention of the malarious tropical influences which I have mentioned.

255. Are the sanitary influences which are brought to bear upon the Company's troops and upon the Queen's troops precisely the same?—Altogether the same, so far as the official regulations can affect them.

256. Then how do you account for the difference in the mortality, which in the Company's troops is lower than among the Queen's troops?—If there is any material difference between the two, I should refer it to the circumstance which I have already mentioned, viz., the better personal hygiene of the old soldier of the East India Company.

257. Then with regard to the question of acclimatization, the Company's troops remain in India longer, upon the whole, than the Queen's troops, do they not?—Yes; but in the return to which I have referred, by Sir Alexander Tulloch, the length of residence would really appear to have been short, for after all

there has been a continual succession of changes, and I dare say that a soldier of 40 years of age is seldom to be found among the Company's troops, unless it was in the character of a non-commissioned officer, or engaged in the ordnance department, being men in comfortable positions.

258. Still upon the whole they do remain longer in India than the Queen's troops, and yet the mortality amongst them is lower?—I am not aware that that is so.

259. Another circumstance to which you have referred was, that the Company's troops are sent out at a younger age than the Queen's troops generally?—I am not aware that they are.

260. I suppose that the Queen's regiments are sent out complete, and are partly composed of old soldiers, so that they must be really older than the Company's troops?—I suppose they must; and then I should say, that the very traditional habits which I have referred to as imparted by the old soldiers of the Company to the recruits, must have tended in a greater degree than I should have expected to preserve the recruits.

261. (*Chairman.*) Is it not the fact, that the period for which the Queen's troops generally remain in India has been about 15 years?—That I believe is about the average.

262. Then, in that case, the arrival of a regiment with men of different ages in it, only rules over the first few years of their stay, because after that, their numbers must be kept up continually by young recruits, until the whole regiment has entirely changed its character?—Quite so.

263. Fifteen years are so long a time, that you may say there is not much difference in the time that the men remain in India, as between the two services?—I should say not.

264. (*Col. Greathed.*) Are not the Company's troops rather older in age as recruits than those of the line?—We observed that especially in regard to the artillery; the others I do not remember; but we all remarked upon the fine character of the artillery recruits.

265. (*Dr. Farr.*) You do not object so much to sending out troops at earlier ages as to the working of those troops in India too soon?—No. There is another advantage to be derived from localizing the European troops in mountain ranges, namely, that these stations might be made fields of drill and discipline being in a temperate climate; and even the great table lands, such as Goonah, which is now occupied by Main's Horse, and Gugoonda and Seepree, not very far from it, are table lands upon which large masses of artillery and cavalry might be located so as to undergo drill without so much injury to their health.

266. (*Col. Greathed.*) Goonah is not at all a hill station; it is a table land of the Deccan?—It is said to be 3,000, I do not know how many hundred, feet above the level of the sea, but I speak of that as hearsay, as being a table land, and compared favourably with the plains, very healthy; but these are all points to be ascertained by future observation of a careful nature.

267. What is the average mortality in India?—It varies everywhere with the station.

268. (*Chairman.*) Allahabad, I believe, is about one of the worst?—Yes, and Cawnpore, which is an old station, is very bad also.

269. The mortality varies from 30 to 70, does it not, per 1,000?—Quite so.

270. Do you know anything about the table lands in the Himalayas, and as to the possibility of locating troops in their lower ranges?—I have inquired minutely into that subject from various officers, civil and military,—civil officers and engineers,—and several of them have told me that the great province of Kumaon possesses table lands of great extent, and of a high elevation, which are well worthy of careful examination by order of the Government, and I have no doubt that there are such places. Chenec, (described by Surgeon A. Grant, already quoted,) a station that I have mentioned in the rear of Simla, is another place where I believe there are grounds for encampments, though perhaps not sufficient as compared

with Kumaon. But the truth as to the subject has to be investigated *ab initio*; the whole question of the mountain ranges of India, and the climates most suited to the occupation of European troops. I may mention, with reference to this great question, a very interesting and curious circumstance that was observed by Montesquieu and others, that the condition of India and its frequent military revolutions were indeed the result of climate and of a physical necessity—the *absence of a temperate zone*; that the conquerors inhabited the surrounding high grounds, and the slaves and the cowards occupied the plains; and therefore the continued immigration of the one, and conquest by them, was a physical necessity derived from climate. Imitating this law of nature, as it appears to be, we should place the European soldier in India in the best elevated ranges which are within our reach; thus soliciting the purest atmosphere and the lowest temperature within our reach, such as we find in the mountain regions, the natural substitute for a temperate zone; while, of necessity, we call into continual action the labour of man. In other words, while we institute those sanitary measures, general and personal, without which no locality on our earth, however favoured, can be safely occupied by man.

The vicinity of swarming and fetid native towns, bazaars, and of native lines occupied by sepoys, has ever been and must always be seriously detrimental to the health and character of British soldiers, both from their extremely defective sanitary condition and from their containing so large numbers of natives of the lowest and most depraved classes of both sexes; persons whose business it is to minister to the worst propensities of the soldier. In most of the military stations throughout India it would be difficult to determine whether they derive more of their injurious tendencies from defects of locality or from their state of defiance of all measures of sound medical police.

To remedy the one or the other of those enormous evils will, I fear, involve a work of generations; so that the removal of the British troops from such sources of depravation, moral and physical, to some better localities than such as are at present occupied by them would seem imperative as an immediate duty to the army and to the State, if we are to arrest the present enormous rates of sickness and mortality in our Indian garrison.

Besides, the labour and cost of a just system of sanitary improvements in so many towns and stations over the vast area of British India would be something inconceivably great, while in the hill ranges the required time, labour, and cost would be insignificant, comparatively.

271. (*Mr. Alexander.*) You would also recommend that the recruits, on first landing in India, should be sent on direct?—That is a question to be determined. If the mountain ranges possess a climate at all to be estimated as a temperate climate, it may, perhaps, turn out that the European soldier may be drilled and trained in the mountain ranges as in any other temperature.

272. Instead of allowing the recruit to remain at Calcutta, would you not recommend that he should proceed to join the head-quarters of his corps at once?—Unquestionably.

273. And at the dépôts, would you not recommend that skittle-alleys should be constructed, with open sides and tiled roofs, and cricket and other amusements encouraged?—I would recommend everything that would tend, by exercise and amusement, to improve the physical frame of the European, and divert and occupy his mind.

274. (*Col. Greathed.*) What is your opinion as to the possibility of doing away with the issue of spirits in cantonments; at present it is a source of revenue?—I think that it ought not to be a source of revenue. I think that the issue of ardent spirits to soldiers in India is everywhere a questionable matter, except

when in full march; then one or two drams in the 24 hours, if they were given immediately after a meal, might rather prove beneficial than otherwise; but under all other circumstances, as it is now arranged, it is prejudicial to his health.

275. (*Mr. Alexander.*) You are aware that invalids returning from the up-hill country, having passed one board have still to pass a board at Calcutta, or at Kurrachee; do you approve of that?—I have been continually upon those invaliding boards, and my own impression was, and still is, that they were unnecessary. Almost every man that came before us was merely an old and worn-out soldier, or else he was in a condition of organic disease, which left not a moment's question as to what should be done with him.

276. Are you aware that several men have been sent back by boards sitting in the low country, who have eventually died?—I think, in reference to that question, that the medical officers require to be instructed in the rules upon which leaves are to be granted both to officers and to men, for it is a subject that is very little understood by them now. I ventured to-day to give to Dr. Sutherland some suggestions on that head. It too often happens that surgeons conceive it to be "very efficient," as they term it, to retain invalids and persons who refuse to convalesce, upon the muster roll, and it is in my opinion injurious both to the State and to the individual. I have never acted upon that principle myself, I have always sent an officer to the place where I thought he would most speedily regain his health, and in doing so I thought that I did my duty.

277. Would it not be better if the recruits were brought down by steamers instead of by the country boats?—The more rapid the transit the better, no doubt; there is a great deal of laxity of discipline and drinking in coming down the rivers.

278. And it would be far preferable, would it not, to transfer those men from the steamboat that brought them down at once to the vessel, without landing them at Calcutta?—Yes; the landing of the old soldier, like that of the young recruit, has often been most destructive. The invalids used to land at Fort William, and they would come in great numbers into the general hospital, with no additional illness than that which was caused by drunkenness.

279. (*Chairman.*) And the same observation would apply in a reverse way to recruits arriving at Calcutta, where they should not be detained?—Entirely.

280. They remain in Calcutta some little time, do they not?—Yes; they wait there for unknown purposes, so far as I know, perhaps until the commissariat is ready, or an officer is found fit to take the command, the detention being most injurious.

281. (*Mr. Alexander.*) As a general rule you would have the decision of the up-country boards made final?—I would; I do not see the use of the supplemental boards at all.

ADDENDA.

No. 1.

EXTRACT from the "Medical Topography of Bengal," by Dr. McClelland.

"At Prome, in 1853, there were five or six burials daily out of an European force of little more than 1,000 men, until they were changed to the heights. This great mortality was checked by the change, although the hills to which the troops were removed were not more than 100 to 150 feet in height.

"The unhealthiness of the low ground was caused, not by the overflowing of the river, but by saturation of sediments formed in a basin of clay, into which the river found its way through the porous soil, and which could not be drained. Something of the same sort may account for the unhealthiness of Cawnpore, which might be difficult to rectify by drainage, as the water might still lodge beneath the level of the drains, and produce its effects on the local climate just the same. Thus there may be no remedy for ill-chosen sites."

Sir R. Martin,
C.B., F.R.S.

25 Nov. 1859.

"Free drainage is the most direct means of counter-acting the influence of malaria, and as this is naturally attained, more particularly in isolated mountain elevations, such situations are usually free from fevers, although these diseases are not uncommon in warm mountain valleys; thus proving that it is only in proportion as mountains are better drained and ventilated than the plains that they are more free from fever. For these reasons I entirely agree with Sir R. Martin, in his evidence before the Army Commission, that elevations of 2,500 to 4,000 feet would be sufficient to overtop malaria in Bengal and the north-west provinces. Whatever the nature of the soil might be at such elevations, there would be such facilities for local drainage as to render the invasion of endemic remittants out of the question. Besides which, the lower temperature of such elevations would lessen the disengagement of malaria, render it more feeble, and the European constitution at the same time less predisposed to its effects.

"Towns, cantonments, and barracks may be drained with more or less facility according to the elevation of their sites above adjacent rivers and plains. A perfect system of drainage to a degree to render cantonments on the plains of India altogether exempt from malaria would be impossible, although the evil might thus be much lessened.

"The extent to which the Army is crippled by fever in the plains of India has suggested the proposal, strongly urged on the attention of the authorities by Sir R. Martin, of locating European troops in hill stations raised above the influence of malaria."

"The moral effect of a large European force in such a position, for instance, as Sohajepore would be much greater than that of the same force distributed widely over the country, while troops might be readily thrown on any part of the low country in which their presence might be likely to be required by means of railways. On the other hand, by following the example of the natives of India in the adoption of their sites in the plains for all our great establishments, we lose sight not only of the sanitary wants of European troops in India, but also of the first principles of our own superior civilization, which should teach us the value of the most salubrious spots, at least for our own institutions and our own communities.

"With the facilities that railways afford, there is no reason why many civil establishments, and even the seat of Government itself, should not be placed on the table-lands referred to, for which there would be ample space."

"There can be no doubt that any elevation on a rocky light soil above 1,000 feet would be preferable to the plains. Although the heat during the months of April, May, and June would be little less during the day than that of the plains, the nights would be cool and more refreshing; and the months of August, September, and October would present a much lower temperature than the plains, as in the case of Hazareebaugh, at an elevation of 1,500 feet. If Hazareebaugh, or any other part of the table-land on which it stands, were selected for the advantage it possesses of a lower temperature during the nights at all seasons, as well as both day and night during the three unhealthy hot months of August, September and October, so fatal to our European troops in the plains. One hundred and twenty miles of railway from the heights to the Ganges at Monghyr would make a large force stationed on the table-lands available for all duties now required of the European troops stationed at Dinapore, Berhampore, and Ghazepore.

"Nor would the use of such a railway be necessarily limited only to military purposes alone, but might be made the means of furnishing cheap supplies of coal to the Ganges from the upper beds in the Damooda valley and its tributaries, as well as from the coal-field of Curhurbalee in Pergunnah Coruckdyah, through which the line would almost pass.

"Proceeding from Hazareebaugh still further to the westward, passing over the table-lands Sirgoodjah and Mainpat, of which we know little, we have a range of high country running parallel with the Ganges, presenting fine table-lands at Sohajepore, the elevation of which has been variously stated at from 3,500 to 5,000 feet. I believe the latter to be the most correct. The table-land is within a range of 130 to 150 miles, or less, in a direct line, of Mirzapore and Allahabad. Here, as we have also excellent coal, we should have the same interest in making it available on the higher portion of the Ganges, where it would be still more valuable. But that is a small object compared with the climate this table-land would afford to our European troops."

"The following is from Thornton's Gazetteer:—

"Amarakantak, in the district of Ramgurh, Saugor, and Nerbudda territories, latitude 22° 40' N., longitude 81° 50' E. According to an account of some intelligent Brahmans, who had visited the temple, it is situated in the midst of the table-lands. The spot, formerly the object of conflicting

claims, was adjudged within British territory in 1826, by the treaty of Nagpore. The place is one of considerable resort for Hindoo pilgrims, though the surrounding country is in general a wild and nearly pathless jungle, regarded by the natives as the abode only of wild beasts, demons, and savage goonds. Although only 120 miles south-east of the British station of Jubbulpore, it has been so imperfectly explored that no tolerable approximation has been made to show its elevation above the sea, some making it 5,000 and others 3,500. The height, however, is sufficient to render the climate much cooler than the country about Jubbulpore, which has an elevation of 1,500 feet, and in the hottest seldom exceeds 95° Fahr."

"A writer who visited the place in 1841, described it as too cold for the usual winter crops of Hindostan, which are nipped by the frost.

"During the month of May the climate is truly delightful. Everything around is fresh and green; the air is elastic and buoyant, with dew falling every night. Fifteen or twenty days seldom pass, even in the dry season, without showers. On the east and south the table-lands at Amarakantak terminate by precipitous cliffs. On the north and west are broad elevated plains, extending for 50 or 60 miles in the direction of north and west, over which the prevailing wind blows.

"Captain Franklin, who visited Sohajepore on these table-lands in 1821, speaks in high terms of the climate. He found coal a few miles north-west of Sohajepore, and about an equal distance from the upper tributaries of the Sone river, and also at the confluence of the Tipan with the Sone river, about 30 miles from the source of the latter and the same distance south-east of Sohajepore. Thus we appear to have elevated table-lands and plains, presenting fine temperate climates, and abounding in natural resources, within 150 miles of Allahabad, but of which we have very little information, the tract of country having never been surveyed and rarely visited by Europeans.

"Patchmaree.—About 150 miles to the eastward of the table-lands of Sohajepore, in the Mahadee hills, between Baitool and Hosingabad, is the table-land of Patchmaree, situated in the Nagpore district. It is about five or six miles in diameter, composed of sandstone, and elevated, according to Captain Franklin, 4,500 feet. The soil is light and sandy. The usual cold weather crops are grown here with difficulty, as the frost generally nips the buds, although it is not quite so cold as it is at Sohajepore. Ferns are said to be abundant, which indicates a moist climate.

"Speaking of the climate, the writer in the Bengal and Agra Gazetteer observes, that the natives speak favourably of it; certainly, in the month of May the climate has been found such as to suit the most delicate European constitution, while the cold season is intensely cold and invigorating. It may also be mentioned that at Multai, above Baitool, the climate, although not nearly so cold as at Patchmaree, is perceptibly cooler than it is at Baitool.

"Alluding to this table-land, but more especially to that of Amarakantak, already described, the writer alluded to in the Bengal Gazetteer concludes his remarks by the following observations:—"A bracing climate, mineral treasures of unexplored value, rich and unappropriated lands, abundance of moisture for all agricultural purposes, beautiful scenery, and a vast variety of products of almost every description are to be found in these table-lands, to which Providence has been so lavish in its gifts, but which man has not yet been taught to appreciate."

"Why should we have so little information regarding these table-lands, their climates and resources. The truth is, hill stations have hitherto been looked upon rather with disfavour on the part of Government, as so many inducements for leave of absence to officers whose duties lay in the plains; but the case is altered when it is proposed to make them the permanent stations of European troops."

No. 2.

SUGGESTIONS for promoting the HEALTH and EFFICIENCY of the BRITISH TROOPS serving in the EAST INDIES.—By Sir RANALD MARTIN, C.B., F.R.S.

To the Chairman of the Honourable the Court of Directors, East India House.

1. It is stated by Colonel Sir Alexander Tulloch, as the result of investigations in the War Office, made by desire of Mr. Sidney Herbert, that amongst British officers and soldiers of the Queen's and Company's armies serving in the East Indies, there occurred, from 1815 to 1855 inclusive, a total mortality, exclusive of casualties, of about 100,000 men, "the greater portion of whose lives might have been saved had better localities been selected for military occupation in that country."

2. Dr. Burke, late inspector-general of hospitals in Bengal, has stated that in the station of Secunderabad alone, during thirty years of its occupancy by British soldiers, the cost to the State on account of loss of life amounted to 150,000*l.*, estimating each soldier as worth 100*l.* But, estimating the loss of life mentioned by Sir A. Tulloch at the same valuation of 100*l.* each man, we arrive at a loss in money of 10,000,000*l.* sterling.

3. Then there has been enormous waste of the public funds on account of barracks and hospitals, placed in stations so unhealthy that they were subsequently abandoned. The buildings for the European troops at Berhampore, Bengal, abandoned since 1835 on account of its unhealthiness, are stated by the finance authorities of Calcutta to have cost since 1757 nearly 17,000,000*l.* sterling.* Tenant declares that, up to this time, the sums expended by the East India Company for the accommodation of their European troops, "if laid out at the compound interest of the country, would, at a determinate period not very remote, have equalled the national debt."

4. Looking to these enormous sums, often absolutely worse than wasted, of what account in the comparison has been the cost of the medical establishments of India? how truly saving of the public revenues must be a well-ordered and well-directed and a well-contented medical corps! In truth, the importance of an efficient medical establishment is so great that we cannot put a money value on it.

5. As regards the preservation of European health in India, and indeed in all tropical climates, the due selection of locality is the first consideration; and next in importance stands the structural arrangements in barracks and hospitals.

6. As to barracks, provided the site be of sufficient elevation, well cleared, drained, and levelled, with a good water supply, the material need not, I think, be of a costly character—well-constructed huts for the accommodation of ten or twelve men forming a good protection against the inclemencies of weather. Such simple and cheap structures will, I believe, prove more conducive to the health of the European soldier in the mountain ranges of India than the most costly barrack, and the same may be said of hospital huts for the reception of the same number of men; viz., ten or twelve. In stations on the arid, hot plains of India, the same structures would answer well; but if large brick-built barracks and hospitals be preferred, they should be very spacious, double-roofed, and raised on arches.

7. The considerations involved in the subject of the last paragraph are of the utmost importance, whether viewed in a sanitary or financial light; and the subject has hitherto been altogether neglected in locating troops in most of our foreign possessions; although our experiences in all our European campaigns have demonstrated that the soldiers who were huddled fared well, while such as were massed in barracks and general hospitals perished at enormous rates.

8. This experience has been uniformly accordant, whether the climate was hot or cold, whether our men were serving in Holland or in the Crimea.

9. The Irish sufferers from typhus, during the famine, who were massed in workhouses and hospitals, perished in enormous numbers, whereas those who were thrown along the roads and under the hedges recovered in goodly proportions;—of so much more avail is pure air towards the restoration of health than a fine building. The thorough ventilation through the openings and crevices of huts supplies the sick with what they don't obtain in our ill-constructed barracks and hospitals—namely, pure air.

10. They were not palaces that were constructed by order of Sir Charles Metcalfe on the mountains of Jamaica, but a substantial form of hut, which, on a pure and elevated soil, was all that was required. Buildings such as those just referred to, constructed of the most ordinary materials, have been found to assure health, while Indian experiences prove that costliness of material and splendour of structure, apart from a good locality, will not prevent disease.

11. The importance of determining the true physical characters, and the exact medical topography of all the mountain ranges throughout India—especially of those situated in provinces in which it is desirable that British troops may reside—has now become imperative. European soldiers cannot maintain health or vigour in the plains, and the selection of suitable mountain stations has become more than ever a state of necessity.

12. The experiences of the Himalaya positions, of those of the Neilgherry mountains, and of those of Ceylon, as sanitary stations, prove that by residence on their respective elevations the European is removed greatly above the range of the malarious fevers of India. But while this great and valuable fact is admitted, it is undoubtedly true that he is,

in too many instances, carried into the range of another class of diseases—namely, that of bowel complaints. This circumstance has been found in various of our mountain positions to constitute a serious drawback from the otherwise great benefits derived from a residence in them.

13. Another disadvantage from the hill stations hitherto occupied by us in the East Indies was noticed by me when serving in Bengal—namely, that while the hill climates are permanently serviceable against the malarious fevers of the country, their influences in conducing to the cure of these and other diseases is limited in extent; the soldier being troubled with relapses of his disorders on descending into the plains, unless kept in the hills for a long time. The mountain ranges, therefore, which have hitherto been occupied by Europeans stand forth as possessing climates *preservative against fevers*, and as such we must improve them, and use them wherever required.

14. When, on the other hand, we find the British soldier lingering under chronic or structural diseases contracted on the plains, a removal to the seaboard, or to an insular sanitarium, or, still better, to England,* will be found the only effective means of restoration; and this last resource of medicine should never be denied to him, for the climate of the mountains, invaluable in prevention, will not cure disease.

15. Referring to what has been stated in paragraph 12, how are we to escape from the admitted evils hitherto experienced in the very high positions occupied by us? Where and how are we to obtain that amount of elevation which, while it removes the European from out of the range of malarious fevers, may not place him in that of an exhausting and dangerous diarrhoea? This is the great desideratum—one hitherto unascertained because unsought for; yet no examinations which may fall short of ascertaining this desired medium elevation can be deemed satisfactory of our sanitary wants.

16. In the climates of yellow fever, an elevation of 2,500 feet is found sufficient to remove the European from the locality of pestilence, without placing him in that of bowel disorders; and in the mountain stations of Jamaica the mortality amongst British soldiers is found to exceed but little, if at all, that of the same class of men in the United Kingdom.

17. Let us then have a series of careful and scientific examinations, by competent persons, of the lower and medium ranges of hills throughout India, in order that the great sanitary problem may be solved in a conclusive manner—namely, the providing a place of resort for our European troops which shall be alike free from malarious fevers and from disorders of the bowels. That such procurable localities are to be found in the East, as they have been in the West, is my firm belief, and let them be perseveringly sought for.

18. Let the solitary hills—those islands on the plains—be sought for, and carefully examined; they give sanitary excellences peculiar to themselves.

Lastly, let there be appointed for the sanitary duties of the army, at each of the Indian presidencies, a medical officer of health—an officer of scientific attainments and of rank, who shall be attached to the quartermaster-general's department; we shall thus add to the department of military topography that of medical topography. The medical officer of health should preserve in his office, for the use of the scientific persons concerned, plans and models of the best barracks and hospitals which may be from time to time approved by the military powers of Europe, in order that the most recent improvements may be rendered available wherever buildings of the nature indicated may be found necessary.

The duties of the medical officer of health should be, in peace, to examine and report on all sites and on the condition of camps, temporary military stations and cantonments, on convalescent stations and sanatoria, on mountain ranges suitable for troops, and on solitary mountains and their capabilities, on the plans and structure of barracks and hospitals, and on everything relating to the health and comfort of the soldier.

In war, he should be attached to the quartermaster-general in the field, and be always in advance with this officer, so as to master the medical topography of the scene of action; and, where military reasons of imperative necessity do not overrule sanitary considerations, the advice and opinion of the medical officer of health should be received on the sites of camps, whether temporary or permanent, and on all matters having reference to the sanitary condition of the camp.

* This was written before the question of Western Australia, or other climate, became known or discussed. Hitherto there has been no alternative for the soldier but to wait for death in the Indian hospitals, or be sent home, generally as a discharged invalid.

* Influence of Tropical Climates, p. 424.

Sir R. Martin,
C.B., F.R.S.

25 Nov. 1859.

Sir R. Martin
C.B., F.R.S.

25 Nov. 1859.

In a recent Report to Her Majesty by a Royal Commission, of which I was a member, and which was ordered to inquire into the organization, government, and direction of the medical department of the British army, the appointment of a medical officer of health, as long previously recommended by me for the service of the Indian army, was strongly urged upon Her Majesty's attention, with a view to the great benefits to be expected from the services of such an officer.

J. R. MARTIN.

Grosvenor Street, London,
August 12, 1857.

SIR, Grosvenor Street, December 1, 1857.

Having recently submitted to the consideration of the Chairman of the Honourable the Court of Directors certain suggestions for the selection of localities for the European troops in the East Indies, and feeling assured that the mountain climates to be found throughout our possessions in the East must be largely used for the purpose stated, I beg leave to submit further suggestions which may prove of use to such officers as the Governor-General of India may appoint to examine and report on the important subject in question.

I do not mean that these are all the questions which may be examined; but I trust they will be found to comprehend the most useful subjects to be investigated and ascertained previously to fixing on permanent stations in the mountain climates of the East.

I have, &c.

J. R. MARTIN.

To Sir James Cosmo Melvill, K.C.B.,
Secretary, East India House.

Suggestions for the Investigation of Mountain Climates in the East Indies:—

1st. The medical history of mountain climates, noting the physical character and state of health of the inhabitants at different elevations.

2nd. Climates of elevated valleys as compared to those of plains.

3rd. Climates at different degrees of mountain elevation.

4th. Differences produced by the different aspects—N., S., E., W.

5th. Differences produced by disposition of surrounding hills.

6th. Climates of solitary mountains.

7th. Meteorology of mountain climates:—

- a. Temperature at different elevations.
- b. Range of diurnal variations at different elevations.
- c. Range of annual variations at different elevations.
- d. Atmospheric pressure at different elevations.
- e. Humidity at different elevations.
- f. Rain and snow at different elevations.
- g. State of the sky at different elevations. Electricity.
- h. Relative dryness of the air of mountains as compared to plains.
- i. Rate of evaporation at different heights.
- j. Frequency and intensity of aerial currents at different heights.
- k. Power of the solar rays at different heights.
- l. Relative moisture of the soil at high and low elevations.
- m. Relative amount of dew at high and low elevations.
- n. Relative frequency of atmospheric renewal at high and low elevations.

8th. Physiological influences of mountain climates of the medium elevations of from 2,000 to 4,000 feet:—

- a. On the nervous centres.
- b. On respiration.
- c. On circulation.
- d. On secretion.
- e. On digestion.
- f. On locomotion.
- g. Summary of the influence of diminished pressure.
- h. Summary of the influence of diminished oxygen.

9th. Physiological influences of mountain climates of elevation from 4,000 to 8,000 feet:—

- a. On the nervous centres.
- b. On respiration.
- c. On circulation.
- d. On secretion.
- e. On digestion.
- f. On locomotion.
- g. Summary of the influences of diminished pressure.
- h. Summary of the influences of diminished oxygen.

10th. Pathological influences of mountain climates at medium elevations of from 2,000 to 4,000 feet:—

- a. Diseases of the nervous centres.
- b. Diseases of the thoracic viscera.
- c. Diseases of the abdominal viscera.
- d. Rheumatism, fevers, and their types.
- e. Ophthalmia.
- f. Other diseases.

11th. Pathological influences of mountain climates of elevations of from 4,000 to 8,000 feet:—

- a. Diseases of the nervous centres.
- b. Diseases of the thoracic cavity.
- c. Diseases of the abdominal viscera.
- d. Rheumatism, fevers, and their types.
- e. Ophthalmia.
- f. Other diseases.

12th. The habitations best suited to mountain climates.

13th. The best modes of water supply on elevated ranges.

14th. The kinds of diet suited to various altitudes.

15th. The kinds of clothing suited to elevated regions.

16th. Capabilities of elevated ranges for the cultivation of vegetables and fruits.

17th. Facilities for cultivating trees, and the influence of arboriculture on mountain climates.

18th. Facilities for exercising-grounds.

(Signed) J. R. MARTIN.

Grosvenor Street, Dec. 1, 1857.

SIR, East India House, Dec. 24, 1857.

I HAVE had the honour to receive your letter of the 1st instant, with its enclosed paper of suggestions for the investigation of mountain climates in the East Indies.

In reply, I have received the commands of the Court of Directors to convey to you their best thanks for this document, and to state that a copy of it will be forwarded for the observation and notice of the government in India.

I am, &c.

J. R. Martin, Esq.

JAMES M. MELVILL.

No. 3.

The following OBSERVATIONS are taken from a Report by Dr. GRAHAM BALFOUR, of the Army Medical Department:—

"If it be deemed necessary to maintain a much larger European force in India than heretofore, considerable difficulty may be experienced in obtaining recruits over and above the numbers now required to keep the army up to the establishment. Whether, therefore, the force shall be local or form part of the general army, the question of the best means of securing the efficiency of soldiers in India is one of great importance, and it deserves consideration whether it would not be possible to reduce the mortality to such an extent that the increased numbers might be kept up by a supply of recruits not greatly in excess of that now required.

"The mortality of the Indian presidencies from 1838 to 1856 was, exclusive of men killed in action:—

Bengal,	76·26	per 1,000 of the strength.
Bombay,	60·94	" "
Madras,	41·50	" "

And the average for the whole of India was 64·54 per 1,000. But these averages result from the mortality of stations, varying between 127 per 1,000 at Loodiana, and 24 per 1,000 at Bangalore.

"If the whole or greater part of the army in India could be retained at stations in which the mortality is the same as at Bangalore, Poona, or Meerut, a reduction would be effected in the deaths equal to half the present amount.

"In all three presidencies there are ranges of mountains in which stations for troops might be found at elevations of several thousand feet above the level of the sea. Such places have already been tried, but chiefly as sanatoria, to which invalids have been sent for the recovery of their health. Thus, in the Bengal presidency Murree, Landour, Darjeeling, and Simla; in Bombay the stations of Poorundhur and Mount Aboo; and in the Madras presidency Jackatalla and Ootacamund have been so employed.

"The medical officers report most favourably of the effect of residence at these on men whose health has broken down while serving in the plains; but, of course, no deductions as to the probable rate of mortality among healthy men can be drawn from the returns of these sanatoria. These stations have, however, been occupied by troops in the Himalayan range, Kussowlie, Subathoo, and Dugshai, all of them at an elevation of upwards of 6,000 feet above the level of the sea. On the average of five years (1850–54), the mortality at these stations was a little under 3 per cent. If it were deemed practicable, in a military point of view, to retain the greater part of the European force on these mountain ranges, detaching to the lower grounds such a number of regiments as might be required for necessary duties, and relieving them frequently, a great saving of life might be effected, and the men living in a bracing climate and with constitutions less affected by the enervating heat,

would be kept in a higher state of efficiency in case of their services being required in the field. By the extension of the railroads to the foot of the mountains, a great advantage would be gained; the long marches, in which the troops so often suffer from disease, or if they do not, frequently lay the seeds of future disease from exposure to malaria, would be less frequent, and regiments could, immediately on landing, be moved up to the hill stations, and be retained there till the men had become somewhat acquainted with the customs of the country, and acquired the habit of not exposing themselves unnecessarily. There is one point only to which I think it necessary to call special attention, in case this system should be carried into effect, namely, the necessity of providing the troops with suitable warm clothing, for at these stations the temperature at night falls so low, that it is necessary to issue firewood to the troops during eight or nine months in the year.

"I may add that these views of the advantage to be derived from quartering the troops in the mountains are not hypothetical, but are founded on the great benefit which has attended this system in Jamaica, where since the European soldiers were moved to Newcastle, and chiefly stationed there and at Maroon Town, the mortality has been reduced to about one third of the rate previous to that change, if deaths from disease contracted in the low grounds be excluded."

Investigations by Sir A. Tulloch show that at Bangalore for the last year, 1859, the 1st Dragoon Guards, with a strength of 600, lost only 10 men, or $1\frac{2}{3}$ per cent. That at Sealkote out of 550, only 11 died last year in the 7th Dragoon Guards, or 2 per cent. That at Poona and Deesa only 20 died last year, out of about 1,100 in the 33rd Foot, or $1\frac{1}{11}$ per cent. That at Bangalore and Jackatalla, 14 only out of about 1,200, in the 60th Foot died, or about $1\frac{1}{2}$ per cent.

No. 4.

WESTERN AUSTRALIA recommended as a SANITARIUM for the RESTORATION to HEALTH and USEFULNESS of EUROPEAN SOLDIERS, prostrated by those DISEASES of INDIA, for which the CLIMATE of the HILL STATIONS does not afford a REMEDY.—By a MEDICAL OFFICER in Her Majesty's Service, who has had experience with Troops both in Australia and India.

DEAR SIR,

Kurrachee, May 29, 1859.

As a friend to the profession, and one whose object, during a long career of usefulness, has been to benefit the British soldier, I have taken the liberty to forward the copy of a letter on the subject of a Sanitarium at Western Australia, published by me in the "Bombay Standard," of April the 27th. The letter has been favourably commented on by the Indian press, and I entertain a hope will meet with similar consideration at your hands, and from others equally interested in the objects of the profession, and the lives of those occurring to me as unnecessarily sacrificed to a pertinacious adherence to official routine. I have endeavoured, in the first instance, to satisfy my readers that Western Australia and the rest of the Australias are separate colonies, that Swan River being on the western coast is within easy distance from India. Its peculiar salubrity will strike you as remarkable, more especially, its exemption from that curse of the British army, *Syphilis Primitiva*. This hygienic condition, I feel assured, might be maintained by establishing proper precautions to prevent the introduction of the disease with an increase of population.

The absence of Sanitaria at the ports of embarkation in India is a drawback to the health of Europeans, and, even where they do exist, the mere removal of a sick soldier to a less unhealthy locality does not constitute sufficient change. Many men require entire removal from the country originating their diseases; for them, Western Australia constitutes an excellent asylum. The voyage from India, under the circumstances alluded to in my letter, and the health-reviving influence of the S.E. trade wind, would soon restore them to their original condition.

As a measure of economy to Government, the facts I have adduced appear to me sufficiently convincing. Western Australia is a penal colony. For the safety of the colonists, an equivalent military force must be maintained, and this can be readily accomplished, without additional outlay, by constituting a Sanitarium—employing the convalescents on military duty. Invaliding would thus be materially reduced, as soldiers will take their discharges in the colony.

I think you will agree with me that our system of invaliding is injudicious, that the detention of such cases as require change of climate during the hot months is prejudicial, if not cruel. I have perused your work with great satisfaction; the acute observation and sound judgment

displayed on all questions affecting the European soldier must make every medical officer regret that men like yourself do not predominate at the head of our departments in India. I may perhaps be accused of prejudice, but I cannot refrain from remarking that dislike to innovation, and dread of official censure, rule rampant; cramping the good intentions of junior officers, conscious of the glaring evils manifest in our sanitary arrangements. I may say, it is with pain I daily witness the sad defects in the accommodation and disposition of those entrusted to my medical care—the determined defiance of all hygienic rules, and the utter incapacity in military authority to understand the importance of the several measures urged upon them. For instance, men limited to less than 700 feet of cubical space, because such was apportioned by the quartermaster-general, stinking urinals, confined bath rooms, with insufficient means for ablution, bad drainage, imperfect clothing, unfiltered water, badly managed cooking, and a host of other defects. I conceive the period must arrive when all questions affecting military hygiene shall be left to the medical department only, that their decision shall be final, without reference to any other authority; until such time, life will be sacrificed, and the benefits resulting from our experience not sufficiently appreciated.

I shall feel obliged by any suggestions you may feel disposed to offer, and for the weight of your influence to bring the subject of my letter before those most likely to promote its intentions. I must mention that I am already indebted to you, as at the recommendation of Sir George Russell Clerk, in 1847, you were kind enough to furnish me with a letter of introduction to the then director-general, Sir James MacGregor, which tended, with my previous recommendations, to get me into the service.

I am, Sir,

Yours faithfully,

H. H. JONES, M.D.,

Staff Surgeon,

Royal Army.

Sir J. R. Martin.

To the Editor of the "Bombay Standard."

SIR,

As frequent allusion has been made, within the last eighteen months, to the subject of sanatoria for British troops stationed in India, I venture to offer a few observations, trusting that, with suggestions from others, they may prove of ultimate value.

I doubt not the question has arisen in the mind of every thinking man, as to whether—considering the large body of Europeans collected in India, besides the local sanatoria—some more suitable situation might not be selected in the Southern Pacific, within reasonable steam distance from India, and entirely devoid of the malarious influences affecting European constitutions. That such recommendations are afforded by Western Australia, four years' residence as a professional man enables me to affirm.

Western Australia, the smallest as regards population of the Australias, extends from an undefined latitude N. to 34° S., the latitude of King George's Sound. The territory inhabited by Europeans ranges from the parallel of about 28° N. to Cape Leuwin, running in an easterly direction from 120 to 150 miles, beyond which the impassable barrier of sand, described by all explorers as constituting the central desert of Australia, defies animal and vegetable existence. The colony abounds in natural products; is rich in mineral wealth; prolific in the finest timber; the wood of Jarrah, resisting the ravages of marine and other destructive insects, and is consequently admirably adapted for ship-building and railroad purposes. As a horse-breeding country, Western Australia is universally recognised, and its capabilities as a wine-producing country are annually rendered more manifest—the soil growing grapes surpassing in richness and in abundance the far-famed produce of Southern France. Perth, the capital, is situated in 34° 54', and is surrounded by lakes, from which, by percolation into wells, the inhabitants are supplied with wholesome drinking water. The town is remarkably free from fever. Individual cases occasionally occur among the civil residents, plainly traceable to defective sanitary precautions in the establishment itself. During the four years alluded to, I had not occasion to attend one case of fever among the troops under my charge.

The colony, though a British possession since 1829, has not been visited by any of the severe epidemics affecting the other Australias. Small-pox, measles, scarlatina, and curious enough, venereal, except in the form of a mild gleet contracted from the aborigines, are unknown. The medical records of the detachment 99th regiment, and Royal Sappers and Miners, from 1852 to 1856, will guarantee the total absence of that bane of the British army—*Syphilis Primitiva*. Dysentery is a rare disease. Diarrhoea is also unfrequent; in fact, diarrhoea may generally be considered

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as a salutary effect of nature; when proving troublesome or inconvenient, the colony affords, in the natural exudation from a species of Eucalyptus, a remedy familiar to every settler and native; a small fragment of which, removed from the bark and chewed, is sufficient to check the ordinary bowel affection of the country.

Disease of the liver, like dysentery, is extremely rare, considering the amount of alcohol consumed in proportion to the population. This immunity may be pronounced as very remarkable.

With such peculiar exemptions from the bodily evils to which man is heir, little doubt can remain as to the recommendation of Western Australia on the score of health. Medical officers, in charge of European troops in India—I allude to those especially in the neighbourhood of ports of embarkation—have frequent occasions to regret the absence, at the commencement and advance of the hot season, of ready means of disposing of their more urgent sick to a less unhealthy atmosphere. The invaliding season, you are aware, commences at the close of the autumn, when regimental medical officers bring forward such men as are incapacitated for further Indian service. The men passed at these annual invaliding boards usually proceed home; should others after this period indicate symptoms requiring change, the surgeon has no alternative but to go on treating until his skill fails, unless the regiment be in the neighbourhood of a sanitarium, and his patient's strength admit of removal; when, however, such favourable alternatives do not offer, the men, of necessity, die. It is to the consideration of these latter I would apply my observations.

The climate of Western Australia I have already represented as healthy. From the middle of March until the beginning of November, it is not surpassed by any in the world. During the months of April, May, June, July, August, September, and October there is an elasticity of the atmosphere indescribably exhilarating, when nature allows a licence to the European, denied to the resident of India. Man feels not intended to die. Do what he will, the vital power is predominant, urging him to physical labour and exposure, enough elsewhere to demonstrate insanity. With advantage, I think, from February, such cases as are considered to require change, should be shipped every fortnight or month by the P. and O. Company's vessels from the several ports of India and China to Point de Galle, where they might be embarked on board Government steamers, ready to receive them, and thence transmitted direct to Freemantle. By this arrangement, a sick man would, in little more than a fortnight (taking Captain Mangles' calculation), from Calcutta, Bombay, or Kurrachee, be landed at the sanitarium. I can speak practically of the benefit of sea air, even in the Indian seas, between Calcutta and Suez, on constitutions debilitated by protracted bodily or mental suffering; but nowhere is this benefit so decided as in the south-east trades. Under the influences of these breezes, the sick man feels a regenerate creature. In three days, from Galle, by steam, the equator can be crossed, the invalid removed entirely from the influences tending to perpetuate his disease, and ushered into the so-much-desired trade winds. The method of conveyance, I propose, by steam, has several advantages over sailing vessels. Time can be calculated to a certainty. The sick soldier is made aware that in a few days he will be introduced into a healthy atmosphere. The novelty of the proceeding is itself reviving (for a soldier can appreciate variety as well as his more educated officer). The steamer being on even keel is better adapted for severe cases, more especially men wounded.

Viewing the establishment of a sanitarium at Western Australia as a source of ultimate economy to Government, I would urge:—

1st. That many a useful life, now lost in India, might be saved.

2nd. That many men, now invalided, would not require to go home; in fact, invaliding might be materially reduced, as soldiers have a partiality for the Australian colonies, and will willingly take their discharge in the colony in preference to returning to England.

3rd. Western Australia being a penal colony, Government is necessitated to maintain a certain permanent military establishment, which the colonists do not consider adequate to the influx of the penal element. The convict population will, if they do not already, exceed the civil and military; the colonists have, therefore, petitioned for an increased military force, which might be avoided by carrying out the measures I propose. The sick, as they improve, ought to be dispersed throughout the colony, to do regular duty. The settlers in the rural districts are totally unprotected, for the safety of whom, if Western Australia is to continue the outlet for British malefactors, Government must provide sufficient security.

4th. In the event of another outbreak in India, an immediate large force would be available; the presence of such a force, I conceive, would exercise the same deterring influence over both mutineers and convicts.

The ports of Western Australia are four, Freemantle, Bunbury, Vasse, and King George's Sound. As a harbour King George's Sound is by far the best. This last is recommended as the most convenient, by Captain Mangles, for the site of a sanitarium, but he appears to have overlooked the fact that the great barrier to the approach to the Sound is the boisterous nature of the weather round Cape Leuwin; six days out of seven the wind is strong, raising fearful seas. During the winter months the navigation is pronounced positively dangerous, and therefore certainly not adapted for invalids or sick. Albany, moreover, is at present ill provided with the necessaries of life, and being distant from the seat of Government, convalescents would not afford that protection so much needed in the more populous districts. Bunbury and Vasse are both unfit, their harbour exposed, and population small.

The most eligible port is that of Freemantle. There vessels may ride at all seasons of the year, sheltering themselves under Garden Island during the winter months. The means of disembarkation would be the same as provided for the convicts, concerning whose welfare in these matters the authorities are more considerate than for soldiers.

I would recommend the principal hospital to be at Perth, which is pleasantly and picturesquely situated within thirteen miles by water from Freemantle. The sick from Freemantle can be conveyed by steamer. At York, Toodjay, Bunbury, Vasse, Campion Bay, might be convalescent stations or barracks for men who are able to afford assistance in their proper military capacity. The nomination of those medical officers from India, as staff, who have already suffered from climate would be conferring a great boon.

The sick, having thus enjoyed the benefit of the more favourable month, might in the early part of November, if recovered, be reconveyed to India; those still debilitated remaining in the colony for further treatment. When alluding to the months from April to October as being favourable, I refer to them as less hot than November, December, January, and February. During these latter the thermometer reaches occasionally to above 100° Fah.; consequently, a considerable amount of lassitude is induced, though totally differing from the same sensation experienced in India.

Having trespassed further on your valuable columns than originally contemplated, I must plead the importance of the subject. Humanity requires that while studying the interests of the state, the lives of those instrumental to our position in India should be equally consulted. England is proud of her noble sons, who, under privations and adversities sufficient to crush the stoutest heart, have, without murmur, at the voice of their country, braved battles, and their still greater enemy, the tropical sun, to uphold our empire in the East. Surely, for the alleviation of the sufferings of such men during their hours of sickness, more active and suitable measures ought to be adopted.

WEST AUSTRALIAN.

No. 5.

EXTRACT from "A SKETCH of the COLONY of WESTERN AUSTRALIA."

Climate and Seasons.

There has now been upwards of fourteen years' experience of the climate of Western Australia, and, during that period, it has not been *even once* subjected to any of the droughts which have, within the same time, occasionally visited the older Australian colonies, and committed such devastation amongst the flocks, herds, and crops.

The nearest approach to drought at Western Australia since the foundation of the colony, can only be called a "dry season;" none of the sheep were destroyed by it (though occasionally suffering for want of water); the crops of that year proved abundant and of excellent quality. The eastern coast was at the same time suffering severely; thousands of sheep and lambs were cut off, and the crops of whole districts parched up and totally destroyed. This wide difference between the climate of two places, parts of the same great continent, lying in the same parallel of latitude, has been thus accounted for. The prevalent winds in Australia are the west and north-west; these, blowing over an immense extent of ocean, arrive at the western coast surcharged with moisture which they scatter over the surface of the western country: proceeding towards the east, they traverse a tract of arid interior, to which they bring no refreshing showers,—dry and exhausted, they mingle with the heated atmosphere of the countries over which they pass, and bear to the eastern side of the continent their blighting

and parching influence. Thus the moisture which they bring from the ocean being exhausted during their passage from the western coast across the interior to the east, it happens that while the western side receives, during ten months of the year, its regular and sufficient rains, and enjoys the other two (being harvest months) without a shower, the eastern coast is parched up not only for months, but sometimes even for years.

At the same time, the atmosphere is clear and free at all seasons from mist or fog. This is attributable to the *gradual* advent of the winter, which commences in a light shower and increases by degrees into a succession of rains, and by these regulated gradations from the dry to the wet season, the earth becomes saturated gradually, instead of suddenly and emits no mists or vapours.

The climate of Western Australia has been found so conducive to health that many who have resorted to it in dread of the rigours of an English winter whilst suffering from pulmonary complaints have been completely restored to convalescence shortly after their arrival in the colony. So mild is the climate that many of the early settlers, though previously unaccustomed to hardships, night after night folded themselves in their cloaks and slept upon the ground without suffering any ill effects during their exploring expeditions in the bush.

Many high medical authorities have recorded their confident testimony in favour of the climate, especially Dr. Crichton, the colonial surgeon, and Dr. Johnson, of H.M.S. *Sulphur*. Mr. W. H. Sholl, surgeon of much experience, reports most favourably of its effects on the constitution and the especial absence of pulmonary complaints among the settlers. The heat of summer is unattended by fevers and the cold of winter by coughs; the atmosphere, he states, is so light that the harvesters feel no inconvenience with the thermometer at ninety degrees and upwards, and infection is swept away by a strong sea-breeze, which sets in at noon daily, and purifies the air. Mr. W. P. Dinely, the surgeon of Freemantle gaol, has lately published a letter in which he gives his warmest testimony in favour of the climate. As it has possibly not yet reached many of our readers, we extract the following paragraph:—"We have no particular extremes of heat or cold; though the days in summer are hot, the nights invariably are cool, enabling us to rise in the morning in cheerfulness and health, entirely exempt from that lassitude and debility which warm climates generally occasion. Measles, small-pox, typhoid or puerperal fevers, or any of those dire diseases to which the mother country is subject, are here unknown. We have almost a cloudless sky, a clear, dry atmosphere, and a climate *unsurpassed by any in the world*. In conclusion, I will only add that I think above all others it is peculiarly adapted to those persons who unfortunately suffer from affections of the chest." Mr. Milligen, surgeon of Her Majesty's 72nd regiment, also speaks in high terms of the climate, and general observers, unacquainted with the principles of medicine, but speaking from their own experience, have assured us that it has the most invigorating effect upon the frame.

The seasons are the reverse of those of England; the summer commencing in November, and winter in May. The summer is the dry season, and the thermometer ranges from 80° to 85° in February; the winter is the wet season, the thermometer falling to 60° or 65° in August. The extremes of the thermometer in each of these months are, February 61° to 95°, and August 50° to 71°. The characteristics of summer are occasional showers, morning land and noon sea breezes, light dew in the morning and clear sky at night; winter is attended by slight cold, sudden and heavy rains and hail; a fire is occasionally acceptable, but snow and ice are very rarely seen. The winter is so mild that the foliage never leaves the trees; the last year's leaves are forced off only by the coming year's buds, and all the plants are evergreen.

The following opinions have been recorded of the climate by eminent medical men, who have had opportunities of witnessing its effects:—"As a proof of its salubrity, during three years H.M. ship *Sulphur* was employed upon this station, not a single death, and very few important cases of disease, occurred, notwithstanding the very great exposure of her men. When exploring the country for several days, and sometimes weeks, they have been exposed to the sun, fatigued in the evening after a day's excursion, slept in the open air (and that repeatedly in wet weather) without suffering in the slightest degree."—J. M. JOHNSON, Esq., M.D., Surgeon of H.M. ship *Sulphur*. "I have met with several individuals here who, on leaving England, were great sufferers from dyspepsia, and disorders of the digestive organs, generally from the nervous affections which so often accompany them—hypochondria, asthma, and bronchial diseases, who have recovered their health in a wonder-

ful degree since their arrival. Children thrive remarkably well; and I may add, every description of live stock although collected from different climates—England, India, America, Africa, &c., find here a congenial temperature."—WILLIAM MILLIGEN, Esq., M.D., Surgeon, 6th Dragoons. "Nothing can be more delightful than the climate generally; and its invigorating influences on the human constitution, especially those of Europeans, renders it more fit for invalids than any other in the world. Several persons arrived in the colony, suffering from pulmonary and bronchial affections, asthma, phthisis, hæmoptysis, or spitting of blood, hopeless of recovery in England, are now perfectly recovered, or living in comparative health. Small-pox and measles are unknown."—JOSEPH HARRIS, Esq., Acting Government Surgeon. "From pulmonary complaints we are happily free: and even when these have gone to some length in other countries, removal to this climate has been of the highest possible benefit. Children are exempt from the diseases common to them in England—small-pox, measles, scarlet fever, and hooping cough are unknown here."—W. H. SHOLL, Esq., Colonial Surgeon, *pro tempore*. "We have almost a cloudless sky, a clear, dry atmosphere, and a climate unsurpassed by any in the world."—W. P. DINELEY, Esq., Surgeon of Freemantle gaol. "We have no fevers or epidemics here."—DR. FERGUSSON, of Australia.

No. 6.

STATEMENT of the MEN of HER MAJESTY'S INDIAN SERVICE, who have come to ENGLAND, for each Year during the last Seven Years.

1852	-	-	-	258
1853	-	-	-	300
1854	-	-	-	415
1855	-	-	-	347
1856	-	-	-	379
1857	-	-	-	348
1858	-	-	-	326
Total	-	-	-	7)2,373(339

No. 7.

RETURN showing the NUMBER of MEN discharged at CHATHAM as INVALIDS from TROOPS of the LINE in the EAST INDIES in the following Years:—

1852	-	-	-	391
1853	-	-	-	572
1854	-	-	-	439
Total	-	-	-	3)1,402(467

No. 8.

OBSERVATIONS on the Plain of MYRUNG, in the COSSYA HILLS, as an eligible Site for a European Cantonment, by T. C. ROBERTSON, Esq., late Commissioner in ASSAM, and Governor of AGRA.

68, Eaton Square,
July 8, 1861.

MY DEAR SIR RANALD,

In the year 1832 and the two following years, I held the post of Governor General's Agent in Assam, and on the north-east frontier. From Chirra Poonjee, on the southern side immediately over Sylhet, to Nunglow on the northern, at the head of the slope into Assam, the Cossya hills, forming a sort of promontory running out from Tartary into low lands of Bengal, are about 40 miles in breadth.

The elevation of Chirra Poonjee is about 5,000 feet above the level of the plain of Sylhet, and being exposed to the full force of the watery monsoon, is enveloped in clouds and rain for at least four months of the year. This liability has given a bad name to the whole region, and the delicate denizens of Calcutta, scared by Mr. Longueville Clarke's picture of the inclemency of the climate, could never be brought to perceive that at about four or five miles from Chirra Poonjee, and to its rear, there is a steep ridge of nearly a thousand feet in perpendicular height, which stops the progress of the clouds coming from the south-west, and arrests the deluge from that region.

I had been struck with the apparent difference between the climate on the north and that on the south side of the ridge in question; in the course of my frequent rides across the mountains, in passing from one part of my extensive jurisdiction to another, but knowing the uncertainty of any

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such cursory observations, I requested a most intelligent young officer, of the Sylhet light infantry, Lieutenant Mainwaring, who was to pass a whole rainy season in command of a detachment posted at Myrung, to keep a meteorological journal, marking the quantity of water ascertained to have fallen on each day of his three months' sojourn at that seldom-visited spot. This was done, and the result was most satisfactory, showing the fall of water at Myrung to be at least one-third less than that at Chirra.

I may mention one proof which I remember of the difference in point of humidity between Chirra Poonjee and Myrung.

At the former place daily wiping is necessary to prevent a mould accumulating on books or any leathern article, while at the latter no precaution of the sort is needed. As to the salubrity of the climate I may mention, that as the hills during the two years of my rule, in that quarter, were in a state of subsiding insurrection, a small detachment was always posted at Myrung, where both officers and men preserved their health.

I never halted there for any length of time, but I have visited it at all seasons. In the rains I found it mild and pleasant, and when last I was there, in the month of February, the ground was crisp with hoar-frost in the morning, and the air clear and bracing throughout the day. Though with a rough surface there is a considerable extent of table land in the immediate vicinity, such as is not often to be found among the hills in India.

I do not remember whether I reported these facts officially to the Government, but I know that I did send a copy of Lieutenant Mainwaring's journal to the editor of a Calcutta paper, by whom it was given to the public, my object at that time being to induce the Calcutta people to turn their thoughts to Myrung as the most fitting place within their reach for a sanitarium.

But though, for various reasons, I did not then put it forward as a matter for the consideration of Government, I was not without a wish on military and political grounds, that so healthy and commanding a position as Myrung should not be lost to the European portion of the army in India, perceiving as I did that the presence of such a force at that point would give strength and consistency to the whole frontier from Rungpore to the extremity of Chittagong. With all my love for the old Bengal sepoy, I had not failed to perceive during the three years of my camp life in Arracan and Ava, that he was out of his element in that humid climate, and could not be safely relied on unless supported by Europeans to act effectively against Burmese entrenched in one of those stockades, which they run up with such wonderful celerity. It was a great object then to have some of our own armed countrymen stationed at some healthy, yet accessible point, whence they could be brought in an emergency to support the sepoy garrison of any of our frontier districts. Now this was an advantage possessed by Myrung in a remarkable degree. Two marches would bring troops to Chattur, on the Sylhet side, and three would take them to Gohatee in Assam. At either of those places water carriage could easily be provided to convey them to any place where their presence might be required.

Materials for building, stone, and wood are to be had in the Cossya hills, and the very best coal for warming the barracks.

Things have so changed since I was in that quarter that it is not to support, but to overawe my old friend Jack Sepoy, that Europeans may now require to be suddenly called in. The large and yet decaying, and consequently discontented town of Dacca, ought, I conclude, to be watched, and a provision for this object could be easily be combined with the establishment of what I propose at Myrung.

Suppose a regiment to be there cantoned, and a small fortified position to be constructed at Dacca. Could not a company be detached to garrison it from the headquarters, thus by the ordinary process of a relief ensuring the presence of a restraining force in the great city, without exposing it to the climate of the plains for more than a month at a time? In conclusion, let me remind you that Sir Edward Ryan was one of the first who visited Myrung, and though he nearly killed some of his legal staff by over fatigue, came away with a favourable impression of the place.

I am,

Dear Sir Ranald,

Very truly yours,

T. C. ROBERTSON.

Sir Ranald Martin, C.B., F.R.S.,
&c. &c. &c.

Physician to the Council of India.

No. 9.

A REPORT upon the STATION of GOONAH, considered especially as to its Applicability for the Locale of European Troops.

Goonah is situated on the Grand Trunk Road, leading from Indore to Gwalior and Agra, in the dominions of Maharajah Sindia, and is about 175 miles (N.E.) from Indore, 95 (S.W.) from Jhansi, 130 (S.S.W.) from Gwalior; as the crow flies it is distant rather over 100 miles (S.E.) from Kolah, and 175 (E.) from Neemuch, and 60 (S.W.) of Sissree, by the road.

Its bearings are—

Latitude - 24° 39' 0"
Longitude - 77° 18' 15" (Col. Thuillier.)

Itself a small and unimportant village, the nearest town of any size is "*Bujrunghur*," otherwise called by the natives "*Jyenuffur*." This is a considerable town, distant five miles south of Goonah, and is supplied amply with the produce of the neighbourhood: it is commanded by an extensive fort, now in a partially ruinous condition.

The other nearest towns of importance are *Chunderi*, in Sindia's dominions, *Seronfe*, belonging to Amir Khan, the Nuwab of Tonk, *Esaghur*, the head quarters of the Sir Soobah of Maharajah Sindia, and *Rafaghur*, where there is a strong fort and a town belonging to the representative of an ancient Rajput family, the Rajahs of Rafaghur.

This station, placed on the elevated table land of Mahouh, stands at a considerable height above the level of the sea; I do not remember the precise altitude, but I believe it is considerably higher than Mhow (1,862 feet above sea level), or Indore even, which is 13 miles north of the latter place, and which lies 1,998 feet above the level of the sea.

It rests on a fine bed of the *latento* formation, which, on this road, first appears at Rafaghur, and crops out constantly in the neighbourhood, alternating with beds of alluvial deposit, the so-called *regan* or black cotton soil.

From this *latento*, a jaspideous clay of varying density, consisting of silicate of alumina and an oxide of iron, iron is procured by rude methods in some villages adjoining Goonah.

I will beg to digress here to remark on the remarkable infrequency of cholera attacking districts and towns where this geological formation prevails; this fact, which was specially inquired into by Dr. Balfour, of Madras, was found to obtain in a very remarkable manner in the Carnatic and south-western coast of the peninsula.

History of the Place.

I believe that Goonah was a station for troops during the Pindari wars.

Latterly a detachment of Gwalior contingent cavalry occupied the place, whilst the late Major Burton officiated in the place as a political assistant in Gwalior; during this time the salubrity of the place was widely known.

Several years ago Colonel Hill, then brigadier commanding the late Gwalior contingent, chose Goonah as the site for a great camp of instruction: to this place the bulk of the contingent, the Malwah levy, the Bheel corps, and others, gathered and remained in it a considerable time, during which all arms enjoyed excellent health.

Description of Goonah.

To enable this I append a rude sketch map of the village and its environs, drawn from memory, showing the site of the present European barracks, the lines occupied by Mayne's horse, &c., &c.

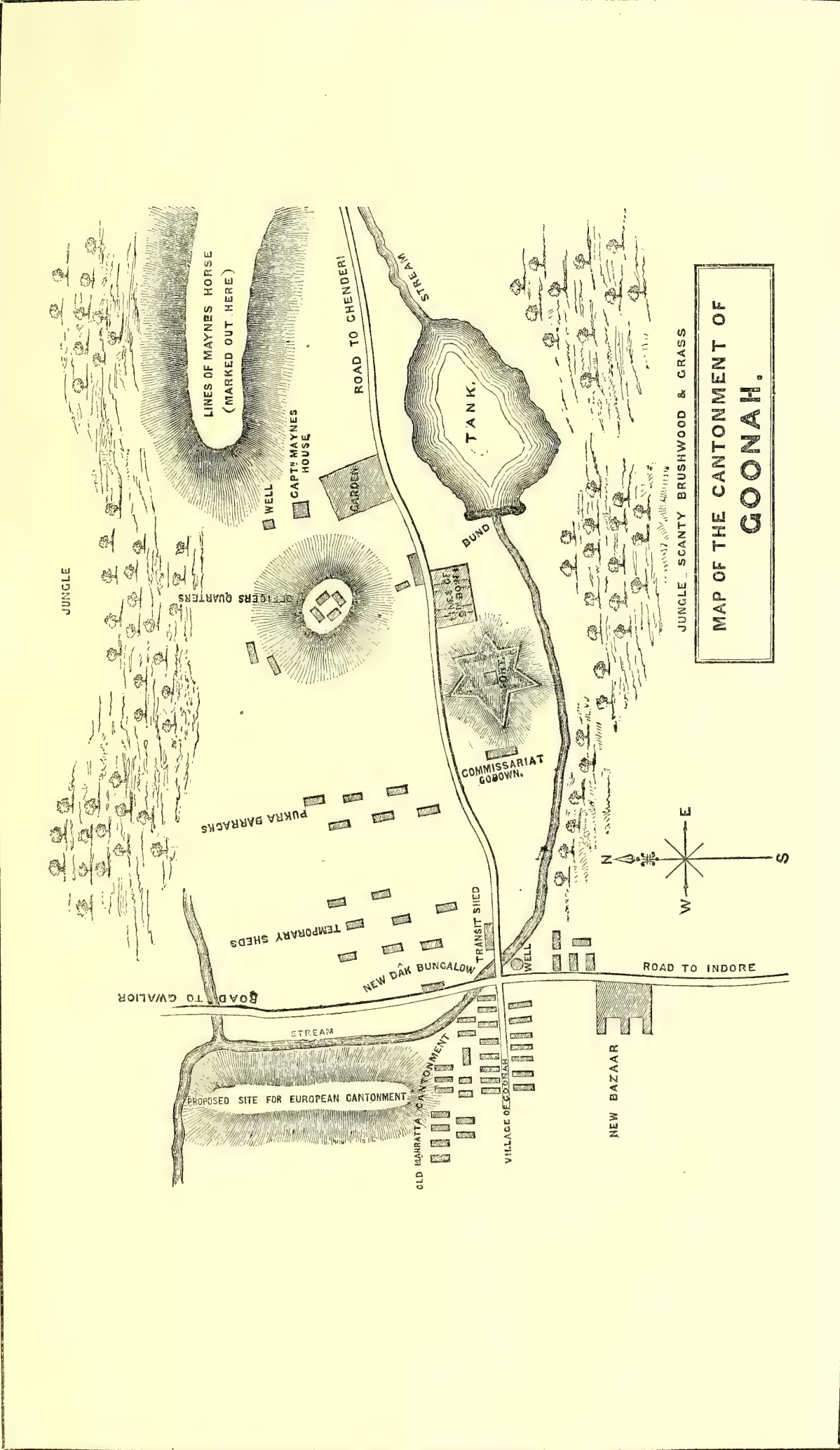
At present, August of this year, there are cantoned at Goonah the following details:—

Royal Artillery, 2 guns with 25 men; H.M.'s 71st N. L. I., 200 men; 3rd Bengal European Infantry, 100 men; 9th Bombay Native Infantry, 300 men; Head-quarter wing, Mayne's horse, 400 men.

These occupy positions in the station which I will now detail, referring to the map for explanation of the various sites.

In August the European details were accommodated in the temporary sheds on the east of the Trunk Road, whilst the pukka barracks were building; these last are immediately east of the sheds.

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The ninth Bombay Native Infantry were lodged in the dilapidated lines formerly occupied by Mayne's Irregular Horse, to the west of these is the fort, in the form of an irregular triangle, with flanking angles; these works enclose a repaired bungalow, which is now used as an hospital for the European troops.

Opposite the Native Infantry lines are the officers' quarters on a slope of latento.

To the east of these is the long ridge of latento on which a wing of Mayne's horse are huted. This is a very fine site for troops, being at a considerable elevation so as to secure perfect drainage. The southern slope of this long ridge ends at the road which leads to Chunderi; on the opposite side of this road is a tank of water formed by damming up the river at the *Bund*, which is at the western extremity of the tank. Though this tank may be requisite for the purpose of watering the cattle, in other respects I consider it objectionable, as it is almost totally dried up in the latter part of the hot season, and must be a source of marsh poison.

The temporary sheds and pukka barracks are unfortunately situated, as the ground they occupy is low, and in the S.W. monsoon almost afloat. When their site was being determined upon, I explained to the committee this objection to the site, and proposed another, but my objection was overruled, and it was determined to fix upon this situation as the ground could easily be drained, and because moreover in this position they would be commanded by the fort.

West of the sheds is the Grand Trunk Road running north and south, to the west of this road stands the village of Goonah, an assemblage of wretched squalid huts, occupying either side of one long street; beyond the village, and occupying higher ground, are the ruins of the old Mahratta cantonment.

Beyond these various buildings on every side is the jungle, with abundance of grass and a scanty brushwood in places.

Climate.

The rains in this part of Malwah are not very copious, the lack of meteorological instruments precludes me from stating what the average fall exactly is, but I should estimate it at 25 to 30 inches.

During this prevalence the surrounding country is very much cut up, the black soil being churned into a thick tenacious mud, which presents an almost insuperable bar to wheel carriages for the time. At this time the atmosphere is not oppressive nor enervating, and the sick list is not materially swelled, excepting under circumstances where prolonged exposure has been inevitable.

I may mention that in 1858, from September 11th to December 3rd, the regiment to which I was attached formed part of the field force under Major-General Michel, and moved in a line of country which may be defined as included in an irregular quadrangle, whose sides were, 1st, the Trunk Road from Sarungpoor to Goonah; 2nd, a line drawn from Sarungpoor through Bhilsa to the neighbourhood of Saugor; 3rd, from Saugor to Thiree; 4th, from Thiree through Chunderi to Goonah; these limits will roughly map the outlines of the country in which the force acted during the latter and heavier part of the rains. The climate of these parts on the average was a fair representative of that experienced at Goonah, and during the hard and harassing duties of the force, the health of the troops, European and native, was excellent.

I cannot imagine a more rude test of the effects of climate on troops actively employed during the rains than this well-known pursuit of Tantia Topee, and the sick list throughout was astonishingly small.

I speak of the climate of this quadrangle being analogous to that of Goonah, but here I do very scant justice to the latter place; it enjoys advantages which most of the points within this space are strangers to. To these I shall presently allude.

During the hot season the heat is never extreme at Goonah; the hot winds are unfrequent, and bring with them little of the dust that is so distressing an accompaniment of them in other parts. The nights and early mornings are always agreeable and refreshing.

In the cold season the climate is unexceptionable, there is a dry keen invigorating freshness in the air that I never experienced elsewhere in India, and at such times the hospitals are nearly empty.

I have an experience of Goonah dating from February 7th 1858 to July of 1859; during this time many detachments of European troops have passed through Goonah, staying there different periods of time, and latterly Europeans have been permanently cantoned in it.

I have no statistics at hand to found an analysis of the ratio of sickness upon, and can only speak in general terms

of such. The first brigade of the Central India field force, Brigadier Smith's detachments of the Rajputana field force, Colonel Robertson's and Major Chetwode's columns, with other bodies of men, European and native, have sojourned at Goonah during this period, and have *invariably* enjoyed excellent health the while.

After the surprise and defeat of Feroze Shah, at Runnôd, by Sir Robert Napier, I was directed to form an European hospital at Goonah, where I treated his sick and wounded, with those of Colonel Somerset's and Colonel Rich's columns, besides accommodating the sick of the details of Royal Engineers, and Hill's 86th regiment stationed at Goonah.

From the formation of this dépôt for the sick, to the breaking up of the same, embracing a period of six or seven weeks, only one European died in hospital, of the sequelæ of remittent fever, contracted in the jungles about Chuppra when with the cavalry brigade. The sick and wounded made good and rapid recoveries, and the Goonah climate was mainly instrumental in enabling me to break up the dépôt in February of 1859.

During the 18 months I spent there I had a great number of sick and wounded European officers under my care, from Chunderi, Jhansi, Gwalior, Seronfe, and elsewhere; at this time Goonah was generally regarded as a sanitarium, and the results of the stay of these officers was invariably beneficial. Most of them recovered perfectly and rejoined their corps and departments, whilst those whose constitutions had received too rude a shock to admit of their restoration to perfect health in the tropics, were sufficiently invigorated to allow of their safe removal to the coast for embarkation to Europe.

Since January of this year European troops have been permanently quartered at Goonah, and the small amount of sickness amongst them was very frequently the subject of remark from the officers attached to the various details. The Europeans were mostly under the charge of Assistant-surgeon Leach, of Her Majesty's 71st Highlanders, who would be able to furnish returns showing accurately the ratio of sick to strength, if applied to.

Prevailing Diseases.

I have at times remarked amongst the poor and squalid population of Goonah, who have sought medical aid at my hands, traces more or less of splenic enlargement; but this is greatly attributable to their poverty and squalor, and the lack of the proper remedies when assailed by marsh fever; the place has not the reputation of being a "feverish" one, and the prevalence of affections of the intermittent type amongst the men of my regiment was in no way commensurate with what I should have anticipated, had I founded my expectations on the condition of the village class.

On our first arrival several of the irregulars suffered from fever, whose predominant type was a proclivity to pulmonary congestion and jaundice; all of these recovered and the variety disappeared, and has not yet been since remarked, I believe.

The place has an infamous notoriety for the extensive prevalence of syphilitic disease, and from some of our men who had been stationed here in previous years, whilst serving with the Gwalior contingent cavalry, I learned that this had long been the case. At one time this accident was so fertile a source of disease, amongst both European and native troops at Goonah, as to elicit inquiries from the brigadier-general commanding, as to its possible diminution by a system of medical police.

To this end, I furnished a scheme to Colonel Hope, then commanding the station, but it was not acted upon. I believe that a plan might very easily be devised that would rid the station of this pest.

During this last year a vast number of the European and native troops who served in the many "raids" into the Seronfe jungles were affected by guinea worm, which they carried with them over the country to various stations. I never yet met with a case of this kind where the least suspicion could be entertained of the parasiting *originating* in Goonah.

Dysentery is rare at Goonah, and I cannot remember a single fatal case occurring to either European or native under my care there.

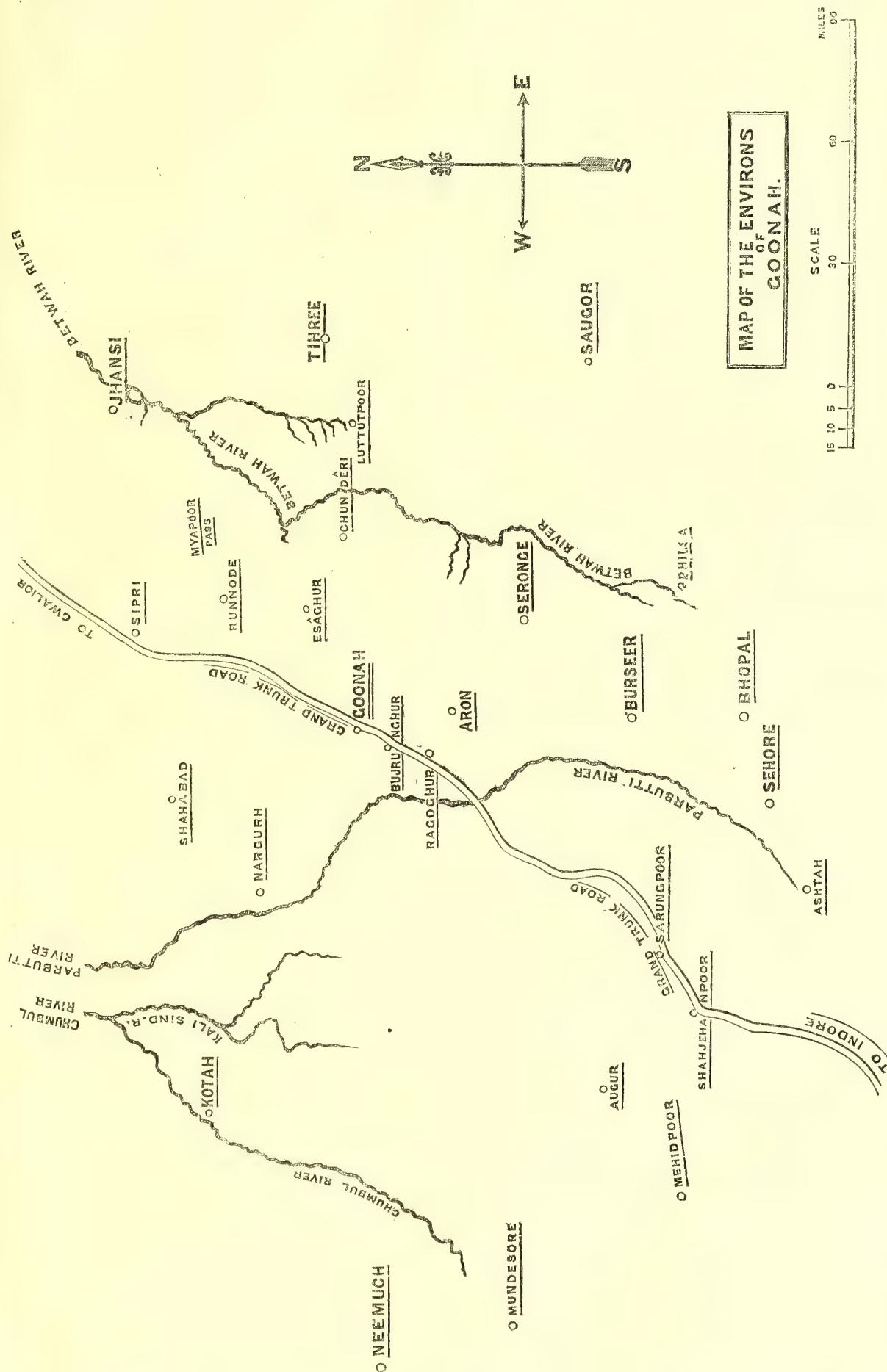
Amongst the native details it existed in a very mild form, and was readily subdued.

The only case of cholera I have seen in Mahoah was that of a "Dhoby," a servant attached to an officer of my corps; whilst on our return to Goonah, from Hosungabad by Seronfe, he was seized, at Aron, with symptoms of spasmodic cholera, and died half way between that place and Goonah.

I have some recollection of having heard of a case or cases of cholera occurring between Sigori and Goonah, I think in the 25th Bombay Native Infantry, whilst on the march from Gwalior to Poona.

Sir R. Martin,
C.B., F.R.S.

25 Nov. 1859.



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Fewer cases of rheumatism and its allied affections were admitted into my hospital at Goonah than into any other hospital I have ever had charge of in India during my five years service.

During eighteen months at Goonah we had only one death in the regiment. This case was that of a Sikh who died at Goonah, I think of remittent fever, whilst I was away on field service with Colonel Rich's column.

This case, and that of the European to which I previously alluded, were the only fatal casualties I can recall to memory in 18 months experience; and I may mention that I have sometimes seen 80 and 90 patients in a day whilst at Goonah.

I do not know of any circumstance existing at Goonah that should be prolific of disease, excepting the presence of the tank I have spoken of. That abolished, I do not think any place could be more favourably situated or circumstanced.

The country surrounding Goonah is undulating, and presents a constant succession of great prairies of grass of an excellent quality for forage. The supply of this would be practically *inexhaustible*, I believe, and would furnish food in abundance for cavalry and horse artillery for many years to come.

Should it be decided on to mass together any considerable force of mounted men, I cannot picture a more advantageous site for them than Goonah, where every favouring circumstance will be found existing. The inexpediency of brigading European troops at either Gwalior or Jhansi will be apparent to all who have experience of these two places; whilst Goonah is sufficiently near to either to act as a menace, and in it the troops will have all the advantages of climate, &c., that the place enjoys.

Wheat is grown in great quantities about Goonah, and furnishes flour of unexceptionable quality. Hülthi and chenna are abundant, and at present moderately cheap. When the Gwalior Contingent detachment occupied Goonah, I believe sixty seers were ordinarily sold for the Company's rupee.

I think that Goonah is exceedingly well adapted for a breeding establishment, should it ever be deemed necessary to form a stud farm for the supply of horses to Malwah, Rajpootana, &c.

Site for a Cantonment.

I have previously spoken of the present locality of the European barracks, and the reasons for selecting the site in question. I will now point out the site I recommended at the time, and which is unquestionably the best position for the cantoning of troops on the spot.

It is an extensive high and dry ridge of latento, to the west of the Gwalior and Indore road, and north of the old Mahratta cantonment. It has a good slope to the eastward, where it is bounded by the stream, and is sufficiently extensive for all practical purposes.

It has been occupied at different times by various camps, once by Sir Robert Napier's force; and it is the proper and the only unexceptionable site in the immediate vicinity for a camp or cantonment.

Next to this locality, I should place the fine ridge on which Mayne's horse were being huted when I left. Here, and on the site I have just described, a large cavalry camp might most advantageously be distributed, and there is plenty of water close to both.

All these localities are well known, and minute measurements, &c., of them might be obtained by reference to the authorities on the spot.

Water.

It is only necessary to bore to a very moderate depth in the latento to ensure any particular locality with an unfailing supply of *most excellent* water. There are already wells in all directions; they never require repairs, for the latento wall hardens on exposure to the air almost to the consistence of granite. This abundance of good water at Goonah is quite a notorious fact in the neighbourhood.

I will append a few remarks on an adjoining station called

Sipree.

This is distant about 60 miles north-east of Goonah, and was formerly a station for the Gwalior Contingent. Here were stationed at one time a regiment of native cavalry, a battalion of native infantry, and a battery of gholundauze. It is a beautiful place, and is exceedingly healthy, resting, like Goonah, on the latento formation. There is a well supplied bazaar here, and a very fair building stone (sandstone) is found in the neighbourhood.

There are a series of small hills in the cantonment, where formerly stood the houses of the European officers; and just without the cantonment is a noble site for a camp or barracks.

There were at Sipree, last August, a detail of Royal Artillery, 200 of the 3rd Bengal European Infantry, 300 of Meade's horse, and 200 of the 9th Bombay Native Infantry.

Additional particulars relative to this station may be learned from Major Meade, commanding there, and Dr. Dalzell, the medical officer in charge of the troops there.

Grass and water abound here as at Goonah; and were one place chosen as the station for cavalry and horse artillery, the other would serve as the *locale* for infantry, who would thus be very nigh to both Jhansi and Gwalior, and obviate the very undesirable necessity for quartering European soldiery at these two unhealthy and trying situations.

HENRY C. BRODRICH, M.D.,
Assistant-Surgeon, Madras establishment, in
medical charge Mayne's horse,

Macclesfield, Dec. 14, 1859.

To Sir J. R. Martin,
&c. &c.

No. 10.

NOTES ON MILITARY HYGIENE, by W. I. VAN SOMEREN, Madras Army.

The augmentation of the company's European force in this presidency is now more than a mere rumour, and the site of barracks for a cavalry corps an agitated question.

At present, also, an extensive relief of regiments is taking place, and already have the marching orders proved to many individuals but the signal of death. As usual, cholera dogs the footsteps of every moving corps, and Dr. Campbell, with the 7th N. I., and Mr. Grant, of the 11th N. I., have fallen victims to the scourge with *hundreds* of natives, men, women, and children.

This then appears a favourable opportunity to call the attention of the ruling powers to the subject of military hygiene—a subject whose very name signifies its importance, but how much is this importance magnified by the fact, that to ignorance or neglect of certain means for the *preservation of health*, many thousands of valuable lives have been from time to time sacrificed, an unholy holocaust. Our experience in all the three presidencies verifies this assertion. In Barrackpore, Dacca, and Cawnpore,—in Secunderabad, Bellary, and Vellore,—in Colaba, Hyderabad, and Kurra- chee, epidemic cholera, fever, and dysentery have decimated our regiments. The specific poison, constituting the potential cause of each of these malignant diseases, has found our assemblages of troops in the state best prepared for its operation, and the evil seed, thus sown in a favourable soil, has germinated, sprung up, and brought forth bitter fruits, a hundred-fold. Whatever may be the origin and nature of these different poisons, we become aware of their pervading existence in any locality only by their dire effects, and are equally powerless to dissipate them and to annihilate the sources whence they spring. But we may, *notwithstanding*, “from this nettle *danger* pluck the flower *safety*.” By improving the sanitary condition of our troops, both in quarters and on the line of march, we have it in our power to mitigate greatly the severity of epidemic visitations, perhaps even to prevent their occurrence. The seeds of disease will not sprout in an unpropitious soil, the leaven of disease will lie harmless in the largest mass of matter incapable of fermentation.

I need scarcely mention that this important subject, the *prevention of disease*, was one all but unheeded and unknown, even at home, twenty years ago. Within this period, however, it has excited a large amount of attention and inquiry, not only in England, but over all Europe and the United States, and sanitary reform has become the burden of several legislative enactments. In the course of their hygienic investigations, medical men have accumulated a large number of useful facts and established general principles of the highest practical import, but these are stored in medical works, sealed books to the public at large. With the object of rendering some of this information better known and thus seconding the efforts of a part of my profession to extend to the Madras army the sanitary improvements of England, I now address you.* By this means I also hope to awaken an interest in the subject in the minds of our public functionaries. The army in general hails with pleasure the advent of an able commander-in-chief, the medical service in particular blends with its pleasure the fervent hope that through his intervention the hygienic condition of the soldier may be advanced, and our assemblages of troops become less obnoxious, both in cantonment and in camp, to the invasion of cholera and cognate maladies.

Montesquieu has said that “un fait, qui n'emporte pas une idée, duquel on ne peut s'élever pour voir plus loin, est

* This memoir was originally addressed to a local press.

"un caillou qui ne vaut pas la peine d'être ramassé, et qu'il faut, au contraire, repousser du pied pour en débarrasser la route." Just such a suggestive idea as the French philosopher contemplates by contrast in this passage has been derived from late observations of epidemics. According to an authority, "we have a strong presumption that the cause of the invasion of epidemic diseases in each individual case may be expressed by this simple formula,—a certain general condition of the human body, *plus* the specific poison of the particular disease. When these two antecedents are concurrently present, the disease is invariably produced; when either of them is wanting, the disease cannot be developed." It is this *general condition of the human body* which constitutes the *predisposition* to the disease, and results itself from the operation of what have been designated *predisposing* causes. Such are *imperfect ventilation, offensive effluvia, impure water*, and some others, with all of which we are only too familiar, although their removal is quite within our power. But an interesting question here presents itself—in what does that *condition of the system* consist, which is essential to the operation of the morbid poisons? To answer this intelligibly I must premise, that decomposing compounds are always present in our blood in minute proportion, minute because they are scarcely introduced in their natural amount into the circulation before they are ejected from the system by the skin, lungs, bowels, and kidneys. The eliminating power of these organs, however, is not unlimited, and although they form ample outlets for the quantity of effete matter generated by, or introduced into, the body placed in healthy conditions, they are inadequate to their removal in a body placed in certain conditions adverse to health. An excess of organic compounds in progressive decomposition then taints the circulating fluid—"the life of all the blood is touched corruptibly," and needs but the specific poison of a grave disease to develop a general dangerous disorder. There is much to favour the belief that a sweet infusion of malt is not more peculiarly susceptible of being changed by the action of a ferment than is blood thus contaminated of being altered by the leaven of disease. It is this striking analogy, if not perfect identity, in the *modus operandi* of an ordinary ferment and that of the potential cause of many maladies, which has led to their inclusion in the Registrar-General's returns at home under the denomination of *Zymotic*—a convenient term which has been generally adopted, and is used to imply that the specific poisons of these diseases act on the blood in the manner of ferments. The "certain general condition of the human body," then, which prepares it for the pernicious operation of *Zymotic* poisons, is an undue accumulation in the blood of degenerating matter, and such an accumulation all the recognized predisposing causes of zymotic disease are calculated to produce.

I have lately been on the track of a marching regiment that suffered severely from cholera *en route*. The scourge did not appear in camp till about half a long journey had been accomplished, and then continued to strike down its victims daily till the corps was comfortably settled in quarters. In none of the towns or hamlets along the line of march did the pestilence gain a hold, nor was it introduced into the cantonment of whose garrison the regiment now forms a part. Are we to suppose that the choleraic influence was limited to the camp, and accompanied it because *fortuitously* the route of the cholera was that of the corps? The subsidence of the disease simultaneously with the housing of the wearied sepoys, however, opposes so vague and fanciful a conjecture, and points rather to the operation of certain causes rendering this assemblage of men peculiarly liable to an epidemic visitation; among these causes *fatigue* and *insufficient nourishment* doubtless held a prominent place. * * *

All these predisposing causes determine in the blood an excess of decomposing matters—the general condition of the body which is one of the *factors* in the formula already given—in one of three ways:—

1. By introducing into the system degenerating elements *ab extra*. In this manner it is that *putrescent food, water polluted by fetid matter, and air loaded with noxious effluvia*, contaminate the blood.

2. By the excessive production of decomposing matters in the body itself—the *modus operandi* of *fatigue*, severe injuries, &c.

3. By impeding the *elimination* of elements tending to putrescence—under which head are ranged an *insufficient supply of air, a high external temperature, and imbibition of alcohol*.

There is, however, one predisponent that cannot be included under any of the above categories—I allude to *starvation*.

Of all the causes just enumerated, I have only to do with such as are shown by experience to operate in rendering our

troops, European and native, liable to epidemic visitations—they are

1. Insufficient air.
2. Impure air.
3. Fatigue.
4. Intemperance.

5. Insufficiency of food,—a predisposing cause chiefly among native troops, and among these principally on the line of march. This may appear at first view a matter of *personal* and not *public* hygiene—one which the individual and not the State should correct—but it is one so frequently operative, and so fertile of the worst effects, that I cannot but include it among those of which it is the duty of Government to take cognizance and devise means for its removal.

First.—It would be superfluous to argue about the paramount necessity of fresh air to all and every one. The fact that the same air cannot pass repeatedly through the lungs without becoming perfectly unequal to the purification of the blood has been proved over and over again, and by no case more startlingly than that of the notorious Black Hole in Calcutta. Connected with this case, however, there is a significant circumstance which has been but partially noticed, and it is *this*,—that many of the 23 who escaped suffocation on that fearful night were subsequently cut off by "putrid fever"—their incarceration proved equally fatal to them but in a different way—though not suffocated, their blood was so tainted by the inhalation of an atmosphere inadequate to the depurating process of respiration, as to render them an easy prey to a zymotic disease. When the *supply of air is insufficient*, then the lungs cannot eliminate the decomposing matters which they are intended to remove, and these remain to circulate in excess in the blood. But *not* only by obstructing the excretion of effete matters does the cause under review produce a dangerous accumulation thereof, for imperfect ventilation and overcrowding confine the putrescent effluvia that are constantly exhaled *as such* from the lungs and skin, and the deleterious operation of an impure air is superadded to that of its insufficient supply. Who has not observed how offensive to the smell the atmosphere becomes in a room where many persons have been confined for some time? and equally offensive is the odour of garments that have been too long worn,—Collard de Martigny detected in the fluid exhaled from the lungs as much as three parts in 1,000 of organic matter, which soon became putrid when kept in a closed vessel and exposed to an elevated temperature, and matter very similar is also given off from the skin. Air thus vitiated becomes a source of supply of putrescent matters to the system which receives them through the lungs, and "thus imperfect ventilation becomes the means, not only of preventing the due elimination of decomposing matter from the body, but actually of re-introducing its poisonous products into the blood, by the very process which was designed for the purification of the vital fluid." The cases of Taunton workhouse, Tooting, and Millbank prison, tell a fearful tale of the liability to cholera-invasion produced by a scanty supply of air, but we need not travel so far for evidence of this. Alluding to one of the regiments (the Rifles) in Kurrachee, assistant-surgeon Thom in his report of the frightful outbreak of cholera, in that station in 1846, states—"I feel persuaded that this corps would have had very little sickness, had they been less crowded in barracks and their rooms ventilated by better arrangements, such as a medical board recommended at the moment the disease was breaking out." The Rifles lost 76·5 per 1,000 men during the epidemic, and no wonder! "The barracks were built in rows, the canteen, schoolroom, and other high buildings, were in front of all, and nearest the sea; then the rooms for each company were ranged behind them; by this arrangement, the sea breeze was totally arrested by the first line, or if it travelled interruptedly and in languid puffs to the second, it never reached the third. Ventilation in the barrack-rooms was not apparently conducted on sound principles, and the soldiers were accustomed at the time of the attack to close both the doors and windows at nights."

To come nearer still, what was our experience till very lately of Bellary as a station for European troops? For 30 years it was the grave of nearly every regiment quartered in its barracks. Cholera was scarcely ever absent during that time, and this despite the fact that the pestilence was scarcely known two or three miles off. In the year 1839 alone, during one of the most violent visitations of the disease, the 39th regiment lost 90 men out of 735 in five months, or 122½ per 1,000. The accommodation in the fort was scanty to a degree, but this did not deter the authorities from occasionally introducing into the barracks marching troops in addition to the regular garrison, and every such accession of inmates swelled the number of casualties; Dr.

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McGregor then said "if the remediable causes of disease were removed, Bellary might become one of the most favourable stations for the health of H.M.'s troops." The contingency alluded to by this officer has occurred; these barracks have been rebuilt on a better principle; Bellary is not now as notorious for cholera, and its average of mortality has been much reduced.

It has been justly averred of our Indian military stations, "that whenever they are distinguished by an unusually high rate of mortality through a long series of years, and this excess is not attributable to any local causes of epidemic disease, it is occasioned by an insufficient supply of air." Secunderabad affords a striking example of this. The members of our medical service who were there with H.M.'s 55th, retain most painful recollections of the sufferings of that regiment, and every corps that has been quartered in the station can bear testimony to the neglect of many essential sanitary precautions. For the 15 years preceding 1846, the ratio of deaths per 1000 men was 75 annually, which was nearly double that of the whole presidency, and more than double the average of all the other stations. The following quotation appeared not long ago in an English journal: "The regiments of the line quartered in Secunderabad have been always crowded in barracks quite insufficient for their accommodation, one-third of the men having been obliged to sleep in the verandahs, and the remainder getting by no means a due allowance of fresh air, whilst on the other hand the officers of these very regiments, who are better accommodated, and the detachment of artillery quartered in more roomy barracks at no great distance, have never participated in this unusual mortality, thereby clearly showing the absence of any special causes of disease at this station which might not easily be removed." In this cantonment also it is encouraging to chronicle improvement. Measures for the preservation of the soldier's health in barracks have been lately carried out with the best results, and they promise to be but the earnest of others as much needed. Especially would I solicit attention to the condition of the Parcherry, with its houses overcrowded, low, and imperfectly ventilated, its streets too narrow, and its odours pestilential.

If the barracks in Bellary and Secunderabad were objectionable, the buildings appropriated to regiments, when by misfortune stationed in Vellore, are much more so. They cannot be called barracks, even by a figure of speech; to term them good stables were a misnomer. Their insalubrity is notorious, and the orders that send a corps thither may be construed into the death-warrant of each tenth man in its ranks. Culpable indeed would be the Government that thus wittingly consigns a body of men to decimation!

It is time, however, to indicate what amount of space each individual requires for healthy respiration. The experience of many of the most competent observers has determined 800 cubic feet as the minimum compatible with safety in a cold climate like that of England, and in the prisons at home 1,000 cubic feet are allotted to each inmate. Less than the latter quantity ought not to be permitted in India, and more is highly expedient, inasmuch as the high external temperature of these intertropical climates, by rarefying the atmosphere, and affording in the same volume of air less oxygen for the aeration of the blood, becomes itself a means of favouring an accumulation of putrescent matters in the vital fluid. In the construction of Indian barracks, then, it may be laid down that 1,200 cubic feet of air should be apportioned to each man; but even this liberal, though not excessive, allowance, must not be unassociated with the most efficient ventilation. As many as 2,000 cubic feet of air in a hermetically closed chamber, would soon become inadequate to support life, by the diminished proportion of its oxygen and its excess of irrespirable carbonic acid gas, exhaled by the lungs. Farther, the amount named should be the space told off to each individual within the walls of each barracks, exclusive of the verandahs. These are never intended as dormitories, and whenever occupied as such the air that passes through them into the chamber they are designed to cool, becomes vitiated in its passage and less fitted for respiration.

As one means of securing perfect ventilation and the circulation of a pure atmosphere, too much care cannot be exercised in the selection of sites for barracks. The influence of geological and hydrological conditions on the progress of cholera, yellow fever, and all other zymotic diseases contributes to render such precaution necessary; for M. Fourcault remarks, that "the cities and villages disposed in an amphitheatre have in general presented three distinct zones: the inferior, the most humid, has been the principal focus; in the middle, the epidemic loses a part of its activity; in the superior zone it is almost or entirely extinguished." It must ever remain an objection to the Secunderabad infantry barracks, that they are located at the very bottom of a basin, and their situation

more urgently demands the rigid observance of all other sanitary precautions. But I am, perhaps, here met by a common objection, that "if site, or an insufficient supply of air, or impure air, be so fertile of evil, why are they not perpetually so? These are causes in constant operation, why are their effects intermittent?" One of the most talented of the corps of engineers has often cast this in the face of medical men, who have taken exception to the site of the barracks already specified; but it is an objection easily disposed of. The best way of replying to it is to recall attention to the formula already given as expressing the causation of epidemic disease. It consists of two factors, both of which must come into operation before the malady can result; they are, a "certain general condition of the human body plus the specific poison of the disease." When the former, produced by an ill-situated, ill-ventilated, noisome barrack, exists alone, disease does not appear; let the specific poison of epidemic dysentery or cholera pervade the atmosphere, however, and its well-prepared victims are singled out at once.

Before leaving the subject of sites, it is worth while to take the evidence of a witness whose opinion and statements on this topic are worthy of the highest respect. The case of the Colaba barracks should be a beacon to all entrusted with the construction of buildings for a body of soldiers, and the late Sir Charles Napier's description of them in his own emphatic and characteristic style is one worth conning:—"The Colaba and King's barracks at Bombay have destroyed whole regiments; commanding officers dreaded them as pesthouses, but it is said the Government has now been compelled by public indignation to pull down or alter those of Colaba. It is full time. I walked through the men's sleeping-rooms there upon planks laid in water covering the floors! An officer who knew them well thus speaks,—'the Colaba barracks, it would appear, are destined to be the slaughter-houses of more thousands of British soldiers than would suffice for the winning of fifty battles!'" The moment we landed each shipload was at once attacked by cholera, and we buried ninety-seven men! * * * * *

"I represented to him that disease must ever attack the troops stationed there, particularly in the monsoon season, while the barracks are so low and close to that mangrove swamp; that if no more convenient site could be found on which to build new ones, the present ones should be raised upon strong arches, fourteen feet from the ground, and the rooms above made high, ventilated, &c. He promised to give all attention, but it ended in draining and raising the roofs, and ventilating, which has indeed improved the barracks, but the 'evil is still there! The men sleep and live on the ground floor,'—the floor walked over on planks!"

"In 1848 I was Commandant of Bombay; sickness was

"at Colaba as usual, and the excellent officer quoted above

"recommended the construction of new barracks on firm

"ground, with a sale of the edifice in the swamp for a bond-

"ing warehouse; the purchase-money would have repaid

"many times the cost of the new construction. A com-

"mittee composed of myself, the quartermaster-general, and

"the executive engineer, chose a very suitable site, and

"estimates were ordered; but without result, and death now

"continues to be over-filled at Colaba."

Illustrations enough have been given of the pernicious

effects of overcrowding and imperfect ventilation in the

barracks provided for our troops in quarters, but in these

respects their lot in tents on the line of march is often much

worse. In each of the tents furnished to Europeans there

is about 1,950 cubic feet of air, and of those allowed to

natives each contains about 911 cubic feet. The number of

men told off for each tent is 25, but sentry and other regi-

mental duties generally reduce the figure to 18 or 20. I

shall take the former and lower of these numbers as a divisor

to calculate the amount of air available for every individual,

and I find 110 feet the scanty allowance for an European,

and 51 feet for a native. In fine weather when the cannauts

of a poled tent can be thrown up and free channels opened

for the air in all directions, this limited space matters little,

but when the nights are cold, or torrents of rain either by

day or night necessitate the closing of the tent, and even the

windward entrance is blocked up, who can presume to hope

that the niggard supply of 110 feet of air to each European

will be compatible with his health and safety—much less

that of 51 which is deemed sufficient for a poor sepoy? If

a prisoner's health at home cannot be thought secure without

the provision of 1,000 cubic feet of air, who shall gauge the

culpability of those that deny an English soldier in an Indian

clime more than 110 feet, and a Hindoo less than half that

amount? With air so scanty and consequently so impure,

who can wonder that the blood is charged with an accumu-

lation of decomposing elements, and that pestilence is so

frequent an attendant on an Indian march? Who can now

express surprise at the fearful mortality from cholera which

occurred in a detachment that left Secunderabad for St. Thomas's Mount during the last monsoon? And what rendered the limited tentage so unpardonable in this instance was the fact, that *sick* men and women principally constituted the detachment,—people whose unhealthy condition specially demanded a liberal allowance of fresh and pure air.

In the epidemic of cholera already mentioned as having raged in Kurrachee in 1846, H. M.'s 86th and the Bombay Fusiliers suffered still more severely than the 60th Rifles. The first discoverable cause of this difference was that those two corps were encamped in tents "on a low, hot, and arid plain." Ten or 12 men "were cooped up in a 14 foot square tent. Here exposed to the burning heat of the sun, with the thermometer at 96° or 100° Fahrenheit, they remained from sunrise to sunset, unable to move out, in a still sultry air, and altogether deprived of the influence of the sea breeze. A deficiency in proper accommodation led to the death of hundreds of men. Twelve men were breathing in a tent hardly large enough for one, the tent itself carefully secured from all means of ventilation, and the season unfortunately one in which the winds fell peculiarly light; in any point of view, this situation was hygienically bad. As regards the poison, it must have found in that close and contaminated air, with the humid atmosphere all round it, the very conditions most favourable for its rapid increase. As regards the human beings on whom that poison acted, they must, in a variety of ways, have been rendered peculiarly susceptible of its influence."

These things are clear as daylight, they cannot be gainsaid; an immense increase of mortality was then caused by circumstances which could have been most easily removed.

The second predisposing cause of epidemic invasion noted for consideration is *impure air*, or that vitiated by miasmatic emanations. It should in *limine* be clearly understood that such an atmosphere and the sources of its contamination do not generate disease, but produce that condition of the body which is most favourable for its development—they *nurse* but do not engender zymotic disorder. The putrescent matters with which the air is charged are conveyed through the lungs into the blood, and these circulate in excess, presenting the most favourable *nidus* for the poison of fever, plague, cholera, dysentery, or any other kindred malady. If the poison be absent the disease is not produced. This being borne in mind, it forms no objection to the asserted insalubrity of a tainted atmosphere, that many live a long time in such with apparent impunity. We can afford to smile at the sapient member of a board of guardians, who denied that the effluvia of a cesspool could be injurious because he had lived near one all his life. And when triumphantly told of the general healthy condition of the Esquimaux living in an atmosphere rendered fetid by putrid blubber, and of the healthy though dense population of Montfaucon, the most stinking suburb of Paris, we shall find no difficulty in showing the objection untenable. There is overwhelming evidence to prove that putrid exhalations are the reverse of harmless, and some of this I shall now adduce. The case of Albion Terrace, Wandsworth Road, already quoted, is one pregnant with warning in this respect, and so is that of Witham, a suburb of Hull—"where about two acres of ground are used as a place of deposit for dung and night-soil, which is interspersed in heaps among the houses and close to the doors of the dwellings. And what is the result? It will be remembered that what were deemed by many the first cases of cholera in this country occurred in September 1848, in the port of Hull. It was not until nine months afterwards, viz., in July of the following year, that the disease became fairly localised in any part of Hull; only one or two sporadic cases had taken place during the previous interval. Dr. Sutherland again visited the town, and found that no preventive measures had been taken to meet the storm, although there was now every reason to apprehend an impending outbreak. No cases of the disease had as yet occurred in or near to the district of Witham; but there was a moral certainty in Dr. Sutherland's mind that if it once appeared there, its ravages would be most severe. The warnings given were still neglected. At length the epidemic struck the district, and his predictions were fearfully realised. On the outskirts of a triangular space, measuring little more than 200 yards, there occurred 91 fatal cases. "I have never known," says he, "an open neighbourhood of this size yield so large a number of deaths."

Enough has, I hope, been stated to prove how essential it is not only that the supply of air should be ample, but that the quality of air should be the purest. In the elevated temperature of this climate it is especially necessary that it should be uncontaminated, and in selecting the sites of barracks and of encamping grounds, the greatest care should be taken to give a wide berth to all sources of offensive effluvia. The vicinity of burial grounds, slaughter-

houses, large drains, and common sewers should be studiously avoided, and the privies of barracks ought invariably to be built remotely from the dormitories and in that direction from which the wind least frequently blows. The privies themselves should be large and airy, and so constructed as to allow the facile removal of all ordure; this should be secured by the direction of a stream of water through them twice daily, by which means all noxious matter might be washed away in channels prepared for the purpose to a safe distance. These precautions need to be pressed on the attention of authorities, for they are rarely observed, and their neglect entails much suffering, much danger, and much expense. There is reason to believe that the intolerable privy atmosphere was a potent predisposing cause of dysentery during the epidemic of this disease that raged two years ago in the Secunderabad barracks, and since that time several hundred-weight of lime have been thrown into the privies weekly as a deodorizing agent."

Third.—It will at first sight appear inexplicable how fatigue can produce an accumulation of decomposing matters in the blood, but the process admits of an explanation, and such too as is easily intelligible. With every action of the muscles there is a breaking-up of some of their texture—muscular contraction cannot occur without disintegration of muscular tissue, the components of which become oxidized, and eliminated partly by the lungs and partly by the kidneys. This being the case, if by exercise the separation of the integrant parts of muscle take place more rapidly than they can be oxidized and eliminated, there must ensue an accumulation of decomposing and fermentible matter in the body. Hence it is that exercise in a hot climate induces fatigue so much sooner than in a cold one—the process of oxidation being carried on at only half the rate in the former than it is in the latter, and the blood becoming more speedily surcharged with decomposing elements. Hence also it is in part that dysentery, cholera, and other zymotic diseases are such frequent scourges of Indian camps. Prolonged marching increases amazingly the predisposition to these epidemic complaints. Mr. Orton, who has written on the subject, says that although his "statements are abundantly sufficient to show the increased prevalence of the disease arising from marches or travelling, they give no idea of the dreadful extent to which this simple and apparently harmless circumstance is capable of operating to the destruction of human life." Surgeon Taylor of Her Majesty's 80th Foot, in a recent report writes—"My own experience and observation furnish indeed ground for the belief, that there is something in the state of the system, induced by recent travelling, positively predisposing to cholera, which disease was, and is, one of the greatest sources of mortality on occupation of the country; and this predisposition would appear irrelevant of any influence of change of climate, simple travelling in the same climate almost equally producing it. The influence of marching in producing this predisposition among soldiers has been observed by many and is statistically evinced." This medical officer then cites several illustrative cases, which I regret being deterred by want of space from inserting, and concludes his remarks with these words—"It would appear, then, that recent travelling has some influence upon the system, predisposing to cholera; and, if to cholera, probably also to that type of dysentery and fever with which cholera is so intimately related." To this deleterious and potent influence it was that the unfortunate 86th foot had been exposed in 1846, when cholera more than decimated the corps in Kurrachee,—and this combined with other causes, already referred to, to render the men of this regiment the greatest sufferers during that fearful outbreak.

An excellent report on epidemic cholera was published by Dr. Lorimer, the present Secretary of our Medical Board, in 1846. In this the author proves by tables which will not bear gainsaying, that the number of cases of cholera on a march increases in a regular ratio with the number of miles and the number of days. So rapidly, indeed, does susceptibility to the disease augment, that about the termination of the third month "the attacks of cholera occurred in the proportion of 61 per cent. of all the marches performed by the Madras infantry; while the attacks in all the native part of the Madras service were 46 per cent. in marches over 600 and under 800 miles, and 75 per cent. in marches over 800 and under 1,250 miles." That fatigue is a fertile source of this susceptibility is evidenced by the fact that the officers, who are mounted, are comparatively little liable to the disease, and cavalry less than infantry.

It scarcely needs specifying that when several predisposing causes combine, their joint operation increases manifold the liability to disease. This result was strikingly shown in the Kurrachee epidemic of cholera, so often alluded to in the present letter, and the following table, borrowed from Dr.

Sir R. Martin,
C.B., F.R.S.

25 Nov. 1859.

Sir R. Martin, Carpenter, discovers how terrible is the combined power of all the other stations in the Madras command being at the rate of 30·2 per 1,000 for the same year. But when this regiment was replaced at Secunderabad by the 84th, a large proportion of which consisted of total abstainers, whilst nearly the whole remainder were habitually temperate, the mortality of the station was reduced to 34·2 per 1,000, which, for it, was unprecedentedly low, being less than half the average of that station for the fifteen years preceding, and absolutely below that of the remainder of the presidency for the same year. Now, the mortality of the 84th regiment during the preceding year, whilst quartered in Fort St. George, had been but 12·1 per 1,000; so that, as we have no reason to believe any other causes than those now assigned to have been in operation in either case, we may regard the increase of mortality in that regiment from 12·1 to 34·2 per 1,000, as due to the imperfect barrack accommodation at Secunderabad, whilst the difference of 47 per 1,000 between the temperate 84th and the intemperate 63rd seems fairly attributable to the effects of alcoholic excess, aggravated by imperfect respiration."

25 Nov. 1859.

Designation.	Strength.	Deaths.	Deaths per 1,000.	Exposure at Drill, &c.	Provision for Respiration.	Previous Exertion.
Officers' Ladies -	42	0	0	Nil	Good -	Nil.
Officers -	200	3	15	Ordinary	Mostly good	Nil or slight.
Horse Brigade -	135	5	37	Ordinary	Good -	Moderate.
60th Rifles -	980	75	76·5	Ordinary	Bad -	Nil.
Artillery -	375	37	96·6	Ordinary	Good -	Severe.
Bombay Fusiliers	764	83	108·6	Ordinary	Very bad -	Nil.
Soldiers' wives -	159	23	144·6	Nil	Mostly very bad.	Partly severe.
Do. of 86th Regiment.	-	-	166·6	Nil	Very bad -	Very severe.
86th Regiment -	1,091	238	21·8	Ordinary	Very bad -	Very severe.
Total -	3,746	464	12·4			

"Thus we see that the *highest* rate of mortality presents itself where the three causes referred to—namely, the fatigue and exposure of drill, the imperfect ventilation, and the previous exertion in a long march—were in concurrent action; the *absence* of mortality where neither of them was in operation. The difference between the mortality of the Bombay Fusiliers and that of the 86th Regiment, which were under precisely the same circumstances as regards exposure and ventilation, shows the marked influence of previous exertion; but that this would not itself account for the high rate of mortality in the 86th is shown by the far smaller proportion of deaths in the artillery, three out of the four battalions of which had been subjected to the same fatigue, but were well accommodated at Kurrachee, so that their mortality was less than that of the Bombay Fusiliers, who had not marched at all, but were overcrowded in ill-ventilated tents. The condition of the soldiers' wives, again, would be much the same as that of their husbands as regards accommodation and exposure during a march. On the other hand, they are exempt from the fatigue and exposure of drill; and, accordingly, we observe that whilst the officers' ladies escaped altogether, the soldiers' wives were affected nearly as severely as their husbands, the loss being the greatest among the women of the unfortunate 86th."

Regiments must march, but they need not, in "these piping times of peace," be sent 800, 900, or 1,000 miles. Their journeys should be short, and the distance daily accomplished ought not to average more than ten miles. The men, too, should trudge without their knapsacks, and be armed with lighter muskets.

With such startling facts before the authorities as I have cited, I leave it with them to decide how much it consists with humanity to march corps without adequate cause such distances as those from Kamptee to Vizagapatam, Secunderabad to Quilon, and Jaulnah to Vizianagrum. Far better embark a regiment on foreign service out of turn than consign 50 or 100 men to certain death by such perilously long and wearisome journeys.

Fourth.—All medical men in India are unanimous in their opinion of the dangerous predisposition to disease engendered by *intemperance*. The manner in which this cause operates to overload the blood with putrescent matter requires but a brief description. The extraordinary affinity for oxygen of alcohol introduced into the blood is a well established fact; and it is by this process of rapid oxidation that the poison is itself speedily removed from the system. Its avidity in combining with the oxygen supplied by the lungs, however, limits or prevents the oxidation and excretion of other matters, which ought to be eliminated. The condition of the blood is then identical with that produced by an insufficient supply of air. In this climate, where the oxidating process is of necessity much less rapid, the potency of intemperance as a predisponent is correspondingly augmented, and drunkards are both much more liable to fever, cholera, dysentery, &c., and much oftener succumb to these maladies when attacked. In the face of such facts, why do we both legitimise and encourage dram-drinking among our troops? If they must have stimulants, let them imbibe malt and vinous liquors in moderation, to the total exclusion of such as are spirituous. It is not long since that, as a matter of course, large quantities of toddy were taken daily into the barracks of a certain European regiment, and swilled *ad libitum* by the thirsty soldiers. If this practice be general in the Company's European force, let the higher powers look to it—the custom, if such exists, is highly dangerous.

The experience of Her Majesty's 63rd and 84th Regiments illustrates remarkably the magnified predisposition to disease resulting from intemperance and imperfect barrack accommodation conjointly. "Thus the 63rd Regiment, which had not been remarkable for sobriety, lost 73 men during

"a nine months' sojourn at Secunderabad, or at the rate of nearly 79 per 1,000 for the whole year; the mortality of all the other stations in the Madras command being at the rate of 30·2 per 1,000 for the same year. But when this regiment was replaced at Secunderabad by the 84th, a large proportion of which consisted of total abstainers, whilst nearly the whole remainder were habitually temperate, the mortality of the station was reduced to 34·2 per 1,000, which, for it, was unprecedentedly low, being less than half the average of that station for the fifteen years preceding, and absolutely below that of the remainder of the presidency for the same year. Now, the mortality of the 84th regiment during the preceding year, whilst quartered in Fort St. George, had been but 12·1 per 1,000; so that, as we have no reason to believe any other causes than those now assigned to have been in operation in either case, we may regard the increase of mortality in that regiment from 12·1 to 34·2 per 1,000, as due to the imperfect barrack accommodation at Secunderabad, whilst the difference of 47 per 1,000 between the temperate 84th and the intemperate 63rd seems fairly attributable to the effects of alcoholic excess, aggravated by imperfect respiration."

The same corps also furnish an illustration of the evil effects of fatigue, *alcoholic excess*, and a high external temperature in combination. In the march of the sober 84th from Madras to Secunderabad and of the 63rd from Secunderabad to Madras, "whilst the former did not suffer at all from cholera or fever, and lost only two men by dysentery (both of whom were old chronic cases taken out of hospital at Madras), the latter lost a considerable number of men on the road, and had so many sick when it met the 84th, as to be obliged to borrow its spare dhoolies or sick palanquins."

Fifth.—In the public mind *famine* is justly regarded as the invariable precursor of pestilence, and, in common with some other predisposing causes of zymotic disease that have passed under review, it has been generally supposed to induce liability to disorder by depressing all the vital powers. That this is not its only, or even principal, mode of operation there is much reason to believe. All observers concur in testifying to the occurrence of a general putrescence even during life in suffering from starvation, and this evidence is supported by most rapid decay taking place after death. Dr. Donovan mentions in his account of the Irish famine of 1847, that a "foetid odour exhaled from the skin, which is itself covered by a brownish, dirty looking and offensive secretion." These facts indicate the presence of a large quantity of decomposing matters in the body—the most favourable nidus of a zymotic poison! That this fermentability of the blood is often prepared in a native on the line of march by *deficiency of food* is what few medical officers, familiar with the camps of Indian regiments, can deny. The thriftless and improvident sepoy seems possessed of neither sense nor inclination to prepare for a long march. In one way or other most of his money is expended before the journey commences, and but a paltry pittance remains to supply his bodily wants *en route*. The food he is then able to purchase is either scanty in quantity or innutritious in quality, or both—and the natural sequence is that condition of body most suited for the development of epidemic disease, which will assuredly break out on the introduction of its poison into the circulating current. As I have already said, *insufficiency of food* is so fertile a source of peril that the State should take cognisance thereof, and provide a remedy, even if this remedy can be none other than rationing and feeding native corps on the line of march in the same manner as Europeans. Why should caste be any more an obstacle in a regiment than in a gaol, where all the prisoners have their food prepared by cooks of their own *zat*? The arrangements for the change may be expensive, complex and troublesome; but the necessity for the alteration is urgent. It is *life* that is at stake, and its value exceeds all money, and overbalances every conceivable amount and variety of trouble. The acknowledged inadequacy of medical treatment in most cases of true cholera, and its frequent failure in all zymotic diseases, render measures of prevention, however difficult of accomplishment, all the more especially necessary.

I did intend to exhibit this subject in some of its economic bearings, and to prove by figures how much less expensive it is to attend to military hygiene than to neglect it. This, however, appears to be like adopting an inferior and even unworthy line of argument, for preservation of the life and health of the defenders of the State should outweigh all paltry rupee, anna, and pice considerations. I will therefore do no more than enunciate this broad principle—"that it costs more money to create disease than to prevent it; and that there is not a single structural arrangement chargeable with the production of disease, which is not also in itself an extravagance."

It will not do to dismiss as summarily the moral aspects of the question, which are equally important and indisputable. Overcrowding, familiarity with impurities of any description, intemperance and similar causes, do not degrade the physical man without blunting his moral perceptions. Is it an object to have a regiment of sickly, insubordinate, and licentious soldiers? Then follow this prescription—select the lowest part of an amphitheatre, near a large cemetery, for the site of their barracks—build these in successive rows one behind the other—let the roofs be low, and about 6 or 800 cubic feet of air allotted to each inmate,—pay no heed to ventilation—place the privies close to the dormitories and to windward of them—make no provision for the removal of ordure—encourage the accumulation of refuse near the main structure—surround the building with a high wall—invite natives to raise both bazaars and huts contiguous to this wall—legalise arrack and toddy drinking—march the corps in crowded tents 8 or 900 miles in rainy weather, and in its new station introduce it into barracks like those lately left—and the lapse of five years will find the men as a body unhealthy and immoral to the last degree.

When we thus neglect the soldier, pestilence is needed to reprove our supineness and startle us into the conscientious performance of our duty. Epidemic diseases have been correctly regarded as “chastisements of rebuke.” The Deity is just and makes our violation of His laws of health an instrument to scourge us. In this manner are we forcibly reminded also of our general forgetfulness of Him, and awakened to the truth that “godliness is profitable for all things, having a promise of the life which now is, and of that which is to come.”

The medical profession, to which I have the privilege to belong, regard it as a sacred obligation to put in practice the knowledge they possess, and reduce physical suffering by every available means. We do *our* duty when we point out what science and humanity demand. Will the authorities do *theirs*? It is related of Pyrrho, the Elean, that discarding all such fallacies as the evidence of his own senses and the concurrent experience of others, he would, had the care of his friends not prevented him, have swallowed a whole bottle of poison to vindicate his principles and show his contempt of common sense! Are our rulers disposed to follow this bright example?

In the course of this letter I have pointed out several sanitary evils and defects for the purpose of attracting the attention of those able to rectify and remedy them. Let it be especially understood that I have dealt with *things*, not *persons*. No official individual do I presume to blame. It is “the powers that be” in their *corporate* capacity that must learn what is wrong and remove it—not this or that particular functionary only, but *all* who fill the highest offices of State must keep pace with the increasing light and knowledge of progressive science, and so alter public regulations as that executive officers, be they generals of division, brigadiers, or aught else, may clearly see and do what is *right*, and this alone.

No. 11.

STATEMENT of Opinion relative to MORFLONG as being likely to prove a healthy location for European Troops in India. By J. W. FLETCHER, Surgeon, Bengal Army.

The Cossya range of hills is situated between the valley of Assam and Sylhet. From the Sylhet side it rises abruptly from a place called Terriah Ghaut to an altitude of rather more than 4,000 feet above the level of the sea; in this situation is the station of Chirra Poonjee, surrounding which there is a good deal of table land. Across the top of the range from Chirra Poonjee it is about 40 miles to Nunclow, where the descent to the Assam side commences, but not so abruptly as on the Sylhet side.

Between Chirra Poonjee and Nunclow there is a great deal more flat and table land than is usually found in Asiatic mountain ranges; it varies in elevation from 4,000 to about 6,000 feet. At an altitude of 5,800 feet is a place called Morflong, situated from Chirra about 17 miles; a mile or so from the Morflong bungalow is a great extent of land well adapted for buildings, and in my opinion a capital situation for a cantonment for European troops. Myrung is a locality about 15 miles beyond Morflong, and 10 from Nunclow; this place has also been mentioned as a good situation for Europeans, but the only flat land about it is damp and swampy, besides which it is, I think, too near Nunclow, which place I do not consider healthy, as from it the road descends into the deadly forest which lies between the Cossya range of hills and the river Brahmapootra, in Assam.

The access to these hills, or more especially to Morflong, would be from Dacca by rivers Megna and Soorma, about a week's journey in large boats to Chaltuck on the Soorma; from Chaltuck by large boats for some months in the year, and at all times in small boats to Company Gunge or Punduah, to either place being one day's journey; the former is situated six miles and the latter three miles from Serriah Ghaut, the foot of the hills; for part of the year Serriah Ghaut even is accessible for small boats. From Serriah Ghaut the ascent commences to Chirra Poonjee about nine miles, and from Chirra to Morflong 17 miles; thus making 26 miles to Morflong from Serriah of land carriage for supplies part of the year, and at other times from 29 or 30 from Punduah, or 33 from Company Gunge, at the driest time of the year.

I have been civil surgeon of Chirra Poonjee for five years. I have also held medical charge of the convalescent depôt at Darjeeling for nearly two years; and have done duty in that at Landour for a short period, consequently have had opportunities of forming an opinion, and I certainly consider that the position of Morflong would be found more suitable in a sanitary point of view for Europeans than Darjeeling, and quite as much so as Landour; besides which there is far more table land both for building and purposes of recreation and military evolutions, than at either of those stations. Wood and coal are found near. Potatoes and oxen for beef are plentiful in the neighbourhood, and the elevation is, in my opinion, quite sufficiently high for all sanitary purposes, and more favourable for many cases of disease than a greater altitude.

A great deal of rain falls during some months in the year in these hills. At Chirra Poonjee from 500 to 600 inches of rain fall in the year; at Morflong, I believe, rather less than half that quantity; but this I do not consider as a great objection, especially at Morflong, as the surface is undulating and rocky, or gravelly, so that the water runs off immediately it has fallen, and the surface remains dry; also, although so much larger a quantity of rain falls in the Cossya hills than at Landour or Darjeeling, still I do not believe it rains for a longer period during the year, and there is certainly less fog and mist than at those stations. When it rains in the Cossya hills it generally comes down in large quantities, and all falls in about four or five months, and even during those months there are generally periods in each day that the men could get out for exercise.

For further particulars on the subject I beg to refer to a report I made to Mr. Mills, who went up as a special commissioner to investigate some civil matters on that frontier in 1853; also, personally, I shall be happy to give any information on the subject in my power.

No. 12.

EXTRACTS of LETTERS from Dr. MACPHERSON, Inspector-General of Hospitals, dated Madras, 27th and 28th April 1859.

“Again, why do we not avail ourselves of our numerous salubrious hill ranges, which are so conveniently situated to our most important stations? The regiment at Cannanore could be placed on the Neilgherries. That at Trichinopoly on the Pulnags, which are equal in altitude to the Neilgherries, and have a plateau on the summit 15 miles by 50, with abundant water supply and 80 miles distant from Trichinopoly, and from the summit of which the sea can be seen on the western and eastern coasts. Again we have the Shinags 5,000 feet high, by the foot of which the railway will pass, and which will then be within a night's run of Madras. Here we might place all our recruits arriving from England, and secure them a good start in their career. Near Vizagapatam also I have brought to notice a range of hills possessing the same elevation not far from Bellary, and midway between Nagpore and Hosingabad there are mountain ranges where our soldiers, instead of being enfeebled in the plains, could become refreshed and invigorated. But it is difficult to convince our authorities, who are now intent on expending money only on “remunerative works,” that the saving of our European soldiers' lives, which, in fact, in a commercial point of view, is the scarcest commodity we possess, ought to be included amongst those.”

“During the past 15 months I have been making an inspection tour throughout this vast presidency. For the last four months I have travelled in company with our Commander-in-chief. Embarking on the western coast, we proceeded to Bombay, and from thence to Nagpore, Hyderabad, on to Vizagapatam on the northern coast. In every station we visited we found curative measures amply

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provided for, but the preventive almost entirely overlooked, and the chief was fully satisfied that such was the case. Take that loathsome disease syphilis for example: one regiment, which had hardly been four months in the country, had forty cases in hospital of the disorder. In another, 800 strong, 10 months in the country, one-half of the regiment had been treated for fresh venereal attacks. In one case I traced ten men who imbibed the disease from the same woman, and still "the liberty of the subject" permits this woman to remain at large and pass her loathsome malady on to scores of others. I need not tell you that two-thirds of these syphilitic cases will, ere five years are passed, be broken down invalids, and sent home with a poison circulating through their system, which will pass down to their posterity, and still no effort is made to check its progress."

"After a long journey, extending from where I last wrote to you, by Bangalore through Coorg to Mangalore, and from thence, with the Commander-in-Chief, to Bombay, and onwards to Jaulnah and Kamptee we returned to Hyderabad. En route the Commander-in-chief and I had many opportunities of discussing sanitary measures. We both witnessed with our own eyes the fatal mistakes of our forefathers, both as to position and construction of barracks, the facilities with which the soldier is enabled to poison himself with deleterious liquors, the absence of all measures in the shape of preventatives to disease, the utter want of hygiene generally, and, worst of all, the fearful ravages which that most loathsome malady *syphilis* is making amongst the troops, and the utter absence of measures to check its progress. In many instances we found that the same woman passed the poison on to several men; in others, although this woman is known to be in a diseased state, she has in the men's eyes some powerful attraction, and, heedless of consequences, they associate with her. Then as to the type of the malady, so destructive has it become that few who imbibe it *can hold on to the service beyond five or six years from the date of inoculation*. Before the primary symptoms are healed, the secondary ones have set in, or extensive suppurating bubos with purulent infiltration of the surrounding tissues, a speedy loss of part of the organ from phagedenic sloughing. Then as to the extent, the prevailing diseases everywhere are syphilitic; and *fully two-thirds of those who imbibe the disease, as I have already said, are invalided within five years*, and are sent out of the service with a loathsome poison circulating in their veins, which passes down to their posterity. Is it not sad that such a state of matters is permitted to exist? Now, however, that the Commander-in-chief has been witness to it all, I hope that some steps will be taken to stay the progress of the evil. I have fully reported on the subject to the director-general, and have urged on his notice this and other measures of sanitary reform."

No. 13.

PROSTITUTION AT MILITARY STATIONS.

In the course of this report, particularly when treating of Cochin, the sanitary condition of Her Majesty's 66th regiment at Cannanore, the 2nd European light infantry at Trichinopoly, and Her Majesty's dépôt at Poonamallee, I touched upon the subject of syphilis, in relation to the health and efficiency of the troops at the above place. But the question of prostitution, in its relation to the health of the army generally, now demands our attention more at large.

This difficult question is now attracting the attention of reflecting men at home, both in its physical and moral bearings, and it becomes us to look it in the face here.

From the army statistical reports, presented by Her Majesty's Commissioners to Parliament this year, we gather that the admissions into hospital from venereal diseases, under which head are included all cases arising from impure connexion, amount to 206 in every 1,000 cavalry soldiers, 250 in the foot guards, and 277 in every 1,000 infantry of the line. The average proportion for the army at home is 267 per 1,000, or more than one-fourth of the whole number. It is calculated that on the lowest average each man is 15 days under treatment; thus, 688 men out of the home force are always in hospital from this cause alone, a number equal, or nearly so, to the strength of a regiment on the home establishment, and the money loss to the State is calculated at nearly 14,500*l.* a year. The above is startling enough, but it is only a part of this enormous evil; the mischief does not stop here, a large proportion of the sufferers have their constitutions permanently impaired, other diseases

are induced or aggravated by the venereal poison, and the mortality and invaliding are largely affected by it.

If we turn to India, we find the case no better. On the occasion of my late visit to the hospital of Her Majesty's 66th regiment, at Cannanore, no less than 25 per cent. of the cases under treatment were venereal, these cases the medical officer carefully pointed out to me. The great majority of them were suffering under the true Hunterian chancre with indurated base, or that form which, according to our best authorities, is essentially the infecting chancre which generates constitutional syphilis. At Trichinopoly, in the hospital of the 2nd European light infantry, the baneful effects of this disease were more evident still, inasmuch as the 66th regiment having but recently arrived in the country, the mischief was only visible in its first stage, but at Trichinopoly its constitutional as well as its primary effects were in active operation. But it was at Poonamallee, the dépôt of Her Majesty's regiments for this presidency, that an opportunity was afforded of seeing syphilis as a cause of invaliding and premature inefficiency in full operation. I was assured by the medical officer in charge, who has been three years at that station, that the great majority of the invalids of Her Majesty's service in this presidency, who passed under his observation, had their constitutions more or less impaired by syphilis. I might add much more on this subject were I not aware that the attention of the Director-General was forcibly drawn to it while serving as superintending surgeon to the Hyderabad subsidiary force, and were it otherwise, the Director-General, from the records in his office, has abundant and ample means to establish the truth of what is said above.

We have now to consider the best means of meeting this indisputable evil; we cannot perhaps indulge the hope that this terrible disease can be entirely banished from the army, but I think it is our duty to devise some plan to reduce it to its minimum. To a large portion of our soldiers marriage is forbidden, and they seek to gratify the strongest of their appetites, reckless of the consequences to themselves and to the State. In time of peace the ennui of a soldier's life is great everywhere, but in this country, shut up during a great part of the day as he is, with nothing to occupy his mind, he seeks for excitement in every den of vice and debauchery to which he can obtain access. I am of opinion that the means of recreation, of moral and religious instruction, which of late years have been introduced into the service, should be still further extended, that healthful and improving employment should be found, and that every possible means consistent with discipline should be used to raise the moral and religious tone of the soldier's mind, and to wean him from habits as destructive to himself as they are hurtful and costly to the State he serves. But I am not so utopian as to believe that we can gain our end entirely or even mainly by such means; we must have recourse to other measures; we must have the aid of the magistrate to help us in controlling this "social evil," and here we are sure to be met by many objections. Interference of this sort is not congenial to British habits, and customs, and tastes; it is "inquisitorial," it is "unconstitutional," it is "contrary to the liberty of the subject." The squeamishness of our countrymen in matters of this sort is notorious, and it long stood, and still to some extent stands, in the way of many sanitary and social reforms. The best mode of dealing with this, the police part of the question, has occupied my most serious attention, and I have put myself in direct communication with several civil magistrates of experience and ability. To Mr. Robinson, the able collector and magistrate of Malabar, I am much indebted for some valuable notes on this subject. It is Mr. Robinson's opinion, as well as my own, that in all our military cantonments, prostitution must be placed under licence and control; but before one step can be taken in this direction a legislative enactment is required.

"Go up to the legislature to have general powers conferred on local government to pass rules for the better prevention of the spread of venereal disease in cantonments and large towns, and enact penalties for the infraction of such rules. Introduce the rules first in your cantonments and seaport towns."

Having obtained legislative sanction, we have next to consider the best plan of administering the Act; and here again I cannot do better than quote from Mr. Robinson.

"For the administration of the rules appoint the commandant (not the commissariat officer, as the commandant can always work through him), the senior medical officer and senior (have no young man in it) magistrate of the district as your commissioners. Then license and register every prostitute and brothel, and have them open to constant inspection. A respectable dresser and a couple of selected peons would do all the work of the *respectable* brothels. The police could be called in to check the low riotous brothels and keep the strictest watch over new comers, Lock hos-

pitals will then be of use. The women will be in a great measure their own police and spies, their own sanitary commissioners, and, with good management, the utmost secrecy might prevail.

"I do not think that such a system would add one prostitute to the awful profession. It would save thousands of female infants (children of 10 to 14) that are prostituted in unknown brothels, and I do not believe that one would resort to the public brothel more than are now seeking the gratification of their lusts on the lowest diseased sluts behind hedges, in filthy huts, and in ditches of our cantonments."

It will be seen that *Lock hospitals* enter, as they necessarily must, into this, as into all plans for restraining within some bounds this terrible disease, and this involves some expense; but after what has been advanced as to the enormous loss to the State under the present no system, I think this objection can be got over. At almost all our stations a civil dispensary is already in existence, and it would not be a difficult matter to add a few lofty and well ventilated lock wards to them for the treatment of diseased prostitutes, and to draw up a set of stringent rules for their proper management.

As an illustration of what may be done in the way of prevention, even without any legislation or extraordinary means, I would refer to the following memorandum from the Director-General, Medical Department, detailing what was done by himself some years ago at Secundrabad:—

MEMORANDUM.

The state of the 3rd European regiment soon after its arrival at Secundrabad early in 1855, then a young regiment scarcely formed, was such, from the number of cases in hospital of venereal, as to draw my especial attention to all the local circumstances connected with the propagation of this loathsome disease, which was ruining the constitutions of many young men, and laying the foundation in numbers for future invaliding and loss to the service. There were about eight per cent. of cases in hospital in a strength not much more than 700. In the neighbourhood of the barracks numbers of native women were prowling about every evening, and the huts of many not far off. They were under no surveillance, and no means used to prevent disease. After some difficulty I got the brigadier to sanction the public women being taken up by the police, where there was good reason to believe they were infected, as when pointed out by the men as the persons they got the disease from, &c., brought to the civil hospital, there examined, and, if diseased, kept in until cured; this measure was almost magical, the number of cases in hospital diminished almost at once to less than half, and soon after to still less, and it was always found that as diligence was used in detecting and examining the women, &c., they decreased, and *vice versa*. An attempt was made the year before by Dr. Goodall, when in charge of the civil hospital, to get diseased women to it, and he paid an old woman himself to get and induce the public women to come to the hospital; but some dancing girls got up a complaint before the police against the old hag and she was incarcerated for interference with the *liberty of the subject!*"

I would, in conclusion, earnestly press this subject on the serious consideration of those in authority; the evil is a shocking one, it is increasing on our hands, and it demands on every ground, moral and physical, our best efforts to root it up.

No. 14.

A REVIEW.—OBSERVATIONS on the HILL FEVERS of the SOUTHERN PENINSULA of INDIA; with some Remarks on Magnetism and Electricity as a probable Cause of Fever and some other Disorders, by Dr. HEYNE, Madras.—Med. Chir. Rev., July 1842.

We have ever considered the geological nature of the soil as one of the most powerful of the causes of physical climate; and in the last edition of the work on Tropical Climates by the senior editor of this Journal, assisted by Mr. Martin, will be found a sketch of our sentiments on that head, referring more especially to the climate of Bengal. In the article mentioned, we have referred also to the various supposed sources of the electricity of our atmosphere; but in truth the subject is an obscure one, and in the present state of our knowledge, we refer with pleasure to such an ingenious and elaborate article as Dr. Heyne's, were it for no other purpose than to direct inquiry, where facts are so difficult of being obtained.

After enumerating the symptoms of the hill fever, Dr. Heyne observes that the ordinarily received opinions as to

the vegetable or marshy origin of fevers will not here hold, for that "the hills are here not more woody than in other healthy places; some indeed, where the epidemics of 1808 and 1810, as well as the endemic, were most destructive, are quite naked of trees, as Diudigal, Madura, and the rocks west of Seringapatam."

"Now, if it should be found, that this fever exists constantly and invariably among certain description of hills, when others of a different composition are as constantly free from the same, would it not become reasonable to suppose that the nature or composition of the rock itself must furnish the cause of the calamity?"

"The hills where it is found to prevail, appear at first view, to be quite harmless, as they are a *granite*, which is the most common rock-kind on this globe. They contain, however, besides *quartz*, *felspar*, and *mica*, a great proportion of *ferruginous hornblende*, which, by its disintegration or separation from the rock, becomes highly magnetic, and in which, I suppose, the cause resides which produces this fever, besides a great train of other disorders. This iron hornblende occurs in such quantity, that all rivulets, public roads, indeed, all hollows along these hills are filled with its sand; from which, also, all the iron in this part of the country is manufactured. This granite is remarkable for its disintegration, as it not only separates during the hot season, in large masses of many tons, but crumbles as easily into its composing particles, and is found as sand in great abundance, not only near every rock, but near every stone, from whence it is carried by the torrents during the rains to the lower parts of the country, and thus forms the particular mark by which these hills may be distinguished from all others. It is generally not attracted by the magnet when united to the mass, even when it occurs as in hornblende state, or greenstone, in the greatest abundance, but after it has been separated it is attracted as much as any iron filings. This may be owing to the incipient state of oxydation, or more likely to the development of magnetism by the high temperature to which it has been exposed in the hot season, which also may have weakened the cohesion of the rock, and caused its disintegration in the mass.

"Hills of this description form the principal ranges of the Ghauts, as far at least as the Godavery; they predominate also among the smaller, and in single hills and rocks in the low country, so that they might be taken for the exclusive rock formation of this country. However, fortunately, this is not quite the case. They are easily recognized at a distance, by their very rugged and abruptly pointed appearance, and the great steepness at their tops. The ranges of this formation are also very interrupted, and generally consist of rows of single hills, although to the southward, I have found them also connected at bases, and in triple and quadruple ranges."

Dr. Heyne then gives an excellent topographic description of the hills "which have rendered themselves known to Europeans for the malignity of the fever," and after that of such as are "as constantly free of the hill fever." This is the right kind of topography, but for obvious reasons we cannot here enter into it. The hills where the fever is "totally unknown," Dr. Heyne describes as "primitive trap, which consists of *quartz*, *felspar*, and *REAL hornblende*." He then adds, that the epidemic fever of 1808, stopped short at a range of hills of this latter composition, in the Coimbatore district,—a remarkable fact.

"These two ranges of trap proceed with very little or no admixture of iron stone through the whole Baramahal, from Nameul to Darampoory and Vellore; the rocks are sometimes compact hornblende and greenstone, or basalt, all belonging to the same formation; but here and there hills appear among them of iron granite, which stand in connexion with other ranges of that description in that province, both east and west of that valley, which have the hill fever as virulent as in other parts of the country, where whole ranges of these hills occur."

"A most remarkable instance illustrative of the above facts, and of my deductions from them, I found at Tripatoor, which lies in the above valley, close to a large table land, the rock of which is sandstone. I asked there a respectable native whether any such disorder as fevers were frequent in the country, but received in answer, 'No, thank God, not within ten miles of this place; at Javadymalle, a hill fort, where no man can live two days without getting it.' To this place a peon was despatched with the simple order of bringing two or three stones from the rock of the hill, and some sand as might be found on the road. The man returned, and brought pieces of a rock composed of red felspar, quartz, and plenty of ferruginous hornblende; and the sand of the road consisted entirely of magnetic sand and particles of felspar."

"I must name now the Pulicat hills, among which, as far as they extend to the southward (Chittoor) the hill fever is

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totally unknown. I was particular in my inquiries on this subject, in the beginning of this year, when among them. They consist entirely of flinty slate, and are bare in some places as they are woody in others, and as lofty and as low as the granite hills.

"I come now to a country and hills where I have lived myself for some years, the Cuddapah district. It is divided from Gurrumcondah on the south, and from iron granite and the hill fever by a range of flinty slate. The same bends there to the northward, where the ranges thicken as they advance, and leave narrow valleys as far as Cummuur, and further up the river Kishna. The whole or most of these hills belong to the clay-slate formation, some are calcareous, all, however, are free of the hill fever. Other fevers may occasionally be seen, such as simple intermittents and bilious remittents, but they do not, like the hill fever, run into a typhus, and the cautious may easily guard against and get rid of them.

"This is the largest extent of inland country which I know to be free of the hill fever, viz. from Cuddapah to Kishna near Chintapilly, a place that has been at all times dreaded for its fevers. There, the iron granite hills prevail again. To the westward of Cuddapah, the healthiness of the country extends to the Ganjecottah hills, which belong to the flætz trap formation, consisting of sandstone, limestone, jasper, and hornstone pebbles cemented together, and which are perfectly free of magnetic ironstones.

"Bababudden is another range of hills which is remarkably free of hill fevers, although it lies between places of notoriety for such, as Seringapatam to the south-west, and Chittledroog to the north-west, and Naggury to the west, an unwholesome country amongst the Ghauts. It belongs to the *clay slate* formation, and *active magnets* are found in large depositions on them. It rains on them for six months in the year continually, when plants keep fresh and alive in the open air for many days after they have been taken out of the ground or broken off the stem. In fact, my observation, viz., that the hill fever on this coast exists *exclusively* among the hills of the granite formation, or where ironstone is found in large quantities, will be confirmed, the more it is brought to the test.

"A principal question arises now, but which, and the answer to it, I presume will be anticipated by every medical man, viz., what can be the particular principle in that rock which should have so powerful an effect on the human frame? I readily ascribe it to the *magnetic or electric fluid*, which seems to exist in the greatest abundance in the iron hornblende, and is disengaged in great quantity, in the hot season."

"The electric and magnetic fluids are modifications of each other—a principle now pretty generally admitted. It exists in the air, and that it does in the earth and in the minerals, need scarcely be mentioned; nor are the animal and vegetable kingdoms less indebted for its influence—indeed, it is the *anima mundi*. It can be accumulated under certain circumstances in the air, and there is no doubt that, as in magnetism, so it is in iron and in some other minerals, and as it is elastic, it can be also dissipated from the place in which it is confined. Of course where magnetic iron abounds the electric fluid, whether in its positive or negative quality, will make, under favourable circumstances, its escape.

"This must be, on common physical principles, the case *when the temperature is more than usually increased*; the hottest season, therefore, when the rocks, exposed to the meridian rays of the sun, are raised to the accumulated heat of 220°, is the epoch when the fever rages most (which we suppose to originate from the greatest development of magnetism). It is known that a high degree of electricity can be raised in certain minerals by heating them merely; and according to my experiment, the hornblende which is found in this granite becomes magnetic on being heated, which before showed no magnetism whatever. It stands also to reason, that the first rain which cools the atmosphere down to 74° must put a stop to the discharge of that principle, and to the further cause of the fever, for '*cessante causa tollitur effectus*.'"

"It is generally believed that so powerful a principle has, or must have, a great influence on the animal constitution, although electricity has hitherto been tried, but with very partial success, as a remedy against some disorders; and if I am not mistaken, with more where it has been *abstracted*, where sparks have been elicited, than where they have been imparted. Magnetism has also been tried, but oftener ridiculed, by the medical world in England, particularly that which is called animal magnetism.

"In my humble opinion, it is here the particular magnetism or electricity of the iron granite, without, however, attempting to determine whether it is the vitreous or resinous; for hornblende in primitive trap contains nearly as much iron as that of the granite. The iron, also, in other minerals, as in

the magnetic iron slate of Bababudden, and the carbonated iron ores of that country, possesses as much magnetism, even in its active state, yet do they not prove themselves in the least hurtful to our constitution, as that of the iron granite hills. Of course, if it be electricity at all (as it should appear) it must be that particular modification of it which is inherent to the iron sand of the granite of this country.

"It has been observed by some practitioners (Mr. Scarman) that the night air in those places, where such fevers occur, is particularly to be dreaded. This seems to militate against the new doctrine, but is actually in support of it; for electricity, as is well known, can be confined to clouds for a considerable time, or can be kept at a certain spot by attraction (as in the *ignis fatuus*), and of course the same principle, under a different form, but from similar causes, may be kept floating in the air for some time at the particular spot where it has been discharged, and, if it should remain till night, it must be condensed by the coolness of it, and hence will be imparted, or come concentrated to those who expose themselves to it at the time.

"The natives are particularly fond of sleeping in the open air with a very slight or no covering. Hence one cause of their being oftener subject to those fevers than Europeans.

"A moist atmosphere destroys electricity (to use the common phrase) or abduces it; it is therefore but natural that the first strong rain in the season, besides the cooling of the rocks, should remove the sickness which is the consequence of it. On that account also, in a season prior to the hot—in January and February—the fever has been restrained by the same circumstance. The heavy dews among our Ghauts, which some have even considered as the forerunner, or as a powerful cause of these fevers, have absolutely retarded or prevented them; for it should be known and remarked, that these months are reckoned the safest to venture among the Ghauts and to remain there.

* * * *

"It may be observed, further, that all epidemics in this country are preceded by uncommonly heavy rains and some lightning; such was not only the case in the fever epidemic of 1808 to '10, as already said; but such existed before the appearance of the present cholera morbus in Bengal, and now at Madras. I do not suppose, however, that they are in consequence of the rain after it has fallen, and the inundations which have followed it, but from the superabundance of *electric matter* which caused the rain, or in fact from the *same cause* (electricity) derived from a different source.

"I would advise, as a precaution, to avoid, if possible, the living near a hill or rock about which a quantity of magnetic iron sand is found. The distance of two miles would be quite sufficient in common cases, as it has been observed, even at Courtallum, where the village, that had suffered much from the fever, has been removed with the best effect to that very distance.

"I could now close my writing, as I have said nearly every thing which I know at present on the subject; but I will suggest a few hints, which strike me, will not inaptly come from me, although I am convinced they would soon occur to others, and would be most likely better expressed.

"It appears, in the first instance, to me probable, that electricity in general is the principle which has most influence on our health and on our life. We live in it constantly, it penetrates everything, it is as a constituent of everything, &c. It may abound in some situations, it may be deficient in others, each of which must have peculiar effects; the positive or vitreous, the negative or resinous, may predominate; either must have its *peculiar* influence. In the preceding pages we have seen what effect it has when it occurs in great quantity from magnetical iron-stone (I believe the resinous); it is probable that it may have similar consequences from whatever other sources it may be derived. The fever in the Northern Circars, although it might not be owing to the electricity from the minerals of the country, may be to that of marshes, which may be easily ascertained; in its attacks, it seems to be like the hill fevers, particularly in its tendency to run into a typhus, or into enlargements of the spleen, &c. It appears to me also very certain, that the fever in fens of some countries, in the south of England, and the Walcheren fever, are engendered in the same manner. I have for the latter supposition, at present, no other proof but the frequency of the *ignis fatuus* in these situations (certainly but an electrical phenomenon), and the account of the fever itself, which seems to resemble our hill fever in many particulars, as do the marsh fevers of Bengal and Sumatra, which quickly run into a typhus, and affect the spleen violently.

"In further support of this opinion I will say that Abbé Nallet, or Dr. Wilson, or even the gentlemen of the medical committee, have long ago suspected the electricity, which we know to exist there in some abundance, must be the

real efficient cause. That the different gases, as hydrogen and carbonic, or the deficiency of oxygen, cannot be blamed, has been frequently demonstrated by endiometrical means, which indeed have generally proved that the air in the most unhealthy places is as pure and as full of oxygen as in the most salubrious situations. To conclude this subject, I must say, that in my humble opinion all fevers are in some degree engendered by a superabundance of electricity, either of the local situation or the habitude of the individual."

After these lengthened quotations we need hardly say that we highly appreciate the laborious research of Dr. Heyne, in which we have no doubt that many of our brother officers in India will follow him. More than twenty years ago we observed that the abrupt mountain ranges which are crossed between Midnapore, in the province of Orissa (Bengal Presidency), and Sumbhulpore, on the Mahanaddi, in the province of Gondwana, are, throughout, of the ferruginous nature described by Dr. Heyne. They are unequalled for their insalubrity, and the prevalent fever, as we well know from personal suffering and sad recollection, is the most severe of any of which we have experience in that or any other portion of India; indeed, there are few survivors from it, whether natives of Hindostan or of Europe.

No. 15.

REPORT ON CLIMATE of "NYNEE TÄL," according to Order from "Secretary of State for India."

"Nynee Täl" lies 6,409 feet above the level of the sea in a basin or glen of an oval shape, having the "Täl" or lake in the centre. This glen or basin is bounded on the north by "Chenee," the highest peak, on the east by "Sheer-ka-danda," on the west by "Ayopatha," while on the south the lake discharges its waters through a narrow gorge down towards the plains of "Huldwanee." Owing to the hills surrounding this station, there are only two entrances for direct current of air, the one on the north-west between "Ayopatha" and "Chenee," the other, the narrow gorge on the south. Hence there are only two winds, one blowing down from the north and north-west, the other blowing up the lake from south and south-west.

The *civil* station lies principally on the north of the lake at the foot of "Chenee." The houses, generally, are well situated, but badly built, and as badly kept in repair. The great fault of this station is, the immense amount of vegetation, trees, and underwood allowed to grow up close to the bungalows, and the want of public latrines.

The *military* station is divided into the "near" or hospital barracks, and the "kail khan" is "far away" huts. The former lie in the very centre of the gorge at the south end of the lake, *below* its level (one hut being at least 40 or 50 feet lower), and so surrounded by trees and rocks, and banks of earth, as to be little affected by the breezes. During the rainy season, these huts are very damp, badly aired and certainly detrimental to the health of the men.

The "kail khan" (or "far away") barracks are, on the other hand, well placed, one mile further out, on the top and sides of an open ridge, one set facing south and south-west, the others north and north-east. Owing to their being on an inclined surface, and not in the immediate vicinity of damp underwood, the huts are dry and well aired.

The *hospital* situated on the top of a small mound at the south end of the lake, and overlooking the gorge, and the near barracks is too exposed, and every way inadequate for the use of sick.

The huts themselves are too low, not having sufficient room in height, while the chimneys are so badly constructed that constant smoke and consequent irritation of men's eyes are the daily complaints.

Generally speaking, the accommodation for the troops is as bad as can well be, and offers a stumbling block to a correct judgment being formed as to the advantages of this station for a convalescent depôt.

The rations of meat are pretty good, the bread is often badly baked, and of course condemned; the water all from the lake is clear and good, and affords ample opportunities for bathing.

In order to do justice to this climate, the troops should be properly lodged. To effect this, I think the following proposals should be attended to:—

- 1st. Condemn the near barracks and hospital.
- 2nd. Raise the roofs of the far away huts, so as to give more ventilation and improve the draught of the chimneys.
- 3rd. Make all the roofs zinc, the walls are strong enough.
- 4th. Build new huts on the face of the hill, running up from the present parade ground, and a new hospital

in a position near, but not too close, such as was proposed by Captain Glover, Bengal Engineers, this summer.

Sir R. Martin,
C.B., F.R.S.

25 Nov. 1859.

One great step towards improving the south end of the lake would be to fix cantonments which would take in, and so bring under military law, a very offensive dirty bazaar, and a ravine which is polluted by every kind of filth, as well as fill up a marsh which lies close under the hospital, and which the civil authorities allow to exist. One other general measure should be adopted over all the station. The trees should be cut down to one-half their number, and all the underwood cleared away and *kept cut*. The vegetation is too luxuriant, and, I believe, is the source of "fever," generated in Nynee Täl, among civilians and troops. The want of public latrines is a source of much annoyance to all, and might be easily remedied.

The "*climate*" of Nynee Täl is for eight months in the year clear, bracing, and invigorating. This *good* season lasts from the end of the rains, 20th September or 1st October, to the end of May. The *bad*, from June to September.

January is clear, cold and frosty, with snow occasionally.

February is much the same.

March is cold, winds severe.

April is boisterous, gales and thunderstorms.

May is fine, warm, with occasional showers.

June is almost constantly clouded, rainy and windy.

July is hot, damp and rainy.

August is misty, damp, and like a vapour bath.

September, towards the latter half, clears up to settled clear weather, while October, November, and December are delightfully clear and bracing.

According to observations made for several years by General Sir W. Richards, K.C.B.:—

219 days are generally fine.

68 days are generally clouded.

78 days rain, hail, or snow.

The *average "fall of rain"* for the year is 112 inches.

The most ever marked, in 1853, was 144·465 inches.

The smallest fall, in 1848, was 68·015 inches.

The *average "temperature"* at 2 P.M. is 64°; at dawn, 51°.

The highest ever marked in the shade was 80°; the lowest 18°. In winter the *daily variation* is considerable, but in summer it never exceeds 4° or 6°. The winter and spring are the most healthy seasons. Owing to the large amount of evaporation, September and the first half of October are not so healthy; but, until the rains come on in June, all the rest are clear and exciting. During the good season little sickness prevails, while during the months of June, July, August, and September, hepatic complaints, head affections, rheumatism, and fevers of an intermittent type are common. Every one, indeed, suffers from headache, "malaise" with languor and listlessness of body and mind. As yet, however, no *local "diarrhoea"* has shown itself during or after the rains, while *cholera* only once came here, and that by reason of the Ghorkas bringing it from "Almorah;" even then it did not spread.

Towards autumn coughs and colds are frequent. Congestion of the liver and spleen occur, but not to any serious extent.

To say that the damp season here is of *no* benefit is to state an untruth. It is to be confessed many invalids *gain nothing* during its continuance, but they *lose nothing*; that is to say, had they remained in the plains they would have lost *all* chance of recovery, while here, though they *gain nothing* they *lose no ground*, and immediately after the settled bracing weather sets in, they improve remarkably.

During the last summer months blistered surfaces, leech bites, marks of cupping, and incisions took on a suppurating unhealthy action. Buboes refused to heal, and it was with reluctance I ever broke the skin in patients at the hospital or in the station. But before and after this wet season wounds and accidents heal with magical celerity. The constitutional effect of this temperate clear atmosphere on the spirits and health of the invalids is more especially seen in October, although when they first arrive in April they recover very quickly, and some of the worst cases *never* relapse during the hot wet season.

Debility after acute disease or fever soon disappears.

Hepatic and dysentery cases have this year improved rapidly both after and before the rains.

Head affections and rheumatism do not improve, at least satisfactorily.

General diseases, such as scrofula, do improve, unless these be organic diseases, such as "*phthisis*," which never does well in the hills. Heart affections, if organic, can expect no relief, while at first the functional affections suffer from the increased action brought on this elevated site and rarefied air.

Sir R. Martin,
C.B., F.R.S. Referring to the table, it will be seen that since June 1858 (when first Europeans came up), 599 have arrived (sick); of these, 137 have been invalided; 19 died (2 from accidents); leaving 17 deaths from natural causes among 599 invalids for the space of 16 months.

In June 1858 (and summer) 290 invalids came up. Of these, 9 died, 15 invalided, 17 were kept up all winter, 149 went to their "duty" with their regiment. Of these,

117 kept all winter;
3 died;
26 were invalided (October 1859).

Several are kept up this winter, as they are on the staff but the rest go to their "duty."

In April and summer of 1859—

309 invalids came;
95 have been invalided;
7 have died; while about
120 will be able to join their corps, &c.; and
130 to remain all winter.

Taking these last two together we have—

421 in total;
10 deaths;
162 or about, who have gone by discharge, and
who are about to go.

About—

128 to remain all winter; and
121 to go to England (invalided).

As to the "deaths." Since my arrival last January (1859), I have had 9 deaths—

1 from dysent. chron.;
1 from apoplexy;
1 from fatty or "nutmeg" liver;
1 from acute "hepatic abscess;"
4 from chronic " "
1 from accident.

The chronic cases could have survived nowhere. One died within thirty hours after arrival. And here I may remark that my predecessor, Dr. V. McMaster (H.M. 78th Highlanders), complained of the same thing, while I have known several instances of invalids dying on the road.

The only very acute case ending in death was from "apoplexy." This occurred in a young man, healthy to all appearances, proving fatal in three days.

The only case when I could say the abscess began to form in the liver after the patient's arrival, was the one marked "hepat. abscess acute." All the others had the seeds of disease, evidently strongly developed ere they came here, the *post mortem* examinations always revealing more extensive disease than could be accounted for by the symptoms while under my care.

I have seen very few acute cases of disease here. Several sharp attacks of "hepatitis" in old standing cases after a *debauch* or exposure, some severe attacks of "dysentery" or "diarrhœa" in patients sent up for these (*all caused more by the improvidence of the men than by the climate, and all yielding to treatment*), with two cases of acute inflammation about the heart and pericardium, form the whole. "Spleen," even accompanied by "liver" and "ascites," has recovered and lessened in size among the young soldiers. All the other cases treated were merely partial relapses of their original disorder.

I have not seen "dysentery" originated here in any man, nor any form of new disease.

"Rheumatism" does not improve, several patients having constant fresh attacks.

The "ophthalmia" cases occurring here, all very slight, have done well.

The women and children are remarkably healthy; even during the rains, very few cases of disease occurred among them. Upon the whole, then, the following results may be considered well founded.

"Fevers" rapidly improve, even during the wet season.

"Abdominal diseases" also (except old hepat. ch. in worn-out men).

"Debility" also, from any cause not organic.

"Surgical" cases improve likewise wonderfully.

But "chest," "head," and "rheumatic" affections should not be sent (not improving here), for we have—

Out of 192 fevers only -	-	-	24	invalided.
" 154 abdom. disease -	-	-	35	"
" 148 debilitus -	-	-	34	"
" 39 surgical -	-	-	13	"
" 9 ophthalmia -	-	-	4	"

While out of—

" 5 head affections -	-	-	3	invalided.
" 20 rheum. -	-	-	11	"
" 23 chest -	-	-	10	"

As may be expected, the rate of sickness per month is greatest during the wet hot summer, while the number of deaths is pretty equally distributed over the year.

It is impossible to be correct as to the names of the disease causing death, hence a discrepancy between these notes and the table. The fatal cases died from some organic disease which became developed after their names and disease had been sent up.

It may be said, however, that no death has occurred (except the "apoplexy") brought on by disease contracted here.

In conclusion, I sincerely believe this station to be admirably adapted for the use of invalids of a certain class, viz., *debilitated, dysenteric, hepatic, and surgical* cases. The air is dry, bracing, and exhilarating during the greater part of the year. All that is required is proper accommodation for the troops here, and a *judicious* selection of the sick in the plains below. For, as may be easily imagined, the cold nights induce rheumatism, while the hills and uneven walking annoy those suffering from chest or (heart) affections.

A. W. P. PINKERTON, M.D.,
Assistant-Surgeon, R.A.,
In medical charge.

Nynce Täl,
Oct. 31, 1859.

No. 16.

DESCRIPTION of the OTTLEY PETT or JAWADE HILLS, by Captain YOUNG of the Madras Army.

1. This range of hills, situated 10 miles S.W. of Vellore, attains an average height of 2,500 feet above the level of the sea; one lofty spur, called Khailasagurh, is said to be 2,900 feet in height, being the same as Bangalore; the extent of plateau upon it, however, is too limited for the purposes of a sanitarium.

2. The main range is called Ottley Pett, in honour of Col. Ottley, late Fort Adjutant at Vellore, who was one of the first to bring it to public notice; it has ample space for all purposes, being alternately plateaus and small heights covered with bamboo jungle and young trees, amongst others sandal wood; the ravines are thickly covered with dense prickly jungle; large trees are scattered about here and there.

3. In 1849, a bungalow was built on the main range by public subscription amongst the officers of the 52nd Regiment N. I. and other residents of Vellore. A well was dug, a vegetable garden laid out, and a road capable of being ridden up was cut out from the foot of the ghaut, up to the bungalow. In 1855, the officers of the 44th Regiment N. I. and other residents repaired and enlarged the bungalow and road.

4. The bungalow was occupied at different times throughout the year, and on one or two occasions for a month at a time. A European pensioner had charge of it during 1854-55, and remained there upwards of a year in the best of health. Mild cases of fever have been known, but if due precautions are taken they would seldom or never occur; there are villages on the range, but fever is not prevalent amongst the people, who look healthy, although they live completely surrounded by jungle.

5. The range of the thermometer was found to be 10 degrees lower than that of Vellore, and the amount of rainfall was certainly greater.

6. The distance from Vellore to the foot of the ghaut is about 10 miles, and the road up the ghaut is 2 miles more, making from the railway station 16 miles in all; about 8 miles of this road would require repair at a trifling cost.

7. The vegetables in the garden succeeded admirably; peas grew to the height of 7 or 8 feet, and all others equally well; the supply of water never failed, and manure from goats and cattle pastured on these hills was to be had in abundance for nothing. The drinking water from the well, some 80 yards from the bungalow, was excellent and never ran dry.

8. Building materials, such as stones for the walls, and bamboos and stout trees for rafters, can be had on the spot; chunam must be brought from below.

9. The spot on which the bungalow is built overhangs the plain and faces the direction of the sea, and owing to a large gap in the opposite range and no other hills inter-

vening, the sea-breeze is perceptibly felt; if there is any difference in climate throughout the year, the N.E. monsoon is the healthier season, as the wind then comes over the plain, and not over any extent of jungle; during the S.W. monsoon the wind blowing over the jungle in rear of the bungalow may probably make that season not so healthy as the other. The scenery is very fine, being not unlike that of the Western Ghats.

10. From the above account, it will be apparent that the Ottley Pett range of hills possesses many advantages for the formation of a sanitarium for the European troops stationed in and around the Presidency, viz., at the Mount, Fort, Poonamallee, and Palavaram, for according to Sir Ranald Martin, the greatest authority on such points, its elevation is in many cases to be preferred to that of higher hills. Its climate is nearly as bracing as that of Bangalore, being 10 degrees colder than the plains of the Carnatic, and is comparatively free from fever; it is easily reached by rail in 8 hours; good water is to be had on the spot as well as building materials. Ample ground for building and parades for troops is available; an unlimited supply of vegetables and flowers can be cultivated, as well as a good description of grass, and the whole can be arranged at a trifling cost.

No. 17.

REPORT on the RAMANDROOG SANITARIUM, by
E. W. EYRE, Esq., Superintending Surgeon.

"As regards the Sanitarium at Ramandroog I can report satisfactorily: marked benefit was derived in the cases mentioned in last year's report as the most eligible; viz., where there was constitutional or acquired debility. The epidemic fever in 1850 furnished just such cases. The men left Bellary on the 9th December 1850, pale and debilitated; but after a fortnight's residence they had made a decided improvement, and after from one to two months' sojourn they returned stout and fresh-coloured, as though just landed from England."

TABLE I.

SHOWING the NUMBER of INVALIDS sent to the RAMANDROOG SANITARIUM, their DISEASES and RESULTS, from 1848 to March 1858 inclusive.

	Sent of each Disease.	Recovered.	Partial benefit.	No benefit.	Died.	Remarks.
General debility, constitutional or consequent on fever or deranged health, without local disease	129	127	2	0	0	
Nervous palpitation of heart	7	6	*1	0	0	* Health improved, but continued subject to palpitation.
Rheumatism	7	7	0	0	0	
Secondary Syphilis and Rheumatism complicated with Syphilitic taint	30	13	5	10	2	
Primary Syphilis in unhealthy constitutions	6	2	1	2	1	
Impaired health consequent on venereal chiefly, and long confinement to hospital	45	43	1	1	0	
Scrofula	18	4	0	13	1	
Bowel Complaint	10	5	2	3	0	
Ditto ditto Convalescents from	6	6	0	0	0	
Pulmonary affections. { Pneumonia, 2 Bronchitis, 8 Phthisis, 1 Asthma, 1	12	0	*2	9	1	
Hepatic affections	14	4	0	8	2	
Ulcers and eruptions connected with depraved habit of body	12	2	0	10	0	
Disease of Kidney and Bladder	3	0	0	2	1	
Ophthalmia with impaired health	2	0	+2	0	0	+ Health benefited but not the local disease.
Total	300	218	18	56	8	Nearly all the deaths in men very ill when sent.

Per cent. of recovered to number sent - - - 72.66.
Ditto no benefit ditto - - - 19.45.
Ditto of partial benefit ditto - - - 6.
Ditto died ditto - - - 2.74.

TABLE II.

	Recovered.	Partial benefit.	No benefit.	Died.	
Invalids sent to Raman-droog	660	38	8	12	2
Ditto to the Mount	660	24	9	14	13

a Accommodated in tents or a temporary building before the present barracks and hospital were erected.
b The cases not selected, but taken consecutively as they stood in the books.

TABLE III.

	st.	lbs.
2 gained	-	-
5 ditto	-	-
13 ditto	-	-
20	-	-

about 0½ 0 ditto

No. 18.

10, Forbes Street, Edinburgh,
4th October 1860.

SIR,

On the 19th of April last I did myself the honour of calling on you to submit for consideration of the Government of India, the accompanying proposal, to establish a sanitarium on one of the hills called Gunong Poolai, in the most southern part of the Malay Peninsula, for the benefit of Singapore.

You having attached some importance to a letter from the late Governor Butterworth, acquiescing in the scheme, I wrote to Singapore for it, and other papers connected with the subject; but have only received the copies of two prospectuses, the other papers being either lost or mislaid.

Prospectus No. 1 was drawn out after my first exploration of the hill, and you will see by the number of signatures, how highly the scheme was appreciated by the merchants and others of Singapore. At this time the local government would have made a road from the landing place on the Malay Peninsula to the hill through the jungle, if the Recorder had not interposed by stating that the convicts, who were the road makers, could not be allowed to work in Johore, as the southern part of the Malay Peninsula is called, as their penal sentence was only to the Straits settlements.

Eight years after I explored the hill a second time and issued the other prospectus, which was as powerfully backed as the first. At this time we had no thought of Government aiding in the scheme, but the agents of H. H. the Tummengong of Johore, the Rajah of the district, proposed to make the road, and the residents undertook to build bungalows on the hill: this fell through from the want of funds on the part of His Highness, and a feeling of want of security from our Government not aiding in the matter.

The necessity of having a sanitarium was not however diminished, indeed the urgency becomes daily the greater, more especially as Singapore will likely be the halting place of a large European force, for whose soldiers a place of the kind is absolutely necessary.

The hill averages in height about 2,300 feet, and, being surrounded by primitive forest, is much cooler than a similar elevation surrounded by water. It is healthy, and even if cultivation was extended to its base, could be kept so by draining, the many small rivers running from its sides affording facilities for that, and when a road is made it can be reached in nine hours from the town of Singapore.

My residence in Singapore for near 20 years, during which time I was actively engaged in the exercise of my profession, enables me to give this opinion, that if Singapore had such a sanitarium it would be a most healthy station, and would equal in salubrity Great Britain itself. That this opinion has not been formed without a careful consideration of the subject, I beg to forward for your examination a volume in which you will see a series of investigations which I made on the topography of Singapore, and on one of the causes of fevers in the East.

What I desire of the Government is simply to make a road from the landing place on the river to the summit of the hill, keep it in order, and while they selected spots for placing Government bungalows on, allowing the residents of Singapore to build there also.

I remain, Sir,

Your very obedient Servant,

To Sir R. Martin, F.R.S.,

Examining Medical Officer,

to the Secretary of State for
India in Council.

R. LITTLE, F.R.C.S.E.

Sir R. Martin,
C.B., F.R.S.

25 Nov. 1859.

Sir R. Martin,
C.B., F.R.S.

No. 1.

No. 2.

GUNONG POOLAI SANITARIUM.

25 Nov. 1859.

MANY of the inhabitants of Singapore, deeply impressed with the advantages that would follow the establishment of a sanitarium at a convenient distance from town, where they can change the monotonous and relaxing climate of this Island, in which they are compelled from business to remain for years, would gladly avail themselves of the fine position of Gunong Poolai, whose elevation, over 2,000 feet above the level of the sea, promises and insures a temperature of not less than 7 to 10 degrees lower than can be met with here, while the salubrity of the air and the picturesque of the spot offer still further inducements to fix on that situation.

The lover of nature has also his inducement in the treasures that earth, sea, and sky most lavishly pour at his feet, while the sportsman has, without exception, the finest field in the world, and the most varied sport that ever a Nimrod could desire.

This change of scene, coolness of atmosphere, and salubrity of climate, affect the interest of one and all of us, being all liable to be struck down by the heavy hand of sickness, when such a place would be all that could be desired for the recovery of our health.

Impressed with these inducements to strain every nerve to erect a convenient and comfortable sanitarium, we hereby subscribe our names, and when a sufficient amount has been subscribed, a meeting will be held to make the necessary arrangements.

Amount of each share 100l.			
Name.	No. Share.	Name.	No. Share.
William Napier -	- 1	James H. Adams -	- 1
W. F. Davison -	- 1	William Dreyer -	- 1
Thomas Oxley -	- 1	W. W. Shaw -	- 1
L. Fraser -	- 1	R. Duff -	- 1
James Guthrie -	- 1	G. McMicking -	- 1
Joseph Wise -	- 1	Charles H. Harrison -	- 1
R. Little -	- 1	W. Graham Kerr -	- 1
Charles Spottiswoode -	- 1	Alfred Bernard -	- 1
William Paterson -	- 1	Albert Schreiber -	- 1
H. M. Simons -	- 1	A. Otto Mayer -	- 1
James B. Cumming -	- 1	A. Logan -	- 1
J. J. Greenshields -	- 1	E. J. Dare -	- 1
W. H. Read -	- 1	For F. A. Cargill, Esq. }	- 1
J. Jarvie -	- 1	Jas. Mac Ewen }	- 1
A. S. Spottiswoode -	- 1	James MacEwen -	- 1
Cursetjee Frommeerge -	- 1	R. C. Woods -	- 1
John Little -	- 1	J. S. Sparkes -	- 1
Little and Cursetjee & Co. -	- 1	C. Baumgarten -	- 1
Thos. H. Campbell -	- 1	Whampoa -	- 1
Joaquim D'Almeida -	- 1	H. C. Caldwell -	- 1
Jose D'Almeida -	- 1	John Purvis -	- 1
John Harvey -	- 1	C. R. Rigg -	- 1
J. J. Thomson -	- 1	Thomas Dunman -	- 1
M. Wilhelney -	- 1		

In company with Mr. A. B. Brown, I have lately visited Gunong Poolai, on the Malay Peninsula, for the purpose of verifying my previous impressions as to its applicability as a sanitarium for the Singapore community.

We lived for five days on a peak, though not the highest in the range, and found the climate, as regards its temperature and clearness, cool and invigorating. The thermometer hung from a tree in the open air, never rose above 76°, and fell to 69°, but still this does not impress the mind with the sensation which such a temperature produces, for we never once felt it warm, although warmly clad, and frequently complained of the cold.

The route we took on this occasion was different from a previous one, and is apparently much preferable, as it can be made easily into a good road, not traversing marshes, while it avoids the haunts of wild animals.

H. H. the Jumerong through his agents, Messrs. Ker Rawson, & Co., is prepared to furnish the requisite funds, to make a good bridle-path from the river Sakodas to the summit of the hill, and keep it in order, provided the public will build two good bungalows there; and the purpose of this circular is to record the opinion of the public on that point, and when the mails are gone, further particulars will be entered into.

(Signed) R. LITTLE.

Seen and approved—

Bonshead & Co.
W. Spottiswoode & Co.
Ker, Rawson, & Co.
Per pro Syme & Co.,
Wm. Mactaggart.
Middletons & Co.
Behn, Meyer, & Co.
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J. O. Crane.
M. Little.
Guthrie & Co.
Whampoa & Co.
C. Baumgarten.
Wm. Macdonald & Co.
A. L. Johnston & Co.
O. B. O. R. Macneil.
Cursetjee & Co.
David Duff.
B. H. Cama & Co.
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Samuel Giffillan.
C. R. Rigg.
Wm. Adamson.
Alfred Bernard.
Jos. Webster.
C. W. Bradley.
James Watson.
James Taylor.
H. Frohlick.
Arch. B. Brown.
Jas. Murray.
Fred. H. Goss.
E. M. Marples.
Thos. H. Crane.
W. C. Siffken.
Thos Dunman.
John Harvey.
Johns. Mooyer.
B. Pestonjee.
James Weir.
A. B. Read.
F. Armstrong.
C. H. H. Wilsone.
Samuel Bateman.
David Paterson.
John Haffenden.

Friday, 2nd December 1859.

PRESENT :

THE RIGHT HON. SIDNEY HERBERT, M.P., IN THE CHAIR.

Major-General Sir HUSSEY VIVIAN, K.C.B.
Sir PROBY CAUTLEY, K.C.B.
Sir RANALD MARTIN, C.B., F.R.S.

T. ALEXANDER, Esq., C.B., D.G.A.M.D.
WM. FARR, Esq., M.D., F.R.S., D.C.L.
J. SUTHERLAND, Esq., M.D.

Colonel
W. Swatman.

Colonel WILLIAM SWATMAN, Bengal Army, examined.

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282. (*Chairman.*) How long have you served in India?—Since the year 1828, with the intervals of three years of furlough and two years and nine months on medical certificate, on which I am at present.

283. In what branch of the service have you served?—In the infantry.

284. Not in the engineers?—No.

285. At what stations have you served?—I have been at Barrackpore, Agra, Gwalior, Mhow, Cawnpore, Dinapore, Mogulpore, Dacca, Chittagong, Chinsurah, and again at Agra.

286. You have had a very wide experience?—Yes; I have also been at Lahore and Peshawur.

287. Have you had an opportunity of seeing a good deal both of the Queen's troops and the local European troops?—During the first period of my service I was almost entirely removed from much

experience in the way of observing the Queen's troops or the European troops of the Company (I was on staff employ for a long time on the Eastern frontier), but subsequently I have been amongst them. Since the year 1850 I have been a good deal amongst both European and native troops.

288. Have you formed any opinion with regard to the comparative health of the two services, and the character of the men in the two services?—It is only lately that I have had actual observation of the European troops, having had the command of them but very lately; the outer observation which I have made of the Queen's troops has not been sufficient to enable me to give any decided opinion.

289. Do you know much of the barracks in England?—Nothing.

290. You could not institute any comparison be-

tween the barracks in India and those in England?—No.

291. Generally speaking, without reference to any particular station, what should you say of the barracks in India; that they are good or bad?—The present barracks are on a new construction, and they are admirable; of the old ones, some of them are very good, and others are of a most inferior description; but I believe that the inferior ones may be chiefly attributed to the fact that they have been quickly run up in order to accommodate troops who have been sent there for the first time.

292. The more recently constructed ones are built, I presume, with reference to the climate, and are very spacious?—They are very spacious and very admirable ones.

293. What allowance of cubical space do they give per man?—My recollection fails me upon that point.

294. Have any pains been taken to secure ventilation?—Considerable now; I do not think it was so much so formerly.

295. What has been done with respect to ventilation?—Ventilation is introduced, I think, both through the roof and wherever it can be gained, and through the doors and windows.

296. Are they built with double roofs?—No, I believe not.

297. With regard to cleanliness in the barracks, is there any regulation with regard to periodical cleanings, lime washing, and so on?—It is the understood practice now; the lime washing is very frequent; every day in the drains and all places in which offensive odours can be generated, chloride of lime or quicklime is used.

298. Supposing you were in command of a regiment in a barrack, and repairs were required to be done, how would you set about getting them done; is there any difficulty in that?—The reference is very easy; if I happened to be in command of a station as well as a regiment I should be empowered to direct the barrack department to execute any immediate repairs to a limited extent; beyond that I must refer to the divisional authorities or to any chief authority within my reach; but there is not the slightest difficulty in it that I have seen.

299. You refer to the superior military authority?—Yes; or perhaps to the lieutenant-governor of the province; there would be access to him at once to obtain any necessary emergent repairs that were required. The natural channel is of course through the chief military authorities.

300. Do you recollect what the limit is beyond which you cannot order repairs to be done yourself?—The limit is named for the barrack department; you are restricted by the barrack department. I should know what it was, but I have been some time in England, and these matters have slipped out of my memory.

301. Suppose the repair required is of a large kind and exceeds the prescribed limit, how do you then proceed?—To represent it at once to the divisional or station authorities, and say that such and such a thing was necessary, and they would then generally send it on to the superintending engineer, or I should represent it to the superintending engineer of my circle.

302. And would he exercise a discretion upon it, and act or not upon it as he chose?—The superintending engineer of the circle has very large powers indeed of acting in any great emergency connected with the health of the troops, and I should say that he would act at once.

303. Your experience having been gained at many different stations, should you say that they have been selected at all with a view to health, or only with regard to political or military reasons?—I should say, as a rule, for military purposes.

304. Generally speaking, have the stations been healthy or unhealthy at which you have been?—They varied. There is one station, Agra, which I considered one of the most healthy stations possible, and in my early days sickness was almost unknown there to

any extent, as far as I can recollect, but upon returning there with an European regiment I found it very much fallen off indeed in that respect; that was lately, within the last three years.

305. To what would you attribute that?—It is impossible to say, because everything had been improved about the station.

306. Was it more built round than it had been formerly?—Yes; the great sickness which I noticed was an epidemic, the cholera, but that station used to be comparatively free from it.

307. At your second visit when it was so sickly, were the troops whom you took there taken under the same conditions, or had they been for a longer time exposed to unhealthy climates?—The regiment that I had was a new one, composed of a great many youths who had been for a year in the lower provinces only, since their enlistment, that is in the last case; in the other case they were the old European regiments. I am speaking of the general scope of health affecting both the natives as well as Europeans, and I think that in both cases it had deteriorated at that station.

308. Was there supposed to be any difference in the health of the civil population?—I think, from what observation I could make, that Agra had fallen off in all respects in point of health.

309. Was there any complaint to make with regard to the barracks or the drainage?—The old barracks were very inferior indeed; but I do not attribute the presence of epidemics to them; they were badly drained, and bad barracks.

310. Were they damp?—They were damp during the rains, on account of the water lying about them.

311. Had good provision been made for baths and ablutions, and so on?—Yes; wherever I have been I have always seen baths and plunge-baths.

312. What length of time was there between your first and second residence at Agra?—It was between the years 1830 and 1854; I beg to correct one thing, which is, that I have stated that the barracks were very bad; but I should say that they were in process of being completely replaced by new ones on a modern scale. These were burned down in the insurrection, so that they have never been properly occupied.

313. Will you be so good as to go through the list of stations at which you have been, taking them one by one?—I will take them in the order in which I visited them; the first was at Barrackpore.

314. Will you state your experience in Barrackpore?—I was but a lad at the time, and I cannot state anything at all definite. With regard to Agra, that was, in my estimation, at that age, a very healthy station indeed; from what we could learn from the conversation around us, the European troops were reputed to be exceedingly healthy, and cholera was very seldom known in that part.

315. To what place did you go from Agra?—I went from Agra to Gwalior, but that was upon mere escort duty, and there were not sufficient troops to enable me to judge; but it was not a healthy place. The next place was Mhow; that is approaching the Bombay side.

316. When you speak of your impression being that a place was healthy or unhealthy, is it merely a general impression, or have you any statistical information to go upon?—Merely a general impression as an inhabitant, and, as a youth, having little true power of observation.

317. What is your opinion of Mhow?—I consider it to be a pleasant healthy climate.

318. How is it situated?—It is upon undulating ground, and stands high.

319. With regard to the general health, putting aside Europeans, can you state whether the men suffered there more or less than at average stations from other diseases incident to tropical climates?—I believe that the health of the troops was generally good there; but I saw nothing of the European troops, they were composed merely of artillery, and I had no means of looking into their state at all.

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320. With regard to the health of the native troops, is the variation in their health as great at the different stations as those of the British troops?—I think it is.

321. With a much superior rate of health, the difference between the one station and another would equally tell upon them?—If you find a station that is unhealthy for Europeans, it will also be unhealthy for the native troops.

322. You attribute, I presume, the superior healthiness of Mhow to its greater altitude?—I think so.

323. Does it differ from other stations in other respects?—The soil is very different indeed; it is a black porous soil. Agra is a very hot soil indeed, very dry.

324. Will you mention any other station, taking them in the same order?—From Mhow I went to Cawnpore, and it was considered a healthy station A.D. 1835; I was there during the prevalence of an epidemic, but I was only there about six or eight months.

325. Barrackpore is considered unhealthy, is it not?—It is considered so.

326. What are the reasons for maintaining troops there?—In order to cover Fort William; it is the nearest cantonment to it.

327. Would that country afford anywhere near, with equal efficiency for military purposes, a healthier sight?—Chinsurah is not more than 23 miles from it, and is, I think, considerably better.

328. Do you think, as to Agra, that you might find in the neighbourhood answering the same purposes, politically or militarily speaking, ground which would be more favourable to the men?—Agra is high and dry, and I do not see how you could improve it by any neighbouring place.

329. Mhow you think is sufficiently healthy, and that it would not be necessary to disturb the arrangements there?—I have not been able to correct the opinion that I then entertained; at the time I was quite a youngster in the service, I did not then think much of these things.

330. What is your opinion of Cawnpore?—That it is notoriously unhealthy.

331. Can you state the reasons?—No; I can scarcely say why it is so.

332. Is it alluvial, or what is the nature of the country?—It is not alluvial.

333. But it is situated on a river, is it not?—Yes; but it is above the inundations altogether.

334. Will you take another station, and state your opinion?—From Cawnpore I went to Dinapore. That is a place bordering upon Bengal and the north-western provinces, having a medium climate between the two.

335. Should you say that that is a good climate or otherwise?—It is comparatively good; but I should say that it could scarcely be called a healthy climate.

336. Is Dinapore a station that would necessarily be occupied, irrespective of the question of health, for public purposes?—I imagine that the reason for selecting Dinapore is, that there is an immense city, Patna, which it is requisite to keep in check. I do not know whether there is any neighbouring place that would be better; Agra and Patna being large cities, that seems to have been the reason why the cantonments were placed in their immediate neighbourhood.

337. With a view to establishing an influence over the population?—Yes. Boglipore I was at a very short time, and it was deserted. It was formerly a station for Queen's troops, but it was left, as I understood, an account of its proving unhealthy, although with every appearance of being a most charming place. All the externals of Boglipore would lead you to think that it was very healthy, but it did not prove so, and it was abandoned, and it is now no longer used as a cantonment.

338. Why was it unhealthy?—I can scarcely tell; I followed the troops there.

339. Does it lie high or low?—It is very high, that is, it is high for a station on the plains.

340. Will you now go to the next place?—From Boglipore I went to Dacca. Dacca is an unhealthy place. I suppose it is quite upon a par with all the other stations in Bengal, and whatever unhealthiness proceeds from it proceeds from the moisture of the climate; it is not at all congenial to Europeans or to the upper country natives.

341. And there is great heat, is there not?—The heat is not excessive.

342. But is it very damp?—Yes.

343. From what class of diseases do men suffer from most?—Fever and ague are the great diseases there.

344. Is the country subject to floodings?—Yes. It is merely posted on a little bank of the river, an elongation of the bank, and on either side the water flows up.

345. Is it a large station?—It is not a European station at all, but one for native troops.

346. Do they not suffer from the unhealthiness of the place?—Very much indeed, the upper country natives. The acclimated Bengalese are subject to the invasion of epidemics, such as cholera, fever, and ague also, but unquestionably the upper country men suffer much more.

347. Why is that place maintained under these circumstances?—It was necessary as being in the neighbourhood of an old city containing a great many Mahomedan inhabitants.

348. Practically before the disturbances, those towns never gave any trouble to the authorities?—We always looked upon Dacca as the very focus of insurrection, and to my great surprise I found it infinitely quieter than I could have supposed when encouragement to insurrection was given.

349. You mean during the recent disturbances?—Yes; I fully expected that it would have burst out among the earliest.

350. I think you stated that there were no British troops there?—No. European officers were there who were attached to the native regiments, and they suffered a good deal. I was there for 12 years; my occupation was then in the Government keddahs annexed to the commissariat department. With myself the climate agreed well enough, but with numberless officers it certainly disagreed.

351. At what place were you stationed next?—At Chittagong; that was a part of my Dacca duty, and perhaps to that may be in some degree attributed my being in better health, having a yearly change, one part of the year I was at Dacca and the other at Chittagong.

352. Is Chittagong a station for English troops?—No.

353. But it is much healthier than Dacca?—Yes, but it is still subject to certain changes in its salubrity; for some years the native troops would be perfectly free from disease, and then they became unhealthy, which was supposed to result from the jungle, and the cantonment was cleared; I have not heard with what result.

354. Has the clearing generally an immediately good effect upon the health of the men?—That is a very disputed point; some hold that it absorbs the malaria, and some that it gives it out. Dacca I think, for instance, was cleared extensively, and it was found that it was worse then than before. Then a belt of trees, I believe, was placed between the great Jheels and the cantonments, in order to intercept the malaria.

355. Was that attended with good results?—The result I do not know, as it was done since I left.

356. Cultivation, I believe, has the same effect, and it is very questionable at first whether it does not aggravate disease?—Disease generally is observable where there are canals and irrigation; I suppose it is from the irrigation and the cultivation, as they produce fever almost invariably.

357. Where were you stationed next?—I then returned to England, but I afterwards went to Chinsurah, where I joined a European regiment.

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358. What was the state of the men's health there ?—For a year and a half that I was there Chinsurah was extremely healthy.

359. Will you describe the principal features of Chinsurah and its locality?—It is a place which is almost entirely surrounded by water in the rains.

360. But does it stand high itself?—It stands rather high itself, but still with innumerable hollows and ditches, and you would suppose that it would promise to be one of the worst possible stations.

361. But it was not so?—It has been extremely unhealthy, but in my own instance certainly we were extremely favoured in that respect.

362. How long were you there?—About a year and a half.

363. There being great variations as to health in the same place, I suppose you could form no accurate opinion as to the healthiness of the station, except by taking an average over a good number of years?—No, I could not; I could not get at an average of a good number of years. From there I went to Agra with the Europeans, and that was attended with great mortality, arising almost entirely from cholera.

364. That was upon your second visit?—Yes; it was then that I learnt that previous regiments had found that the immunity which we supposed had attended Agra had been broken through; it was certainly so with the regiment that I had.

365. Did that immunity exist when cholera was prevalent elsewhere, or only during healthy years?—Yes, I understood that it did.

366. Many of those stations which seem to enjoy an immunity from cholera are very fatal to health in other ways, are they not?—Particularly so.

367. Is the supply of water good at Agra?—No, it is extremely bad; the water is brackish there, and there is but one well in the neighbourhood of the barrack that produces spring water.

368. Is it drinkable water?—Yes; as to the other water, almost all the wells in the station are brackish.

369. Would not that be a great cause of the bad health?—I should say that it was a great drawback.

370. At the other stations with which you are acquainted, how was the water supplied generally?—It was obtained either from a river or from wells. The water which is furnished to the troops in India I do not consider at all wholesome water.

371. In what respect is it not wholesome?—It is drunk, I think, before it has been properly filtered.

372. Are you speaking of river water or of well water?—Of both.

373. The river water, I suppose, holds a great deal of sediment?—Yes; and the well water, I think, also requires filtration to make it wholesome.

374. That was especially the case, was it not, at Agra?—Yes, more so than at any station that I know of.

375. Will you now take another station?—That is the end of my local knowledge.

376. You stated, I think, that you went to Peshawur?—Yes; I was wrong in saying that I went to Chinsurah on my return from England,—I went to Peshawur. I went to Lahore, in the first instance, and occupied the fort there with a native regiment, and it was very unhealthy indeed.

377. To what causes did you attribute that; had you a better climate there?—The climate was apparently much better, for in cold weather it approached to an European climate, but during the hot weather the heat was excessive. The fort was supposed to be very unhealthy, and it was in the neighbourhood of a city that was very filthy indeed. The enclosure of the fort, I suppose, contributed a great deal to render it unhealthy.

378. Was it well drained?—Yes, the fort was.

379. Does it stand upon a height?—It stands high but not upon an eminence.

380. Is it near water?—There is a river that runs past it.

381. And winds round the side of it, does it not?—It approaches it from the east, or north and east, I think.

382. How were you off there for water?—I think the water there was indifferent, if I recollect rightly.

383. Were the barrack buildings good?—No.

384. Were they confined?—They were; the troops were put into buildings which were never designed for such a purpose.

385. In what year was that?—In 1851–1852. My regiment was so unhealthy that it was relieved, and sent into the neighbouring cantonment of Anarkullee, about a mile outside. That was a better station; and Meanmeer, which is four or five miles away, is more healthy still than the fort at Lahore. It was badly drained in the first instance, but since that time I have understood that it is well drained, and that the health of the troops has very much improved there; I mean at Meanmeer, which is a great military station.

386. How do you account for the superior healthiness of that place?—It was removed from the influence, in the first place, of a dirty city.

387. Is the country generally healthy there?—It is subject to fevers, what was termed the Lahore fever—a very violent fever, I think, remittent and intermittent too. Then I went to Peshawur.

388. What account can you give of that?—That is in a fine northern climate; it has eight months of cool temperature, and four months of extremely trying heat. It forms the apex of a valley, and there was irrigation going on in the neighbourhood of the cantonment, which we supposed gave out some malaria; the troops were very unhealthy there.

389. Did you attribute that to the increase of the irrigation?—I do not know; the climate itself I should say was bad.

390. There are four months in the year which are very trying from the heat?—Yes, and it acts upon the constitution almost at once; both officers and men suffered very much there, the men had very bad barracks there, but lately they have had very good new ones.

391. But for eight months, during which the heat did not prevail, the place was healthy?—Yes, unquestionably, and the natives of the place showed it; during the other four months they looked sickly, and they were sickly, and suffered very much from intermittent fever.

392. Do you suppose that the health of the natives has been also affected by the change in cultivation and the increase of irrigation?—I do not know that.

393. That is likely to go still further, is it not, for these irrigations are very successful?—Very much so.

394. The tendency is to increase the irrigation?—Yes.

395. Which would, of course, make the stations near to them still more unhealthy?—Yes; and knowing that, the military authorities have been pushing it back from the cantonments, and not allowing it within a certain distance. When I first went there it was much nearer than it was subsequently.

396. That is done, I presume, by the military authorities in connexion with the civil authorities?—Yes.

397. Should you say that all the care that ought to be taken is taken with regard to cleanliness, for example, in such things as privies and drains and so on. Are precautions taken with respect to them which would not be taken in a more temperate climate?—They require such excessive care that I believe it is now generally understood, and you see it improving every day. Now that attention has been directed to it, everybody who is responsible looks to these matters now.

398. Are there any printed regulations as to cleanliness and sanitary precautions in cantonments and barracks?—I do not know that there are printed regulations; but it is the practice to attend to these things, and nobody would deviate from it.

399. Is there any officer appointed who is specially responsible for such things?—The commanding officer is held responsible, but he is controlled again by his superiors who visit the barracks, and again also, on the medical side, the superintending surgeon also comes and inspects the premises repeatedly.

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400. Have the persons who inspect the power of ordering any necessary improvements to be made, or must they be referred again to the superior authorities?—If my regiment, for example, were found to be wanting in cleanliness by the brigadier, or by the general, who saw that my regiment was in a negligent and uncleanly state, he would direct me to remedy it.

401. The bazaars, I suppose, cause a great deal of trouble in that way?—Yes; but they are improving them, they occupy new sites, and they are better laid out.

402. Do they form part of the cantonments or are they exterior entirely to them?—Each regiment has its bazaar, and it is immediately in the rear of the regiment.

403. The cantonment is entirely open, is it not?—Yes.

404. And the bazaar is behind it?—Yes; sometimes in irregular stations any convenient spot has been chosen, without reference to its being in the front or in the rear.

405. Are there any regulations as to that; does the commanding officer interfere for the purpose of seeing that the cleanliness of the bazaar is maintained?—It is the quartermaster's duty to do that, and the cantonment magistrate would look to it.

406. Has the filth of the bazaar ever produced any bad effects in the way of illness in a cantonment?—I think not, especially as all these defects are now in process of correction.

407. Has the quartermaster special charge of these bazaars?—Yes.

408. But there are no special regulations regarding them?—It would be laid down as part of his duty to do so; but I do not recollect the standing orders upon the subject.

409. Are there any regulations as to slaughtering cattle; for instance, that it must not be within a certain distance of the camps?—That matter is looked to; and if I were to see a slaughtering house near a regiment, the health of which I thought would be affected by it, I should endeavour to have it removed.

410. Is that again under the quartermaster?—It would be his duty to look to it, but the slaughtering of the cattle would be with the commissariat.

411. But they would not be allowed without the consent of the quartermaster to take up any position which they please?—No.

412. Do any bad effects result from the horses and bāt animals of the officers?—The horses of the officers are always in their compounds, which are small spaces if they have the regulation space only given to them. In the old stations they are very large, but I do not think that the accumulation of anything from horses is at all noxious as far as it exists.

413. Provided it is not allowed to accumulate?—I mean so: as the custom now obtains the cantonment carts go through the stations and remove all this manure.

414. Where is it taken to?—At some of the stations it is carried out to the fields as manure, or to some neighbouring pits.

415. Do you think that there is sufficient precaution taken that they should not be near enough to the camp to do any injury?—Formerly sufficient precautions might not have been taken, but I think everybody looks to that matter now.

416. How is the water raised in the camps,—artificially?—From wells; it is raised either by a leather bag and a rope, or else by a leather bag attached over a pulley by bullocks.

417. How is the water distributed?—The water-carriers bring it to the barracks and deposit it in earthen jars, which are kept for that purpose.

418. Have you never been at any station where the water supply has been effected through pipes?—No; perhaps the only example to the contrary was at Peshawur, where there is a running stream directed through the cantonment; the river is dammed, and small channels are diverted through the whole of the cantonment.

419. Is that a healthy practice?—I think so, except that the irrigation takes place to the gardens from it.

420. Then those channels would be again dammed up to irrigate the gardens?—If a channel runs through my garden I should irrigate my garden from it.

421. (*Dr. Farr.*) Are the wells superficial from which the water is drawn?—There are wells in the city, but in the whole of the cantonments the supply of water at Peshawur is from these channels.

422. (*Chairman.*) Are you quite satisfied with regard to the soldier's ration in India?—Yes.

423. Is it very good?—Yes, I think so.

424. Is it issued as in England, where only certain portions, for example, bread and meat, are issued, and the soldier supplies himself with everything else, or does the commissariat issue the whole ration?—The Government ration is supposed to be sufficient for a man, but for growing youths I do not know that it is; they purchased in my regiment extra meat, and they were then drawing a pound a day.

425. But they required more than that?—They wanted more; not that they asked for more, but we found that they were not sufficiently fed, being in a damp climate, and the experience of the old regiments taught us that it was better that they should be better fed.

426. You had authority to allow that?—It was an authority that I exercised upon my own responsibility, taxing the men so far that they were recommended to do it.

427. Was the pound of meat with bone or without bone?—It is supplied with bone from the commissariat, the upper part of the rib bones being cut off.

428. Did they issue coffee or tea to the men?—Both tea and coffee alternately.

429. Were they issued as part of the ration?—Yes.

430. And rice?—Yes; and if they did not procure bread, a larger quantity was allowed.

431. Any vegetables besides these articles?—They had salt and sugar, and vegetables, either potatoes or onions.

432. Upon the whole you considered the diet sufficient and liberal?—I think it was a very good and sufficient ration.

433. Do you know at all what it costs?—I think three and a half annas a day; I am not quite sure.

434. What is that in English?—Sevenpence.

435. That would be about the cost of the stoppage?—Yes.

436. You would not recommend any change in that?—I do not see anything necessary.

437. The men have three meals a day?—Breakfast, dinner, and tea.

438. How do they cook; in messes?—Yes. You might include almost another meal, for very often the men have an opportunity of getting coffee; coffee sellers early in the morning are admitted to the barrack at gun fire, and a man can buy coffee at his option; it is sold at a small price, and many of the men adopt that practice.

439. It is supposed to be a very good thing for health, is it not?—That or ginger tea.

440. Is beer issued to the men?—Yes, beer and porter.

441. Not in the ration?—No, it is purchased at the bar of the canteen.

442. But under Government regulation?—Yes.

443. Is it sold at cost price, or for less?—I forget the sum that it was sold at, but I think one and a half annas a quart, 3d.

444. Is there any spirit ration issued?—Spirits are not issued; they are sold.

445. They are sold in the bazaar also, are they not?—No, that is not allowed.

446. Not at all?—Not to Europeans.

447. Is the restriction really adhered to, or is it evaded?—Whenever it can be it is evaded.

448. Spirits are sold in the canteen?—Yes, under regulations; so many drams; sometimes one dram only is allowed, and sometimes two, according to the

then existing regulations, or as the regiment would appear to require it.

449. In the canteen the officers regulate the price of things, do they not?—There is a canteen committee, but they can scarcely be said to regulate the price, except that they superintend the canteen and its disbursements.

450. That does not apply to the bazaar?—Not at all.

451. There spirits are forbidden to be sold?—Yes, and if the bazaar seller is caught at it, very heavy fines are inflicted upon him.

452. Would it be advisable to put an end to the sale of spirits in the canteens?—One would like to see it abolished altogether; but it appears to be necessary to many men, and it is much better that they should purchase wholesome Government liquor than the trash which is procured in the bazaars.

453. But you stated that they did not sell any?—They obtain it surreptitiously; the natives sell spirits amongst themselves.

454. Do the natives use spirits much themselves?—Frequently.

455. Are they getting intemperate under the contact with British troops?—The Government, I think, are somewhat to blame for that; for there are men who hold a licence to sell spirits, provided that it is not sold to Europeans, but that is how it would come into the hands of Europeans.

456. The soldiers drink beer to a very great extent, do they not?—I should say, not to a large extent; not so much, perhaps, as you might wish.

457. Is the beer made in the country?—Some beer is made in the hill stations, near Simla.

458. Is it good?—It is very good, but it will not keep; it is a light, palatable, good beer.

459. (*Maj.-Gen. Vivian.*) Would it keep in the low country?—No, I think it is the hot weather that destroys it; during the cold weather it is perfectly good.

460. (*Col. Cantley.*) They make beer at Mussourie, as well as Simla?—Yes, that is the brewery I was alluding to.

461. (*Chairman.*) The beer which is exported from England, and which is made on purpose, and very bitter, keeps for some time, does it not?—Yes, it keeps well.

462. And could not beer of the same quality be made in India?—I have seen it tried by amateurs on the plains, but it did not appear to answer. Many years ago there was a superintending surgeon at Dinapore who had a private brewery, and he invited me to taste the beer, as a great triumph of art, but I was quite satisfied that it did not answer.

463. Of what do they make the beer?—Of the same materials as in England.

464. Do you think that the sale of spirits in the cantonments cannot effectually be got rid of?—Of course you have the power to suppress it, but you would drive the men then to worse.

465. Have the habits of the soldiers in India, with regard to drink, improved?—The discipline is more severe, therefore externally they appear to have improved.

466. That is internally, is it not, whatever the cause may be?—That I can scarcely pronounce upon. I had not had former experience of European troops; but I think I may say that their habits have improved.

467. And their health too?—That I do not know; I have not seen any tables to show.

468. What are the usual means of recreation which are provided for the soldiers?—The ordinary games are fives and rackets, and skittles, and quoits also; and long bowls is a very favourite amusement of the soldier.

469. Have they books and libraries?—They have Government libraries and books.

470. Do the men use them much?—They read all the light works, I think, with avidity.

471. Do they attend the schools well?—Yes; lately they have attended them better than they did for-

merly, because promotion is a good deal dependent upon their ability to read and to write; their children are sent to school compulsorily.

472. Has there not been an attempt made to provide the soldiers with gardens at some stations?—Yes.

473. Has that plan answered?—I think so; it ought to answer.

474. Are there very frequent changes of the stations in India, and are the troops frequently moved?—The ordinary rule used to be three years at a station.

475. What do the men grow in their gardens?—Almost all the European vegetables grow well.

476. Are there any workshops in which they can carry on trades?—I am sorry to say that there are not.

477. Might they not be introduced with advantage?—I think with the greatest benefit.

478. They would be a source of profit as well as of amusement, would they not?—Yes. The only difficulty is in furnishing the materials at first. The workshop ought to be self-supporting after that.

479. Do the soldiers not do much for themselves in the way of work?—They are entirely idle; but I think an establishment of that kind would encourage them to do more than they do.

480. I believe almost all the barracks have verandahs?—The new ones have.

481. Upon the whole I suppose the men in cantonments leads a wearisome life?—Very much so.

482. Could you suggest any mode of improving that condition?—I do not know of any better outlet for their ennui than workshops.

483. But you think it would be necessary for the Government to lend out materials in the first instance?—I am sure of it, from one instance that I know in my own regiment. I applied for assistance in that respect,—at least I made no direct application,—but in answer to a circular, calling for my opinion upon workshops, I suggested that they should be provided; but it was not acceded to, and the workshops fell to the ground.

484. For want of materials?—Yes.

485. And tools?—Yes.

486. How long is it since you have been in India?—Two years and nine months.

487. There has been a good deal of change in the matter of dress, has there not?—Yes.

488. And great improvements?—Decidedly, as far as efficiency goes, and comfort.

489. What have been the changes?—The tunic has been the great change, the adoption of the tunic instead of the tail coat; the head-dress is lighter too.

490. A helmet has been substituted, has it not?—Yes.

491. It is of wicker generally, is it not?—I do not know what the present one is.

492. They have some light clothing, have they not?—Yes, but they always have had light clothing. You allude, perhaps, to the fatigue dresses and light clothing which the troops wear when they are at all exposed to the sun, which is then necessary.

493. They wear no stock, I believe?—I do not know; the stock was in existence when I left India.

494. A man does not carry his knapsack?—No.

495. Can you describe the soldier's life, as to the hours of drill, and so on?—He commences his day at gun fire, probably about five in the morning, and then he begins his parade, which may last an hour and a half; after that he takes his breakfast; probably he will get a bath between the parade and his breakfast. After breakfast he is a wanderer, if he chooses to go out.

497. (*Maj.-Gen. Vivian.*) The cleaning of his arms and accoutrements must take up some of his time?—Yes, of course it does. He would go abroad, in order to visit the bazaar; or after he had finished his walk, he would then come back to his dinner; he must necessarily attend his meals.

497. (*Chairman.*) At what hour?—At one o'clock. In warm weather he is very often restricted to the

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barrack ; in a very hot season, when the men go too much out, the commanding officer restricts the hour till late in the afternoon, but the soldier has his recreation, if the weather will admit of it, out of doors or in the skittle-grounds, which are generally covered.

498. Have you ever known roll calls in the night ?—The last roll call is at night, properly speaking, at gun fire; it is dark then, and it is night; but not during the night, unless the men have been showing any indications of a desire to get out, and then to punish them, as well as to check the men from going out, a roll call might be ordered here and there, but it is unfrequent, and only done under unusual circumstances.

499. Do they remain on guard in the same way as they do in England ?—They have two hours sentry duty.

500. There is a very great difference in the distribution of the time, is there not, besides beginning earlier ?—That is all I can state.

501. How many nights a-week does a man get in bed ?—In places where they have night pickets the duty falls heavily upon the regiment ; but ordinarily, in the course of 15 or 20 days, a man will have but one night guard ; he would be 19 nights in bed, and the 20th he might be out, or between the 15th and the 20th.

502. Have you ever been resident at any of the hill stations ?—No, I have not.

503. Have you never visited them for health ?—No.

504. You cannot, probably, then give any opinion upon their character ?—I can only tell from officers who I have seen going and coming on account of their health.

505. Are the men sent up to the hills in any great number ?—They are now, when they are sufficiently near to get there.

506. In the parts of India where you have served, you would not say that, generally speaking, you could find healthy elevated situations in lieu of those places where you were stationed without going a considerable distance ?—I do not know of any that possess any near advantages of the kind.

507. Do you think it would be possible to establish the great Indian military stations in the hills, letting the men only come down to the plains for a turn of duty ?—Those who have been with the men in the hill stations do not give them altogether a good character, with regard to their improving the physical condition of the men, for although those stations are healthy, yet there is a degree of confinement there which is oppressive to the men, and they do not appear to enjoy themselves.

508. What do you mean by confinement ?—The place is small naturally ; there is but little table land, and the men can scarcely leave the immediate vicinity of their barracks.

509. But the hill stations vary very much, do they not ?—They do, I believe ; some of them are very confined indeed.

510. (*Sir R. Martin.*) Those are examples of ill-chosen stations ?—I have understood that Dugshai is a very confined place indeed.

511. (*Chairman.*) Have you ever seen a new station chosen ?—I was one of a committee that chose a station in the immediate vicinity of Peshawur.

512. Was that a successful choice ?—It was successful, but unfortunately it has been subjected to an extraordinary inundation, which has barred its present success.

513. Supposing you wanted to choose a station ; what would be the process gone through ? Who would form the committee to whom the choice would be intrusted ?—The quartermaster-general in his department would be the first referred to, and it would be done partly by the civil governor of the province ; from that it would go to the military authorities, who would select a committee according to standing regulations ; it would be composed of senior officers, men who had been some time in the service, mixed with army medical officers, and engineers, as a matter of course.

514. Is there any regulation about it, or is the

matter left to the option of the commanding officer ?—There is a regulation defining the formation of the committee.

515. Which would include somebody representing the quartermaster-general, a medical officer, and an engineer officer ?—Yes.

516. Also including a medical officer ?—Invariably.

517. In some cases you have in India sanitary officers, have you not, apart from the medical officers ?—That is quite a new feature.

518. Would the medical officer, in case of ill health, have any authority to interfere with regard to the supply of water to the troops, and so on ?—He would at once represent any want or any failure in that respect to his commanding officer, and he would also represent it to his medical superior, the superintending surgeon.

519. But he would have no power to say that such and such things might be done ; he could only suggest them to others ?—He could only suggest them to others ; but I think that that is tantamount almost to possessing the power.

520. Supposing a case occurred where the supply of water was very bad, and it was represented to the commanding officer ; what would he do ? Because it might be an expensive affair, from the necessity of having to bring water from elsewhere ?—If there were any immediate means of removing the defect, I think that the commanding officer would not mind taking the responsibility upon himself to effect what he could, but referring it as a matter of course to the higher authorities.

521. The same remark, I suppose, would apply to drainage questions ?—Yes.

522. Could that be done by the military authorities without the permission of the civil authorities ?—Yes, so long as it is within the confines of the military cantonment, supposing that any nuisance or defect were required to be removed ; but if that defect affected the cultivators, you must necessarily go to the civil authorities outside.

523. Take a case of drainage : it might be an expensive thing to construct a large drain for the purpose of carrying off everything offensive from the camp ; how would that be effected ?—That would go in the general routine of representation.

524. If it were confined to a camp and did not extend beyond it, it could be done, as I understand you, without reference to the civil authorities ?—Yes ; and compensation would be paid to any loser by it.

525. Small repairs would be done as a matter of course ?—Yes, upon the authority of a station order.

526. There is nothing to oblige a commanding officer to carry out any recommendation that is made to him ; he may exercise his own discretion in the matter ?—Yes ; but he would be very deficient in judgment if he failed to take a hint of that kind.

527. He might think it a fanciful matter, and not necessary ?—If he did so, the surgeon has another outlet under his superintending surgeon, who is entirely independent of the commanding officer.

528. He would send a duplicate recommendation to him ?—Yes ; he would report to him directly.

529. In other cases, such as the hour at which troops should be brought out in the conduct of a march and the selection of the places at which they should halt, are those questions upon which the medical authorities would be at all consulted ?—I have always consulted the surgeon of my own regiment.

530. (*Maj.-Gen. Vivian.*) It is the common practice to do so, is it not ?—I think so.

531. (*Sir R. Martin.*) But it is not done by order ?—It may or may not be.

532. (*Chairman.*) Do the men suffer very much from venereal diseases in India ?—Extremely so.

533. Could not that, by communications between the civil and the military authorities, be a good deal checked ?—Everything is done that can be done, as far as I am aware. In the station of Peshawur, I recollect that the cantonment magistrate was very active on those points, and he established a systematic

supervision of those women through a senior matron ; he took her into the public pay, and insisted that before a prostitute should be suffered to enter the lines of the cantonment, she should register herself as willing to be overlooked by this person, and that was considered to be a great check upon disease.

534. Did it have any effect upon the health of the men ?—I have no doubt that it had an effect in suppressing disease.

535. No other women would have been allowed to come near the camps ?—Any woman who was notoriously diseased, and had not been under that matron's examination, would have been subjected to punishment, and liable to be turned out of the cantonment; but it was done there on a systematic scale, which is not always possible. The station at Chinsurah, where I was, was infested with women living just beyond the military precincts, and disease was rife there. The only check that I could interpose was to make those men who were admitted into the hospital for the disease bring up their duties which they had neglected in consequence. That was out of justice to the other men, as well as an example to themselves.

536. At that place could you get no authority to act upon those women ?—No ; I do not see how it could have been exerted well, unless they had reverted to the old system of lock hospitals, which were formerly in use.

537. Why were they discontinued ?—It was a Government measure to discontinue them. I think it was a measure of economy.

538. Were they successful when they did exist ?—I cannot tell ; but they were always held to be a great check upon the women.

539. You were saying that the change of stations took place about once in three years generally ?—It was so, I suppose on account of its financial bearings ; but more frequent change would be beneficial to health.

540. As applicable to Europeans as well as to natives ?—Yes.

541. As far as your experience has gone, frequent changes are healthful ?—Yes ; people on the march are generally marked with every appearance of strong health,—men, women, and children.

542. You do not lose people by it ?—I think not, except under harassing circumstances ; but ordinary marching I have always considered very healthful indeed.

543. You think that exercise is conducive to health ?—Yes, regular exercise.

544. But a change of station is conducive to health ?—Yes ; the influence of change is very often remarked, for even though you may remove to a worse station from another where agues have acquired a hold upon the frame, sometimes by going to a worse station it has produced a check upon the disease.

545. From the effect produced upon the mind, I suppose ?—Yes, I suppose so.

546. For what period would you keep troops at a station for the benefit of the troops themselves ?—I rather incline to a stay of three years' duration, because there are so many other considerations to be taken into account.

547. Such as what ?—The great expense of removing troops ; the expense to the soldier ; if he is a married man, he must bear a great part of the expense ; the Government cannot hold him acquitted of all.

548. (*Maj.-Gen. Vivian.*) That would apply particularly to the native army, would it not ?—Yes.

549. (*Chairman.*) Why more to natives than to Europeans ?—I misunderstood the question. The previous answer should be made applicable to Europeans, not natives, who ordinarily do not march with their families.

550. For how many years, upon the average, should you say that a soldier remains efficient in India ?—That is entirely dependent upon his own constitution in the first instance, and upon his temperance.

551. But, taking the average of soldiers, how soon should you say they begin to drop off ?—I should speak without any accuracy if I were to give an opinion upon that.

552. Do you think that their service could be extended, if they were kept more in the hill stations ?—That I do not know ; certainly those who return from the hills show that they have recovered vigour very much.

553. Do you think that sending them to the hills might be resorted to as a preventative against disease, instead of a cure ; as the regiments might be removed to the hills, or masses of troops could be moved thither, before disease had made any great progress amongst them, making it a relief as between the plains and the hills ?—I cannot satisfy my own mind upon that point at all.

554. Is that upon the ground of cost ?—No ; independently of that, I do not know whether the soldier would be better for the service if he was called suddenly to a hotter climate from the hills.

555. He would be fresher and healthier, would he not, before he was called upon to encounter the severity of the climate in the plains ?—Yes ; but there is an advantage in being acclimatized. I think that if you want to have them exposed, you must accustom them to it.

556. Do you find that a man put into a very hot station is better at the end of his stay there than at the beginning ?—No ; but he is more capable of enduring the fatigue and the exposure in that heat than a fresh man would be. I think that a man coming fresh from a cold climate, and being suddenly introduced to heat, having been unaccustomed to it, would suffer much more than an old soldier who had been long in it.

557. But during the process of getting acclimatized do not a good many men drop off ?—Yes.

558. Is it not the fact, that in the course of time you have none to deal with but the very strongest ?—Yes.

559. Would not that account a good deal for the theory as to acclimatizing ?—Yes.

560. The officers, I believe, do not suffer so much as the men in India ?—No.

561. How do you account for that ?—They live with more care, and expose themselves less.

562. And they occupy better quarters ?—Yes.

563. What is the practice in India with regard to furloughs to officers ?—The practice is, that they can return to England after 10 years' service for one furlough of two years, and after 20 years' service for a second furlough of two years.

564. The men have no furlough ?—They have not.

565. They stay until they are invalided ?—They must be invalided.

566. Except being moved to the hills, which is a sort of furlough ?—Yes.

567. (*Maj.-Gen. Vivian.*) That would be a sick furlough, would it not ?—They are sent to the convalescent depôts in the hills.

568. (*Sir P. Cautley.*) Referring to the confinement that you talked of in the hill stations, do not you think, that if the men had workshops there and gardens, and had their families around them, that they would be a great advantage to them in the hill stations ?—Yes.

569. (*Sir R. Martin.*) If the mountain ranges admitted of exercising grounds, do not you think that they would then be very valuable places to send troops to ?—Yes ; but the difficulty is to find space, for they cannot take advantage of the fine climate there and walk as they would do in the plains. There might be, I imagine, some difficulty in finding table land and open ground.

570. Near the plains ?—Sufficiently near the plains.

571. There is at present an utter want of recreation for the men in the hills ?—As I understand, there is a complete deprivation of it ; there they want the ordinary amusement of the bazaars and shops, and other conveniences which they have in the plains, and everything is very expensive that is taken to the hills.

572. (*Sir R. Martin.*) Has any systematic plan been adopted for the purpose of investigating the mountain climates throughout India ?—Not that I am aware of.

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I know that reports upon different places have been made, but I do not think that any systematic plan has been adopted.

573. You have spoken highly of the climate of Mhow; do you consider that, owing to its elevation, it possesses the climate of a table land?—I have given an opinion upon Mhow, stating at the same time that I was very young at the time, and formed my opinion, perhaps, upon very slight grounds. It was high, and considered healthy in the estimation that a boy would form of ground.

574. You are aware that it is above 3,000 feet above the level of the sea?—I can imagine that it would be about that.

575. Do you know whether the ranges of mountains about Boglipore have ever been investigated, with a view to their occupancy by European troops?—No; their localities are pretty well known, but I do not think with any reference to that particular.

576. You have stated that you have served with a newly raised battalion of Europeans?—Yes.

577. Did they suffer from non-acquaintance with the sundry precautionary measures which were in use amongst the older battalions?—The officers and those who were interested in them endeavoured to supply them with what precautions might have been wanted in that respect, but having them so completely under our eye as we had at Chinsurah, where you are, perhaps, aware that the men are completely overlooked by the officers, when we saw that they were exposing themselves, it was checked.

578. But in the older European battalions of the Company you are aware that there are amongst the men themselves certain traditional habits, which they impart to the recruits when they join?—But those were disseminated through my own regiment, because the nucleus of the new regiment was from two old regiments; we had drafts of the old men, and of course their ideas were disseminated amongst the new recruits.

579. And that I presume was advantageous to the young soldiers?—Very much so. You saw that instanced in every act of the soldier, in marching, for instance, and in their preparation of the ground for tents; all those little arrangements were learned from the old soldiers of the old battalions.

580. You have expressed yourself strongly in favour of amusements being provided for the European soldier in India?—Yes, of every kind.

581. Do you think that the European soldier should be permitted to do for himself what he can do without injury to his health and discipline?—Yes, I think that he does too little, and omits things that he might well do, such as cleaning his own shoes and such things.

The witness withdrew.

Dr. D. Stewart.

Dr. DUNCAN STEWART examined.

593. (*Chairman.*) Will you state what position you hold at Warley?—I am surgeon to the dépôt.

594. You are in the medical service of the East India Company?—I was.

595. Were you for many years in India?—I was for thirty years in India, and I came home four years ago, and was immediately appointed to Warley.

596. Therefore the whole of the recruiting service belonging to the local army passes through your hands?—The whole of it.

597. I suppose during the time that you have held that appointment you have formed some opinion as to the age at which recruits should be sent out to India?—Yes, I have.

598. You have, I believe, prepared a paper upon that subject?—Yes, my own opinion is that they go out at present too young, a great many of them.

599. At what age do they usually go out?—The age is between 20 and 25, but there are different ages for the different arms, cavalry and infantry; it is between 20 and 30 and from 20 to 35, but a great many pass into the service who are not 20.

600. Upon the whole, the men who are sent from Warley to join the local corps in India are

582. What he does do now tends to make him a better man and a better soldier, does it not, diminishing crime and courts-martial?—In what respect do you assume that he is permitted to do anything.

583. I mean that his occupations and amusements, such as they are, have that tendency?—They have.

584. (*Sir P. Cautley.*) With regard to the clearance of the jungle in cantonments, you appear to think it doubtful whether there is any value in it or not. Do you not think that the great growth of trees which has been allowed to go on within the last 20 years has been the cause of injuring the health of cantonments? I mean the trees in compounds and along the roads in particularly?—It is a doctrine which is admitted by experience, and I should be sorry to pronounce against it, as I really have nothing but my own simple ideas upon the subject, and I have nothing to back my theory; but I do not object to trees myself, though I believe others do. If you obstruct ventilation, I conceive that that is unhealthy; but the mere presence of trees I do not look upon as unhealthy. In stations where I have been the hedges have not been allowed to grow or trees to any extent, in order not to obstruct the circulation of the air.

585. (*Sir R. Martin.*) Then the difference, you would say, would lie between underwood and a forest tree, the latter being rather beneficial?—I think so.

586. (*Dr. Farr.*) You are of opinion that the supply of good water is very defective in India?—At some stations it is peculiarly so, of course there are exceptions.

587. At Agra, Cawnpore, and Dacca, for example, the water is supplied to some extent from the wells?—Perhaps I am wrong with regard to Cawnpore, because there are good wells there, but I really forget the nature of the water.

588. Are the wells generally shallow?—Yes, I believe they are dependent upon the height of the river, and therefore they are filtrated from the river.

589. May dirt from the surface get into the wells in any way?—If a well is rapidly drawn, it is generally better than if it is allowed to accumulate for days; if it is in continual use it is considered wholesome and good; in fact, some very good wells become dangerous from disuse.

590. (*Mr. Alexander.*) Are you an advocate for flannel shirts for soldiers in India?—I think so. I think flannel is most wholesome.

591. In preference to cotton?—Yes, when the men exert themselves greatly, they are not at all cautious as to removing the wet shirt.

592. They would not be so liable to chills if they wore flannel?—I think not.

older than the recruits who enter the Queen's regiments?—That I cannot say; I am not cognizant of what the rules are in the Queen's service.

601. You give the same kit and bounty as they do in the line, do you not?—I believe so.

602. Have you served with Queen's Indian or native troops?—I have served with all.

603. In what presidencies have you served?—In Bengal presidency, including Burmah in 1826.

604. At what stations have you served?—My service after 1830 was confined to Calcutta and its neighbourhood, first as assistant-surgeon at the General Hospital, afterwards as a presidency surgeon, and one of the professors of the Medical College.

605. What dépôts for the Indian recruits are there in England?—The dépôt at Warley is the only one in England for East India recruits. All the men who enlist (in the eight recruiting districts of the kingdom) are collected at Warley, and remain there until embarked. They proceed by sea in detachments of from 200 to 350 in each ship, direct for India, *via* the Cape. The recruits do not enlist for particular regiments, but for particular arms of the Indian service, viz., for cavalry, infantry, or artillery.

Transfers from one arm to another sometimes take place after their arrival at the depôt, but are not common. The commandant of the depôt selects and assigns to each Indian presidency the men required for it. I do not think I have ever heard the men express any preference for one particular presidency over another. They enlist for general service in India, and not until they arrive at their own presidency are they told off to particular regiments. Much of the mortality which took place in India among the young cavalry recruits last year is said to have taken place soon after their landing there and before they had joined their regiments. The following is the present state of the depôt, 1st December 1859, and shows the nature and extent of the medical charge:—

**The MEDICAL CHARGE at WARLEY BARRACKS DEPÔT,
1st December 1859.**

Staff Commissioned Officers -	-	8
Staff Non-commissioned Officers -	-	26
Buglers -	-	6
Engineers -	-	23
Cavalry -	-	60
Artillery -	-	243
Infantry -	-	289
Ladies -	-	4
Soldiers' Wives -	-	58
Children of Officers -	-	21
Children of Soldiers -	-	113
Total	-	851

The locality of Warley is high and healthy, quite above the influence of the malaria of the flats of Essex. The barracks are calculated for 1,500 men; the hospital for 100 patients. The barracks are spacious, airy, well drained and lighted; there is an abundant supply of water, and one peculiarity (as I believe it) deserves mention, viz., the lavatories, where every man is made to attend daily with his own soap and towel, and to perform his ablutions effectually under the eye of a non-commissioned officer. There is a large glass-roofed shed, where the men are drilled and exercised in bad weather, and care is taken to suit the hours of parade to the season of the year and the weather, so as to avoid unnecessarily exposing the men to cold or wet; owing however to the youth and inexperience of the lads and their positive ignorance of the civilized usages of life, very many fall ill soon after their arrival, owing apparently to nothing save change of habits and diet. Many bring the seeds of disease with them (even small pox) which explode a few days after arrival. The hospital has 8 wards for 10 men each, and 8 small wards, affording with the corridor 783 cubic feet of air for each patient. The average per-centage of sick to strength is 6·50. The average number of men in hospital is 40, and of these rather more than one-half are venereal cases. The common diseases are rheumatism, sore throats, and scarlet fever. The staff officers, the non-commissioned officers, and their families are attended, when ill, in their quarters, as also the wives and children of soldiers, in number varying from 20 to 80. The proportion of married soldiers allowed to join is six in every hundred.

606. What comparison would you institute between the recruits of the Queen's and Indian service; are the men equally good?—I feel very sure that no better or healthier men (for their age and size) could be found in Europe than the recruits who have embarked for India during the last two years from Warley depôt. Notwithstanding all our precaution, men are, however, not unfrequently sent home from India declared to be unfit, with some such remark as the following, lately received from the Adjutant-General of the Army at Madras, "that sufficient care is not apparently taken by medical officers in "examining recruits." The most frequent causes of unfitness, detected or discovered at the depôt after a short residence there, are consumptive disease, heart

affections, dependant on rheumatic poison, hernia, *Dr. D. Stewart.* and epilepsy.

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607. What proportions of recruits are rejected on primary inspections?—The primary medical examination of recruits is made in each district by a staff surgeon specially named for the duty there. After being passed by the surgeon, the recruit is immediately examined by the inspecting field officer of the district, and his approval is final (*vide* the instructions regulating surgical inspection of recruits, No. XVI., as also *vide* Horse Guards circular, 24th November 1851, and *vide* General Orders, 22nd February 1857). I cannot say how many or what proportion of candidates are rejected by the district surgeons, but there is a very great difference observable in the physical character of the recruits who join the depôt from different districts, some surgeons being more particular than others. The rules for the guidance of surgeons in this duty appear to me to be vague and indefinite. (*Vide* Circular of 3rd Feb. 1858 from Director-General of Army Medical Department.)

608. What is the recruiting age?—The age and height fixed for the Indian recruits are as follows:—

Artillery.	{	Under five feet six inches from 20 to 25 years, five feet six inches and upwards from 20 to 30 years of age.
Cavalry.	{	Five feet three inches and upwards not under 20 nor above 30 years of age.

609. What kit and bounty are given to the Indian recruit?—The bounty is 3*l.* and a free kit, infantry and artillery, weighing 20 lbs.

610. How long are the men drilled before being sent out?—There is no fixed time for the men to remain at the depôt for the purpose of drill or training. The average time passed at the depôt before 1857 was four months; it is now less than six weeks. I have known men embarked the same day they joined the depôt. The following table shows the number of men of each arm embarked in 1856–57–58–59:—

RECRUITS embarked for INDIA.—Women and Children.

Year.	Sap- pers.	Artil- lery.	Caval- ry.	Infan- try.	Wo- men.	Chil- dren.	Total.
1856 -	76	543	—	946	86	47	1,698
1857 -	89	1,294	814	1,519	100	41	3,857
1858 -	89	997	2,545	2,558	144	99	6,432
1859 -	117	1,625	2,100	381	147	84	4,354
Total -	371	4,459	5,459	5,404	477	271	16,441

611. Can you state what proportion of recruits are rejected on the secondary inspections?—Before embarkation every man is specially examined by the depôt surgeon, who must declare those only fit whom he considers to be so. If he finds reason to doubt of any man's qualification for service in India, the man is held back till next embarkation; should further observation during this interval satisfy the surgeon that the man is unfit for tropical service, he reports his opinion to the commandant, with a statement of the grounds for this opinion. Up till 1857 it was usual to send all such men with this report before a medical board at Chatham. The majority of the men thus submitted were sent back to Warley, and thence out to India, being pronounced fit by the board. Lately this procedure has been dispensed with, and all the men of whom I reported unfavourably have been summarily discharged by an order direct from the Horse Guards (with but one exception). The number of men who have been discharged in this way at my recommendation has been—

Year.	No. of Recruits.	Discharged.	Died.
1856 -	2,105	52	8
1857 -	3,958	26	5
1858 -	6,636	61	7
1859, six months. }	2,143	56	2

Dr. D. Stewart.

2 Dec. 1859.

612. Have you ever been in charge of troops to India by the Cape of Good Hope, or by Suez, which route do you consider the better for the health of the men?—Undoubtedly the route by the Cape is preferable for recruits.

613. Could you suggest any improvement as to diet, lime juice, clothing, and exercise, or in any other matter during the transit to India, for the preservation of the health of the men?—I believe the arrangements for the accommodation, the diet, and the exercise of the men during the voyage to be excellent.

614. Would it be an improvement as regards the health of the men to place them in depôt at some intermediate station, as, *e.g.*, the Cape of Good Hope, where they might perfect their drill before proceeding to India?—I cannot see any advantage in such an arrangement.

615. State your opinion on the question of acclimatization?—I do not think that acclimatization, as generally understood, confers any immunity from tropical disease. I merely give this as my own opinion. I think young men are more subject to acute diseases than old.

616. Is there any other point upon which you can give the Commission information?—I am not aware that there is.

617. (*Maj.-Gen. Vivian.*) You say that the men are frequently embarked on the very day that they are received?—I have not said that many men were so sent. I stated that I had known one instance of it. As we were embarking some men, we wanted a man to fill up the number, and one man was so taken.

618. Within your own knowledge was that system at all common before the late disturbances in India?—No; up to 1857 the men were always kept from four to six months, but during the last year, owing to the immense hurry, and the number of the embarkations (and there were 29 in one year), they were hurried off without having any chance of being properly drilled, and I had scarcely time to form any opinion as to their constitutions.

619. (*Mr. Alexander.*) Generally speaking, before

the insurrection in India the men were thoroughly drilled before they were embarked?—Yes.

620. (*Chairman.*) You do not take men under 20 years of age?—They swear that they are 20, but I believe many of them to be younger.

621. (*Dr. Farr.*) You stated the amount of sickness at Warley; can you give the rate of mortality?—It is very low; there were only two out of 2,000 this year, and about the same proportion last year, and those men fell ill very suddenly after their arrival.

622. (*Sir R. Martin.*) Have you formed any opinion as to where recruits could be drilled before being sent out to India?—I have already answered that. With regard to the Cape of Good Hope, I do not see that there would be any advantage in drilling them there more than at Warley.

623. The climate of the Cape of Good Hope being a semi-tropical climate, you would rather think it disadvantageous to the drilling?—I conceive that it would be far better for a healthy man to go out direct, if he is properly taken care of when he arrives, rather than stopping on the way.

624. Have you formed any opinion as to the probable effect of drilling recruits in the mountain ranges of India, provided that they were in the occupancy of European troops?—No, I have not considered that question.

625. (*Chairman.*) Do you know whether much precaution is taken on board ship to preserve the health of the men?—I believe every possible precaution and care are taken in the way of ventilation, cleanliness, diet, and drill. I have always understood so, and I think that nothing can be better.

626. They have artificial means of ventilation on board, which is applied?—Yes; in all the ships that I have been on board, and I generally go with a party when they embark.

626a. (*Sir R. Martin.*) Have you reason to know that, generally speaking, the men arrive in India in a good sanitary condition?—Yes, excellent. I cannot say what mortality takes place during the passage, but I think it is trifling, if any at all.

EAST INDIA DEPÔT, WARLEY.—NUMBER OF RECRUITS, &c. embarked in 1858.

Date.	Name of Ship.	Sap- pers.	Arti- lery.	In- fantry.	Ca- valry.	Total of Men.	Wo- men.	Chil- dren.	Grand Total.	Destination.	
January 22 -	Burlington -	-	2	4	294	300	1	1	302	Bengal	
February 25 -	Vittoria -	-	104	188	-	292	11	7	310	"	
" 26 -	Alibar -	-	3	4	287	294	10	5	309	"	
March 16 -	Jason -	-	9	4	223	240	9	6	255	"	
" 23 -	Poictiers -	-	9	3	191	206	1	1	208	"	
April 30 -	Canning -	-	20	28	13	330	391	7	5	403	"
May 15 -	Maria Hay -	-	-	50	50	279	379	8	6	393	"
June 10 -	Surrey -	-	12	12	51	330	405	6	4	415	"
" 20 -	Overland Steamer -	-	2	-	-	2	-	-	2	"	
" 20 -	Ditto -	-	2	-	-	2	-	-	2	Madras	
" 25 -	Harvest Home -	-	79	114	-	193	5	-	198	Bengal	
" 26 -	Overland Steamer -	-	2	-	-	2	-	-	2	Bombay	
July 2 -	Sir Robert Sale -	-	25	275	-	300	5	3	308	Bengal	
" 6 -	Violet -	-	-	92	160	252	-	-	252	"	
" 31 -	Maldon -	-	5	17	28	50	-	-	50	"	
August 7 -	Walmer Castle -	-	1	233	156	390	8	8	406	"	
" 10 -	Forerunner -	-	13	100	80	193	8	6	207	Bombay	
September 2 -	Jalawar -	-	-	60	84	100	244	10	9	263	"
" 4 -	Gloriana -	-	15	40	88	143	6	2	151	Madras	
" 4 -	Vernon -	-	2	40	100	142	6	5	153	Bombay	
" 18 -	Ellenborough -	-	1	80	122	137	340	8	4	352	Bengal
October 2 -	Seringapatam -	-	1	26	168	195	4	2	201	Madras	
" 6 -	Kennington -	-	1	50	91	142	6	4	152	Bombay	
" 8 -	Havering -	-	-	52	-	52	-	-	52	Madras	
" 25 -	Caroline Coventry -	-	33	67	-	100	1	1	102	Bombay	
" 26 -	Janet Willis -	-	16	84	-	100	2	1	103	Madras	
" 29 -	Tudor -	-	78	215	-	293	6	3	302	Bengal	
November 25 -	Eveline -	-	39	238	30	307	8	5	320	"	
" 27 -	Lincluden Castle -	-	119	121	-	240	8	11	259	Bombay	
29 Embarkations.		89	997	2,558	2,545	6,189	144	99	6,432		

D. STEWART, M.D.,
Depôt Surgeon.

The witness withdrew.

ADDENDA.

December 16, 1859.

HAVING been called upon by the Commissioners to prepare certain tabular reports relating to the recruiting operations at Warley, I beg leave to state that, unlike a standing regiment, which is subject only to ordinary casualties, the "strength" of the dépôt varies every day in the year, owing to the daily influx of fresh recruits, and their frequent exodus by embarkations, of which there were 29 last year.

Another peculiarity of the dépôt, which much affects the medical charge, and mars the attempt to estimate correctly the healthiness of the establishment, is the circumstance that, though none but men in good health are ever embarked, the sick, we may be said, to have always with us; for they, of course, are left behind, and help to fill the hospital, together with the sick from among the new comers. And again, as the "time of residence" at the dépôt of any number of men is extremely short, the hospital returns cannot be said to represent fairly the sanitary condition of the locality; but would rather indicate that of the districts which our recruits come from. So much is this the case, that whenever the hospital is full of zymotic cases, skin diseases, coughs, &c., the inference is that some batches of recruits have lately come from Cork, or Belfast, or Bristol, whence all the filthiest and worst men generally come; the best by far being from London.

Replying seriatim to the further questions addressed to me, I have to say with respect to,—

("No. 1.) The number of recruits arriving at Warley annually, distinguishing the recruits to each arm;" and

("No. 2.) The number of recruits embarked annually, distinguishing the arms and the presidencies."

I am not able to reply to these exactly from my own records; the following tables are, however, I believe correct, as far as they go. Colonel Leslie tells me that the information now sought for is already stereotyped in the evidence of many officers, laid before the late Royal Commission on the Organization of the Indian Army.

NUMBER of RECRUITS arriving annually at Warley Dépôt.

Date.	Artillery.	Infantry.	Cavalry.	Total.
1854	524	1,847	—	2,371
1855	477	1,380	—	1,857
1856	580	1,525	—	2,105
1857	1,194	1,589	1,145	3,928
1858	1,062	2,450	3,124	6,636
1859	1,824	2,072	376	4,272*

* Up to December 16, 1859.

NUMBER of RECRUITS embarked from Warley for India.

Date.	Engineers.	Artillery.	Infantry.	Cavalry.	Total.
1856	76	543	946	—	1,565
1857	89	1,294	1,519	814	3,716
1858	89	997	2,558	2,545	6,189
1859	117	1,625	2,100	381	4,223

("No. 3.) As regards the number of men annually declared to be unfit for embarkation by the dépôt-surgeon," I have already stated it (in my reply, 611). I now subjoin a statement of the disqualifying causes in these 195 cases.

CAUSES of REJECTION of 195 Recruits.

—	1856.	1857.	1858.	1859, for 6 Months.	Total for 3½ Years.
Diseases of Brain and Nervous System	7	3	6	4	20
Cachexia and General Ill-health	1	4	1	4	10

Causes of Rejection of 195 Recruits—cont.

Dr. D. Stewart.

—	1856.	1857.	1858.	1856, for 6 Months.	Total for 3½ Years.
Scrofulous and Glandular Disease	3	1	2	7	13
Phthisis and Pulmonary Disease	11	4	23	12	50
Cardiac and Vascular Disease	4	2	3	5	14
Liver and Bowel Disease	1	1	1	0	3
Diseases of Kidney and Urethra	1	0	2	0	3
Disease or Loss of Organs of Senses	3	3	3	5	14
Loss of Limb or Member	2	0	2	3	7
Hernia	8	5	4	3	20
Dropsy	1	0	0	0	1
Malformation of Spine, Limbs, and Joints	6	1	7	4	18
Insanity	3	2	2	3	10
Rheumatism	0	0	3	1	4
Syphilis	0	0	1	4	5
Skin Disease	0	0	1	1	2
Branded with the letter D.	1	0	0	0	1
Total	52	26	61	56	195

REMARKS made by the Dépôt Surgeon on the Attestation Papers of 254 Recruits sent forward to India, not rejected as unfit.

Causes.	Year.	
	1858.	1859.
Number of Enlistments	6,636	4,284
Younger than stated	10	37
Older than stated	14	11
Curvature of Spine	30	33
Knock-kneed	13	7
Contracted Chest	2	8
Flat Feet	47	28
Marks of Medical Treatment	10	4
Total	126	128

(No. 4.) I cannot possibly say what or how many men are rejected by the district examining surgeons, nor what causes would be deemed sufficient by any of them for such rejection; but I am bound to declare that many men join the dépôt whom I consider most ineligible recruits for India; some are evidently much younger than the minimum age prescribed, others considerably above the maximum allowed; many, although in fair present health and of the regulation height, exhibit unmistakable signs of a consumptive tendency; others give evidence of bad constitutions in the form of curved spines, knock-knees, relaxed inguinal canals, tumid abdomens, enlarged cervical glands, pale lips, &c. Should any of these men during their short probation at Warley fall so ill as to come into hospital, an opportunity is offered me of reporting my opinion of their unfitness; but otherwise I am not at liberty to move in the matter, and under the present system it would be useless my doing so.

While now writing a letter reaches me, dated 26th October 1859, from my friend Mr. G. E. Morton, who is surgeon to the 6th Bengal European regiment at Hazreebagh:—part of this letter bears so appropriately on two important subjects connected with the present inquiry that I may perhaps be pardoned for quoting it verbatim. He says:—"The last recruits you sent out have certainly been an improvement on the former batches, but even among them one finds several that will do no good, and be a mere source of expense to Government.

"This is a most delightful climate and very healthy; I have to-day only 23 men in hospital out of 416, or about five per cent., a small average for the month of October in Bengal. I should be very glad, indeed, to pass the rest of my exile here."

("No. 5.) Average number of recruits constantly resident at Warley during each year (from diet or other rolls"). I can only answer this question by reference to the subjoined tables, which give the actual numbers of men of each class, present on 12 separate days in one year, and the average of these, and the annual averages for eight and a half years.

Dr. D. Stewart.
2 Dec. 1859.

The MEDICAL CHARGE at WARLEY on the First Day of each Month in 1858.

	1st January.	1st February.	1st March.	1st April.	1st May.	1st June.	1st July.	1st August.	1st September.	1st October.	1st November.	1st December.	Average Total.
Staff Commissioned Officers.	7	8	8	8	8	8	8	8	8	8	8	8	7·916
Staff Non-commissioned Officers.	23	23	23	23	24	24	24	24	24	24	24	24	23·666
Buglers - - -	6	6	6	6	6	6	6	6	6	6	6	6	6·
Cavalry - - -	330	510	87	534	573	487	246	176	120	22	50	63	226·5
Artillery - - -	87	142	610	117	143	130	103	193	96	110	95	94	160·
Infantry - - -	199	229	65	57	90	422	284	425	200	274	202	194	220·083
Ladies - - -	5	5	5	5	5	5	5	5	5	5	5	5	5·
Soldiers' wives -	46	55	37	34	37	42	39	50	45	41	31	36	41·083
Children of Officers -	21	21	21	21	21	21	21	21	21	21	21	21	21·
Children of Soldiers -	110	114	103	101	104	109	99	102	91	87	82	84	98·833
Total -	834	1,113	965	906	1,011	1,254	935	1,010	616	598	524	535	—

WARLEY DEPÔT and HOSPITAL.
Averages for Eight Years and a Half.

	Average Number of Recruits in Depôt.	Average daily Number in Hospital.	Per-centage of Sick to Strength.	Died.	Dis- charged Unfit.
1851 - - -	316·397	27·149	8·782	4	26
1852 - - -	382·901	32·340	8·714	5	9
1853 - - -	418·412	37·172	8·567	4	10
1854 - - -	359·000	32·472	8·731	5	20
1855 - - -	384·623	34·863	9·710	6	15
1856 - - -	672·914	45·897	8·515	8	52
1857 - - -	712·52	40·316	5·014	5	26
1858 - - -	704·727	41·549	6·001	7	61
1859 } for 6 months.	864·591	70·833	8·524	2	56

(No. 6.) For the "number of deaths at Warley" the Rev. Mr. Laurence, who has been officiating chaplain to the depôt for many years, has kindly furnished the following statement, showing the mortality of all classes connected with the establishment, including the recruits.

RETURN OF MORTALITY at WARLEY BARRACKS during the last Ten Years.

1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.
Men - 5	Men - 4	Men - 5	Men - 5	Men - 5	Men - 7	Men - 8	Men - 5	Men - 7	Men - 3
Women 0	Women 1	Women 0	Women 0	Women 0	Women 1	Women 1	Women 0	Women 1	Women 0
Children 6	Children 8	Children 3	Children 3	Children 2	Children 4	Children 4	Children 2	Children 2	Children 1
Total 11	13	8	8	7	12	13	7	10	4

Copied from the Parish Register, December 14, 1859. (Signed) FREDERICK ROSS LAURENCE.

Friday, 9th December 1859.

PRESENT :

THE RIGHT HON. SIDNEY HERBERT, M.P., IN THE CHAIR.

Sir RANALD MARTIN, C.B., F.R.S.
THOMAS ALEXANDER, Esq., C.B., D.G.A.M.D.
Col. EDWARD HARRIS GREATHED, C.B.

WILLIAM FARR, Esq. M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

ARCHIBALD STEWART, Esq., Deputy Inspector-General of Hospitals, examined.

A. Stewart,
Esq.
9 Dec. 1859.

627. (Chairman.) What rank did you hold while in India?—I went to India as an assistant surgeon of the 9th Lancers ; afterwards served as surgeon, 61st regiment ; surgeon, 14th Light Dragoons ; field surgeon, 2nd division Persian Expeditionary Field Force ; field surgeon, Gwalior division ; and deputy inspector-general of hospitals.
628. How long have you been in India?—I have just returned after upwards of 17 years continuous service in India.

629. Was it stationary service, or have you been at many different stations?—I have been at a good many stations in Bengal and Bombay, either on stationary or field service.
630. Did you serve with the Queen's troops?—Always.
631. And with the native and Indian troops?—Rarely with native troops ; I know little of them.
632. In what presidencies have you served?—In Bengal and the North-west Provinces for upwards of

12 years and a half; in Bombay and Central India about four years.

633. Will you mention to the Commissioners the stations at which you have served?—At the end of 1842 I was at Cawnpore, and afterwards went to Umballa, Ferozepore, Lahore, and Meerut. That concluded my service in Bengal. I afterwards went, early in 1855, to the Presidency of Bombay, and was stationed chiefly at Kirkee and in Central India.

634. Where were you stationed for the longest period of time?—At Meerut; I was there for nearly four years.

635. What are the stations with which you are most intimately acquainted, having reference to their position in a sanitary point of view?—I was intimately acquainted with Cawnpore, but have not been there since 1845. I also know Meerut very well, and Lahore,—but not so well the present station of Lahore (Meân-Meer).

636. Will you have the goodness to describe the stations you have been at, especially with reference to their comparative healthiness or unhealthiness, referring to the climate, the local position, and so on?—Cawnpore was the first station at which I served. It is a tolerably healthy station in the cold months; that is to say, for three or four months in the year. At other times the climate is very severe; and I think it is, or used to be, from 1842 to 1845, a very unhealthy station.

637. How do you account for its unhealthiness?—The climate in the hot months is severe. There are dry hot winds. The soil is light and sandy, and it is deficient of vegetation at that particular time. The country is flat, and the station is near the Ganges, about a quarter of a mile from the right bank of the river. The country on the left bank is liable to be overflowed to a great extent annually during the rains. In the rains, and immediately after, the station is very unhealthy.

638. Is there much irrigation about it?—A good deal, but at some distance from cantonments.

639. It is not so near as to produce an effect upon the atmosphere?—I think not; but I should say that at the time I refer to the sanitary arrangements at Cawnpore were, as perhaps they were everywhere else, extremely imperfect.

640. Are the cantonments close to the town?—I am more intimately acquainted with the east end of the station, where the old dragoon barracks were; the cavalry lines near the artillery.

641. How are they situated with regard to the native buildings, are they near to them?—They are some distance from the native town or bazaar.

642. As I understand you, it is a low flat situation on a sandy soil and liable to be overflowed annually?—During the rains the water is apt to lodge a good deal on the plain where the dragoon hospital stood, and the draining was not what it might be made. The surface is not favourable altogether to drainage, and there was not much done artificially to aid it there, or throughout the station.

643. When you speak of drains, do you mean drains to carry off all foul matter and refuse, or drainage to guard against humidity?—Generally, as well as in particular localities.

644. Beyond the liability to annual floodings there is no source of malaria in the neighbourhood?—There is a good deal of broken ground in the neighbourhood of the bazaars.

645. Ravines?—Yes, and the sanitary measures taken, as regards those localities, were very often imperfect; natives frequently retired there, and there used to be, generally speaking, no proper police to maintain cleanliness. Then the river overflowing to the extent that it does may also, produce its effect upon the climate; for instance, the river is about a mile broad during the rains, and it recedes so much towards the right bank at other times that it is not one-fourth of that breadth; that is in the cold weather.

646. What is the level of the ground on which the

cantonments are placed, above the summer height of the river, are there banks which descend deep into the river?—The right bank has, generally, an abrupt descent at Cawnpore. The overflowing of the river goes in an opposite direction; it does not come towards the cantonments, it is towards the other side of the river.

647. What is the nature of the sub-soil under the sand?—It is sand mixed with clay and masses of "kunkur."

648. Could that be easily drained?—The drainage might be much improved. I think the water disappears rather rapidly from the surface, much of it, probably, by percolation.

649. With regard to the precautions which are taken as to latrines, urinals, and so on, are they all properly drained away, or what was the practice at the time you were there?—The latrines were in the neighbourhood of the barracks; there was one, I think, for each troop, a house close by, and they were sometimes exceedingly offensive. Latrines are often in unpleasant proximity to the cook houses. There is, generally, a want of urinaries a little way off the rooms, and with covered passages leading to them, to prevent exposure.

650. Are they merely cess-pits?—They have seats, &c., made of masonry, or burnt brick covered with chunam or lime plaster. The soil falls upon this and runs into a common receptacle outside, which is often concealed by a screen wall. The masonry becomes highly impregnated with urine, and the latrines are often exceedingly offensive, notwithstanding the free use of slaked lime. In the Bombay Presidency I have seen a better plan adopted. There the seat is higher, and the upper part is made of plank, perforated according to the number of separate compartments in the masonry beneath. In each compartment is placed, from without, an iron pan, which receives its portion of soil and urine, so that their spreading over the masonry is in a great measure prevented. The pans are removed and emptied when necessary. The result is that the latrines are more easily kept clean, and generally less offensive than under the plan usual in the North-west Provinces.

651. Are they emptied at intervals?—The soil is carried away by carts at night.

652. Is there a good supply of water?—There is generally very good water.

653. And a good supply of it?—Yes, procured from wells.

654. What kind of barracks are there there?—The old dragoon barracks are, I believe, now removed; they were removed before the mutiny. The dragoon barracks were of a very inferior description, and I believe it has been decided to erect new barracks on another site.

655. Are the barracks built in the same way as in England, or is there any peculiarity in them to suit the climate?—The barracks at Cawnpore were eight in number, that is to say, there was one for each service troop of a dragoon regiment. They were placed with the broad sides to the north-west and south-east, or to the east and west, the ends being north and south. Their order was parallel, with an interval of about 50 or 60 yards between each. There were no proper separate quarters for married men and their families.

656. That mode of construction, I suppose, was resorted to for the purpose of creating a good draft between them?—I think that the arrangement was objectionable, because the wind sets in, taking the year round, generally from the east or west, with exceptions, and for that reason barracks ought to be built so as to profit by the most favourable winds in the hot months. If they stood singly they would have that advantage, but being arranged in parallel order as they were, the one barrack sheltered the other, and the space between them being so limited, excluded the others more or less from the influence of the most favourable winds, especially in the hot season.

657. If the axis of the barracks had been reversed it would not have been the case?—If they had been

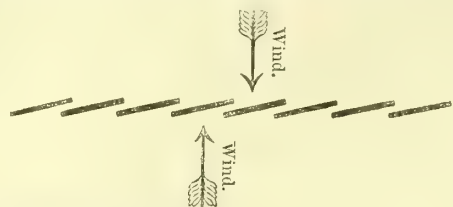
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Esq.

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Esq.

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as at some other stations, placed in echelon, it would have been far preferable, especially if arranged thus:—



658. But that is always possible, I suppose; there is no difficulty about want of space?—In many stations it is possible, and it is at all times a most important measure, as respects health and comfort. No barracks ought to exist in the North-west Provinces except in that position, so as to ensure the full advantage of the barrack being rendered cool and comfortable for the men during the hot weather, so far as that is possible.

659. Is the lower story raised above the ground, so as to permit of free circulation of air underneath?—All the barracks that I have seen in Bengal have been barracks with a single story.

660. With no circulation of air under the floors?—No; they are more or less raised, that is to say, from a foot to a foot and a half, and from that to two feet, on a basement.

661. But with no circulation of air through?—None whatever.

662. Ought not that to be secured?—If it were done in a certain manner it might, in flat or low situations where drainage, as after rain, is not rapid, be highly advantageous. I have seen it attempted, as at Kirkee, but in an objectionable way; if it is not done properly, that is to say, on well-elevated arches, I think the plan is objectionable.

663. For what reason?—For this reason: if the situation is flat or low, or difficult to drain, it is a great point to have the barracks well raised above the ground; but these arches, if they exist at all, should be of such elevation and space as to admit of thorough cleanliness and ventilation underneath, and also to be useful as places of shelter for the men during the hot weather for their amusement. Again, at Kirkee, where the measure was attempted in another way, the result was exceedingly objectionable, so much so that as regimental surgeon I have been appealed to by the men on account of the annoyance which this caused them, and I had to apply to the authorities to have the places built up. To illustrate my meaning I will refer to the two new and best barracks at Kirkee, in the dragoon lines; they were built of late years to replace two that were burnt down when the barracks were occupied by the 10th Hussars. They are very superior to the other old barrack rooms at Kirkee, but not what they ought to be; they are flagged and somewhat raised from the ground, and along the centre of the floor there was a sort of tunnel or drain about a foot and a half deep by a foot broad; this was covered in except at two or three places, extending along all the barrack, and there was a moveable perforated flag here and there, apparently intended for air-holes; transversely, and extending out to the verandah on either side, there were similar, but smaller, communications; these were grated outside, and the effect was that dust and impurities drifted in from beyond the verandahs into these places which were grated, and when the rooms were swept the dust and impurities escaped through the perforations in the flagstones, and the tunnels underneath became filled with dust and impurities. Again, the rooms are washed frequently, the water escapes into these holes, and the accumulated contents of the tunnel are converted into a disagreeable kind of mud, which is very offensive, so much so, that when I visited the barrack rooms, weekly or oftener, the men complained to me that they could not exist in the neighbourhood of these tunnels, as the smell emanating from them often made them sick.

664. (Sir R. Martin.) That would be especially

during the rainy season?—Especially so; but at any period of the year the plan is most objectionable.

665. But more so in the rainy season?—Yes.

666. (Chairman.) When a barrack is sufficiently raised, with sufficient ventilation underneath, the space underneath must be kept perfectly clear and available for use?—It is most important that barracks should be raised three or four feet at least from the ground, and the more flat the locality is the higher they ought to be. The basement ought to consist of thoroughly solid material, and no under ventilation ought to be attempted unless it be efficiently carried out by constructing elevated arches.

667. Are the barracks overcrowded, or is it the reverse generally in India?—So far as I have seen, they are generally overcrowded. On some occasions I have seen the evil much increased, owing to the want of proper separate quarters for married people and their families.

668. Do you know what cubical space is allowed per man in the barrack rooms at the different stations where you have been?—It is difficult exactly to say, because the construction somewhat varies; but the space to be allowed as laid down by Sir Charles Napier, when he was commander-in-chief, was 1,000 cubic feet for every man—that is, for every man irrespective of men being in hospital and on guard.

669. That is 1,000 per bed, not per man?—For every man occupying the barrack; that is, that they should also have the advantage of the additional 1,000 feet for every man in hospital or upon guard.

670. You mean that if there were 10 occupants of a room, and two of them were absent, there would still be 10,000 cubic feet in that room?—The full proportion for each man would still exist, although the man is absent, as I have understood the arrangement. In the original plan for a barrack room, 1,000 cubic feet should be allowed for each person, according to the number for whom accommodation is intended.

671. Was that plan ever carried out?—After Sir Charles Napier gave that order, I heard an engineer officer high up in the company's service—the superintending engineer of the North-western Provinces—say that as it was each soldier in the barracks then existing had at least that space one way and another; but if so, I should say, with regard to the health of the men, that the space is much too limited, and that it would be for the benefit of the service, although it might be expensive to carry out, if the space were at least doubled, particularly in all barracks situated in the plains. The breadth of verandahs should not be less than 12 feet. Outer verandahs should have jalousies: I have almost uniformly observed, that on those years in which circumstances happened to admit of improving the accommodation of the troops, together with arrangements calculated to add reasonably to their comfort, the number of admissions into hospital was less, as likewise the mortality, compared with preceding years.

672. The 1,000 feet?—Yes. If this officer was correct in saying that the men had already 1,000 cubic feet of space, as was intended by Sir Charles Napier, I should say that, considering the severity of the climate, and the necessity of the soldier in India, it is by no means sufficient.

673. Practically, is it common to find a barrack in India in which so much as 1,000 cubical feet are provided for each man?—The barracks which were said to contain this quantity were very similar to most of those I have seen, perhaps better.

674. Have you ascertained by measurement what the space provided per man has been at the different stations?—No, I have not.

675. Do they make any arrangement with regard to the superficial area allotted to each man besides the number of cubical feet?—As far as I have seen it has generally been very small.

676. Are the walls or the roofs usually double or single?—Sometimes the walls are single; very often they are double. That is to say, there is an inner

central room in which the men sleep, and there is an enclosed verandah, and then an open outer verandah in many places, that is, on each side of the central room.

677. Which is equivalent to a double wall?—Yes; the second inner verandah is equivalent. In the barracks at Kirkee there are no double walls, and in some of the same barracks, on one side, there is no verandah at all.

678. Neither double walls nor verandah?—No, not on one side in some of them,—the old barracks.

679. Are there not sometimes barracks which are built differently on the two sides?—Yes; on the north-west side. I think there are not any verandahs on that side in the old barrack rooms at Kirkee, and there are no double walls.

680. Is there not a marked improvement in the barracks that have more recently been constructed over the old ones?—Judging by the plans, there is; but my experience is chiefly connected with the old ones. I left Bengal when they were going to build the new ones.

681. (*Sir R. Martin.*) The old ones have been almost invariably defective in structure?—I may say that, with but one exception, I never saw what I considered to be really a good barrack, and that was at Meerut, Lahore. That barrack was one of a series intended for European troops, approved by Sir Charles Napier, and planned under his orders. I saw it in 1850, and then it was unfinished; but, having been on the committee at the time the site was selected, and seen the plans, I am enabled to say that it was the finest barrack I ever saw, and, although expensive, I have no doubt that it would be found sound economy, in the end, to provide barracks of the same kind all over India. The excessive heat of the climate demands more atmosphere and more space than given in the old barracks. I have reason to know, that in one particular at least, a serious defect in many of the old barracks and hospitals is still adhered to; as, for example, in the plan of “temporary half-company barracks” recently adopted. I have seen one of these barracks being built with this defect. In the case of a “temporary barrack” such a matter is apt to be considered as of little consequence. Temporary barracks, however, once built, are too apt to become permanent, or to be occupied for an indefinite period, especially if, as in the instance I witnessed, they are built in a substantial manner. But, even supposing barracks to be “temporary,” much evil arises from their faultiness of design and construction, by impairing from time to time the health and efficiency of troops occupying them. No building, however temporary its nature, ought to be built for the accommodation of troops, without due regard to thorough protection of the occupants from all avoidable causes of disease, as regards judicious, salutary ventilation, protection from strong direct currents of air, &c. &c. This has not been sufficiently attended to. The defect alluded to is this. In referring to the usual barrack built after the old plan (Q. 676), to which hospitals, in point of general construction, were often very similar—it was mentioned, that there is a central room occupied by the men, and in which they sleep. Outside this central room, on either side, separated by a wall, is an enclosed verandah, say from eight to 10 feet broad, and outside this an outer open verandah, also separated by a wall from the inner verandah. In the outer wall, or that separating the outer and inner verandahs, there are numerous doorways, say about seven feet apart; and corresponding to these, in the wall between the inner verandah and central room, is an equal number of doors, or doors and windows alternately. The arrangement of one side of the building corresponds to that of the other; so that the doors and windows on opposite sides exactly face one another, and there is little or no impediment to strong direct currents of air sweeping right across the interior of the building.

In the inner wall, or that separating the inner verandah from the central room, there is usually either

an open doorway at the distance of every seven feet, or a doorway and window, low down, alternately at the same distance. These windows are not glazed as in England, being often either closed with ill-fitting shutters, or open. Within the central room, the seven feet of solid wall between each doorway, or each doorway and window, is intended for, and always occupied by, the beds of two men. If two beds be placed in this space of seven feet, taking the breadth of each bed at three feet,—and it ought not to be less in so hot a climate,—it follows that six out of the seven feet are occupied, leaving only an interval of one foot between the two beds. Now, I think, that in any climate, and particularly in that of India, the space of one foot between every two beds is altogether too limited,—utterly inadequate either for proper ventilation, health, or comfort. The space of clear wall allowed for every two beds should not be less than 10 feet. This proportion would admit of three feet in the centre for a small table,—an article which should henceforth be allowed as barrack furniture in India,—and six feet for the two beds, besides eight inches of clear wall on either side,—thus affording to the occupants of the beds protection from strong, direct currents of air through the open doorways and windows in all seasons.

There is another point also to be considered in connexion with this subject. Soldiers of late years read a good deal in their barrack rooms, especially in the hot months, when exposure to sun and weather is very injurious, and often fatal. They obtain books, &c., from the library, and lie upon their beds and read during the day. Being employed in this way, they are not so apt to go out, and expose themselves to the sun, whereby much careless, injurious exposure is avoided, with manifest benefit to the men themselves, and to the service.

Among the well-conducted men too I have almost uniformly observed that, sooner or later, and at the expense of the men themselves—no such article being at present allowed by barrack regulations in India—a small table was introduced and placed between the two beds for mutual convenience, receiving books, writing materials, and various little articles more or less in constant use. Sometimes a box was substituted for a table. The space left between the beds to receive this table, as before stated, is only one foot. Supposing the table to be one foot and a half or two feet broad, and placed in the centre, so as to be convenient for both men, it follows that the bedsteads must be pushed laterally into the open doorways or windows. The beds consequently project more or less beyond the protection of the wall, and the men occupying them are liable to be injuriously exposed, by night and by day, and in all seasons, to strong direct currents of air from the doors and windows.

In the rains, in the cold season, this may lead to serious results, as also in the hot months, when, to cool the atmosphere of the rooms, wetted tatties are placed in the doorways within a few feet of many of the men, and a stream of cold damp air is apt to blow directly upon them when on their beds. In fact, from the faulty plan and general construction of the buildings, men are necessarily compelled to pass much of their time in barracks, under more or less constant exposure to direct currents of air, by night and by day, and in all seasons. It need not, therefore, be matter of surprise, if, under such circumstances, rheumatism, pulmonic affections, dysentery, with other serious, and too often fatal, diseases, should prevail at certain periods. Improvement in the plan and general construction of barracks, so as to admit of a system of judicious, free, salutary ventilation being established, would go far towards removal of present evils. As it is, the mode of ventilation usually existing in barrack rooms in India, much of it being through open doors and windows, is far from salutary, or even safe.

682. That arises from the space being made inadequate to hold two beds?—Yes, and from faulty construction and the way in which ventilation is carried out. It is not so much deficient ventilation that is

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generally to be complained of in barrack rooms in India, but rather the reverse, owing to the objectionable manner in which ventilation is effected; and that, in great measure, arising from fault in the original plan of buildings. The great desideratum is, buildings so planned and constructed as, together with other proper sanitary measures, to admit of the establishment of a free, salutary, and safe system of ventilation, under a judicious practical application of sound principles. Ventilation can scarcely be too free, provided it be effected in a proper manner and under due control, conditions which, at present, cannot be said to exist.

683. Although the two beds are but a foot apart on one side there is a much greater interval between the beds and the next one on the other side, as there is the whole space of the window?—Yes, and the men beyond that window then come in the way of it and the other door, and they are just exposed in like manner. Were the man next the window to move his bed into the space opposite to it, he would be exposed to a direct draft from the window. If again, the man next the doorway moved his bed further from the other, he would be still more exposed, and also obstruct communication.

684. (*Sir R. Martin.*) The two cots correspond with the solid wall, and by putting the table intermediately the beds are thrust half into the open space?—Yes.

685. (*Chairman.*) How many doors are there in a room?—A great many. There are large doorways at about every seven or eight feet, or windows; that is a very common construction in the old barracks.

686. What is the object of having doors in lieu of windows in such large numbers?—I suppose for the purpose of ventilation, they perhaps require both. Then the windows are very low down, but they are not glazed as windows are in England, sometimes having only one or two panes fitted into the wooden plank or shutter; at other times, as in the barracks at Kirkee, having no glass or opening at all in the shutter; so that when the latter are closed, during a storm or otherwise, light by such windows is altogether excluded. In the hospitals where a table was actually allowed, and where the breadth is generally a foot and a half or 20 inches, the same faulty construction often existed.

687. (*Sir R. Martin.*) The men in hospital were exposed to the same evil in common with men in the barracks?—Yes.

688. (*Chairman.*) Did they ever sleep in the verandahs?—Frequently from necessity; and when that happens the evil is in no way diminished, rather the reverse.

689. Is that a healthy or an unhealthy practice?—The men are very apt to suffer from it for the reason I have mentioned, that is, from drafts; and besides, if they are on the sunny side of the barrack, they will, during the day, in the hot months, be exposed to great heat, a very serious matter.

690. I suppose the walls get so baked that the heat is retained in them and remains after the evening has come on?—Yes, in hot weather the walls become so heated that they scarcely get cool before the morning, and the atmosphere is very still, as the winds usually cease at night.

691. With this immense amount of open space you do not find that impure and foul atmosphere which you do in the barracks in England, when every aperture is closed up?—I have not perceived it so much, but still from other causes, as the highly rarefied state of the atmosphere and the heat of the climate, which, in the hot season, is intense, I think they require very much more room than they have in the old barracks.

692. (*Sir R. Martin.*) The atmosphere will be offensive when the barrack or the hospital is placed under the ramparts of an old fort?—Yes, or if the doors were shut. But from so many doors, which perhaps convenience renders necessary, and insufficient control over ventilation, the hospital is very often extremely uncomfortable for men, particularly those suffering

under chronic dysentery, rheumatism, &c., in the cold months.

693. (*Chairman.*) Are any means resorted to to cool the air?—In the hot months tatties are supplied by the executive engineer; they are made of the roots of "kuskus," a particular kind of grass, put up against the doorways, and an establishment is furnished at the expense of Government to water them; that is during the hot winds; they are discontinued during the rains and afterwards. Tatties are in general used only by day; but at Ferozepore, Lahore, and on one occasion at Meerut (June 1854), when hot dry winds continued throughout the night as well as by day, I have known them used by night also. Thermantidotes would be of great service in cooling the air and promoting ventilation in close sultry weather, I mean in addition to tatties, and should be allowed for barracks in the hot season and rains, especially in the North-west provinces.

694. You have spoken of a station, that which you were at, namely Cawnpore; is that one which in your opinion it is necessary to maintain for public purposes, or one which ought to be occupied for political or strategical purposes?—When I knew it it was rather an important station, there was a force there of all arms, and I should fancy it to be still a necessary station.

695. You have given the Commissioners a description of Cawnpore, and your objections to it as a station. Will you take any other station with which you are thoroughly well acquainted?—I know Meerut very well.

696. What account can you give of it with respect to its salubrity?—I left the station at the beginning of 1855; I had been there from 1851, and up to the time I left, the barracks were very much of the same description as at Cawnpore; they were arranged in a similar manner.

697. One behind the other?—Yes; they were arranged in parallel order, just exactly in the same way as the old dragoon barracks at Cawnpore.

698. Was it a healthy station?—At that time the barracks were frequently complained of. While I was there a committee was ordered to assemble to inspect and report upon them. And it was decided that some improvements should be made. I believe that those improvements have since in a great measure been carried out. But with all these disadvantages, Meerut, compared with most others in the plains, is a good healthy station.

699. With regard to the position of the barrack, do you consider it more healthy or less healthy than Cawnpore?—The station altogether is better than Cawnpore.

700. Does it not stand on higher ground?—It is somewhat more favourable to drainage, although it is rather flat; it is further north, and in a much better climate, but the barrack accommodation there was extremely bad and deficient. I may mention that the 14th Dragoons, at Meerut, during the years 1851 to 1854 inclusive, averaged in strength, at head-quarters, throughout the year, 696 rank and file, exclusive of men in the country, but absent. There were, I think, eight barracks remaining, some of them were thatched, and some of them with flat or terraced roofs; those barracks were, from the number of men, the sick being often comparatively few, overcrowded; the barracks were bad, and to add to the evil, there existed no accommodation for married people; hence it was necessary to accommodate the families of the married men (screened off in compartments) in the enclosed verandah on each side of the central room occupied by the men, and with the exception of a few instances in which other out-buildings were appropriated for the purpose, all the families were accommodated in that way, the barracks, having due regard to health, being altogether insufficient for the men themselves.

701. Did you find that the health of the men was affected by those proceedings?—The health of the troops, strange to say, remained good, but that it remained so was to me a matter of surprise. I have

no doubt that if any epidemic had visited the station the result would have been very serious. Two barracks had been burnt down in former years by some accident, which helped to produce the evil I have mentioned, and they were never rebuilt, so that the regiment, with that great strength, and with the families in this way, was exposed to the disadvantage of being without those extra barracks.

702. But there being no epidemic when you were there, the health of the troops was well preserved?—Yes; but it required great care. It was just a piece of good fortune that it was so.

703. That tends to show that the climate, the soil, and other conditions of the station must have been very good?—As stations go, I suppose Meerut, for the plains, is one of the best stations in Upper India.

704. Do you know what the mortality at the different stations is?—Yes, as respects the stations at, and corps with which I have personally served. The 14th Dragoons arrived in the North-west Provinces early in 1846, from Bombay. On going to Meerut in 1851, and afterwards, they were in better health than they had ever been since their arrival in the North-west Provinces. With the exception of 1851 and 1852, the mortality in the 14th Dragoons, while at Meerut, was less than half that of preceding years of the regiment's service in the North-west Provinces. In the last two years at Meerut, 1853–54 and 1854–55, the mortality in hospital was 12 and 11 men respectively.

705. In the regiment?—Yes; out of an average annual strength of 702 rank and file, at head-quarters, in 1853–54, and of 699 in 1854–55.

706. Did any deaths occur besides those in the hospital?—I do not remember any; there may have been.

707. But not deaths from sickness?—No, I mean deaths from sickness in hospital only.

708. That was in a force of about 700?—Yes.

709. Will you be so good as to state the mortality, and in each year?—At the stations at which I have personally served, it was as follows:—

North-west Provinces.

Cawnpore, 1843–44, 9th Lancers; out of an average annual strength of 573, 54 died.

Do. 1844–45; out of an average strength of 679, 53 died.

Umballa 1847–48, 14th Dragoons; out of an average annual strength of 586, 35 died.

Punjab.

Lahore, (*Anarkullee*) 1849–50, 14th Dragoons; out of an average of 646, 28 died.

Do. (10 months) 1850–51, do.; out of 681, 31 died.

North-west Provinces.

Meerut, 1851–52, 14th Dragoons; out of 697, 22 died.

Do. 1852–53, do.; out of 686, (at head-quarters), 12 died.

Do. 1853–54, do.; out of 702, (do.), 12 died.

Do. (10 months) 1854–55, do.; out of 699, (do.), 11 died.

Bombay.

Kirkee, 1855–56, 14th Dragoons; out of 709, 6 died.

Do. (10 months), 1856–57, do.; out of 680, 4 died.

This is the mortality for the whole of each year, in hospital; but only those years are quoted in which the troops were stationary for the whole year, or nearly so. There is one matter I wish especially to mention, and to which I attach great importance as regards the future. It has been the custom in dragoon regiments to have the saddles, valises, bridles, and the different accoutrements of a dragoon, suspended in the room where the men sleep.

710. Of course, taking up a great deal of the space in the room?—Yes; they hang immediately over the men's heads, in the space of seven feet, which I have alluded to (681), immediately over the beds. I have

seen a man's saddle hung close by his ear, low down. The saddles are frequently saturated with the horse's perspiration, and when cleaned are hung up. Now, independently of the space the saddlery occupies, and the saddle itself being often foul from being saturated with the horse's perspiration, it tends to impede ventilation very much all round where the men sleep, and the consequence is, that they breathe an impure atmosphere; they breathe it over and over again, and that, too, in the very hot months when thorough ventilation is essential; and when cases of death from heat-apoplexy, a very fatal disease in the north-west, and not unlikely to be favoured by imperfect ventilation, are far from being uncommon. Now, it appears to me that nowhere, and especially in India, ought the dragoon's saddlery to be allowed in the same sleeping apartment with himself. It is highly necessary for the health of the men that the saddles should be otherwise disposed of; that is to say, put into an apartment attached to each barrack, allotted for the express purpose of receiving the saddlery. I have seen the objectionable practice referred to, constantly. I do not know whether it may not now be discontinued in some stations, but that has been my experience. The practice goes on now at Kirkee, or did so, until the beginning of 1858, when I left.

711. Is it usual to keep the saddles in the sleeping rooms, and not in the stables?—I have always seen the saddlery kept in the men's rooms, and more than once pointed out the evil; but, I may almost say, in vain. The stables are at some distance, and are not enclosed in a barrack square as they are at home. Some regiments, I believe, have kept them in their stables, but some commanding officers do not approve of the practice.

712. In such a case as you have mentioned a man would have to carry his saddle to the stable and back again?—The dragoon does it, or he has a horsekeeper allowed by the Government who does it for him; but the great point is to have the saddles removed from the sleeping apartments, and at the same time to be within the men's reach. At all events, in a sanitary point of view, they are most objectionable in the barrack room, as they diminish, from their bulk, the atmospherical contents of the room, pollute the atmosphere, and impede ventilation.

713. (*Col. Greathed.*) Can you give any practical hint as to the best place for putting the saddles—you know the barracks in India so well?—I think, as they are now building new barracks, that for these bulky articles, especially saddlery and harness, it would be desirable to have at one end of the barrack room, wherever most convenient and out of the way, a place for the reception of the men's saddles, which could be locked up, and where they would be available at any moment when required, and be thoroughly protected from the weather. That would meet the objection of some commanding officers to having them in the stables, and at the same time keep the men's sleeping rooms free; or, where that could not be done, at least they ought to be placed on the other side of the wall; that is to say, in the inner verandah, on the opposite side of the wall of the room where the men sleep. This last arrangement, however, is liable to serious objections, inasmuch as the men usually take their meals in the verandahs, and are often obliged to sleep in them, from want of sufficient accommodation in the central rooms. The separate apartment for saddlery is therefore, in my opinion, the arrangement to be preferred.

714. (*Chairman.*) There appears to be a high ridge to the west of Meerut, a line of hills?—It is of no great elevation, and probably to the north of, or somewhere near Delhi.

715. Delhi is very unhealthy, is it not?—Is has the character of being so, but I have never been there.

716. (*Dr. Farr.*) Is there any higher ground near Meerut than the ground on which the barracks stand?—I think not; not till you approach the Himalayan range.

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717. (*Chairman.*) Are there other barracks besides those you have mentioned at Meerut?—Yes; but I speak particularly of the dragoon barracks. There are infantry barracks also, and artillery. The European infantry barracks are built entirely upon a different plan from the dragoon barracks. They are about 700 or 800 yards to the eastward of the dragoon lines, and on their right flank. These are built in parallel lines, and I think there are two or three (I forget which) barracks to each company with spaces between separate barracks—a barrack for half a company or the third of a company.

718. (*Col. Greathed.*) A barrack for 28 men?—Yes, 28 or 30 men; and they are very favourable to ventilation; but that kind of ventilation, it struck me, is not properly carried out, the men being too much exposed to direct drafts sweeping across the rooms.

719. Are these barracks of masonry?—Yes.

720. What is the roof?—It is thatched.

721. They are masonry huts?—Yes, they are substantially built, mostly of burnt brick and lime.

722. Do you find that barracks constructed in that way in separate houses are more or less healthy than others?—I have often heard them spoken of as favourable to ventilation, but the mode of ventilation ought to be rendered safe.

723. (*Dr. Farr.*) Meerut was the head-quarters of the artillery, was it not, when you were there?—Yes; it had just become so. The head-quarters had been moved from Dumdum.

724. Are you acquainted with the barracks of the artillery?—Not particularly well. There is a question as to whether the hospitals are light, airy, and well ventilated. The hospital at Meerut at the time I referred to, in 1851, was particularly objectionable in various ways, but it was afterwards considerably improved (1854). It was thatched, and, to give an idea of the manner in which it was lighted by day, I may mention that the central room had an enclosed verandah on each side, and it had outside of that a narrow verandah about six feet broad, resting upon piers, and it was all thatched. It was one continued slope of roof from the ridge under the ventilator down to this outer verandah, and the distance from the lower edge of this roof of the outer verandah to the ground was in many places no more than seven feet and a half; and to gain the interior of the building from the outer verandah, it was necessary to ascend two or three steps. The building throughout was consequently dark and dismal, the dispensary included; and moreover, as has hitherto been the case in all the hospitals I have seen in India, there was no proper well-lighted apartment in which any medical committee might meet, or in which any important or delicate surgical operation might be performed; a defect from which I have often, but on one important occasion in particular, experienced the most serious practical inconvenience.

725. Where were operations performed?—We were obliged to take patients into the verandah, or into the best-lighted place we could find; but there was no one place properly lighted, or with sufficient space. I have not seen any hospital in India where a proper place existed for performing important surgical operations when necessary. In the plans of hospitals, the necessity of any such provision seemed to be entirely ignored, although there was an apartment of the kind provided, it would ordinarily be found most convenient for various other purposes. I had occasion, in the case of a man, on account of dangerous bleeding in the groin, to take up one of the large arteries at the lower part of the abdomen; it was in the month of April, and there was dust blowing outside, a high wind, and the sun was high. I could not take the patient into the outer verandah, but was obliged to go into a narrow dark apartment (the best available for the purpose), at the end of the hospital, facing the north, and the operation was commenced. After completing the necessary incisions, I found it impossible to see the bottom of the wound, until a

medical officer present suggested that a mirror should be held out in the open air in the sun, and the reflection cast into the bottom of the wound, by which means I was enabled to finish the operation safely. A few days after, I had occasion to perform a capital operation in the same apartment. But after this I made application to have a sky-light put up in the surgery, but three years elapsed before anything was done, and then, not until the whole hospital was improved.

726. (*Sir R. Martin.*) Wherever there is a defect of light, there must necessarily be defect of ventilation along with it?—Yes; I would particularly specify the inconvenience by referring to the fact I have mentioned. I felt it very much at the time, for it is neither just to the soldier, nor to the medical officer responsible for his treatment. A surgical operation under such circumstances may at any time, and unjustly, cost the medical officer his good name, and the soldier his life.

727. (*Chairman.*) The hospitals would appear to be less good as hospitals than the barracks?—I should say generally that they are, in some points, no better.

728. Being neither so well lighted nor so well ventilated?—All are not so badly lighted as the one I described, but the mode of ventilation is often liable to the same objection as in barracks; they are not seldom deficient in several desirable conveniences. In mounted regiments (European) the number of horse-keepers, grass-cutters, water-carriers, &c. &c., and other native followers, a large proportion of them paid by Government, sometimes amount to nearly the number of the corps itself. Some of these followers, as, for example, horse-keepers, grass-cutters, &c., are, independent of all ordinary causes of sickness, from the nature of their employment, liable to meet with severe injuries, often requiring careful and prolonged surgical treatment. The number of sick among these native followers, moreover, all of whom, by the usages of the service, are entitled to medical aid, is frequently considerable, especially in autumn, and when cholera or any other epidemic happens to prevail. For these numerous native followers, frequently, no accommodation whatever is provided, as happens this moment at Kirkee, or when any is provided, it is seldom, if ever, adequate. At Kirkee, when native followers came under treatment, it was necessary, from want of any other accommodation, to put them into the "deadhouse;" and when they exceeded a certain number into the open verandahs of the men's hospital, where, besides being exposed to weather, their presence often proved inconvenient. Even the "deadhouse" was not always available, as when any casualty occurred in hospital it became necessary to remove the native patients, who often could not be afterwards prevailed on to return. To avoid all these inconveniences there should be connected with the hospital of every European mounted corps, and within the same enclosure, a *separate hospital for native followers*, capable of containing at least 30 beds. As, also, cases of small-pox, or other infectious disease,—not uncommon among native followers or others,—it would be desirable to have in a corner of the same enclosure a separate building, capable of containing five or six beds, for the perfect seclusion of cases of that nature.

Hospital tents for sick European troops should be of large size, and uniformly double-walled, with 2½ feet space between. Tents of this construction are warmer in cold weather and cooler in hot. In Bengal, the only tent available for hospital purposes was the ordinary single-walled tent issued to the troops. *Privy tents*, as in Bengal of late years, should uniformly be allowed for troops on the march or in the field.

Lock Hospitals, and a more thorough system of control in view to the prevention of venereal disease, are much called for. At present there is no proper system of control; and any system, to be effective in its result, must be carried out by general co-operation at stations, and not left to individual effort.

Venereal disease, in some form or other, is frequently, as to number, the most prominent disease in hospital. I have known it amount to about *one-half* of the total number in hospital.

729. Do they allow a larger space per man in them than in the barracks?—I am not quite certain what the rule is upon that point; but I suspect not. The construction of the hospitals appears to be very much the same way as I instanced in the case where the men had but a small space between the doorways (681).

730. (*Sir R. Martin.*) It has always happened, has it not, that the same authorities who ordered the construction of the barracks, have ordered as well the construction of the hospital?—Yes; and I have never heard that, as a matter of certainty, when new buildings were erected the medical authorities were referred to, or consulted as to the plans to be adopted.

731. (*Chairman.*) Is a thatched roof considered to be good against heat?—It is much cooler.

732. How do they stand in the rainy season?—Generally speaking before the rains set in they are repaired, and when properly repaired they stand very well. Ventilation is often partly through the ridge; and when so, there is generally an upper supplementary ridge, which extends nearly the whole length of the roof. Occasionally rain drives into the rooms through the space intended for ventilation.

733. (*Col. Greathed.*) Did you ever practically try the thermometer in tiled or in thatched buildings?—I forget just now having actually tried it, but I think I have felt a difference on going from a thatched to a tiled building.

734. (*Dr. Farr.*) Is the material used for the thatched roof grass?—Yes, a coarse kind of grass, which is put on very thickly; sometimes the roofs are covered with tiles which are laid over more or less grass covered with matting. Tiled roofs have, I believe, become more common of late, being less liable to take fire. The roofs are almost invariably single; I have only seen two instances of a double roof, and that was at Mhow.

735. Were you long at Mhow?—About five or six months.

736. After Cawnpore and Meerut, which is the station with which you are best acquainted?—In the North-west, Lahore.

737. There you have said there has been a great change in the barracks?—Yes; at Lahore. Anarkullee, the old station near the town, has been given up, and barracks have since been built at Meanmeer, about three or four miles off.

738. The old barracks, I believe, were within Lahore?—There was accommodation for, I think, two or three companies in the citadel in the town. During the rains a branch of the Ravee came close under the walls on one side, and overflowed a considerable portion of the adjoining country. Troops quartered in the citadel were generally, in my time, very unhealthy. The principal barracks were at Anarkullee, in a hollow, about a quarter of a mile outside the walls. The position was difficult to drain, and from the vicinity of the branch of the Ravee just mentioned, which came close on one side, very damp.

739. When you were there where you quartered in the old barracks or in the new barracks?—In the old barracks.

740. And those have been abandoned on account of their unhealthiness and unfitness?—Yes; and partly because a more permanent station, Meanmeer, has been established, and better barracks built there.

741. Have you been in those barracks also?—I have seen one built as a specimen (681), which, although unfinished, was very fine. They were just beginning to build the rest when I left. The barracks outside the walls of Lahore were not, I believe, built by our Government, they were built at the expense of the Lahore Durbar, immediately after the Sutlej campaign, to accommodate a certain number of troops sent there.

742. Were they healthy or unhealthy?—Very unhealthy, so far as my experience went.

743. Do you know whether the new barracks have proved to be healthy?—I do not know, but the barracks, from the original plan and specimen I saw, promised to be very fine.

744. Is there any other station that you would wish to describe, as to the healthiness of the climate and the soil?—I know Umballa very well. It is a good station; and, next to the single barrack mentioned, the dragoon barracks at Umballa were the best I saw in India. The barracks, for one regiment of dragoons, were built between 1843 and 1845. The infantry barracks were not so good; besides which, a deep nullah approached the rear of the infantry lines, particularly towards the left flank.

745. What is the elevation of the site on which the barrack is built?—It is rather flat; the whole country in that immediate neighbourhood is rather flat.

746. Of what character is the soil?—Much the same as at Meerut, a light sandy soil mixed with clay.

747. Is it well drained?—A good deal has been done. When I was there (1846 to 1848) it was not well drained, but it has been improved since, I believe; the surface is not everywhere favourable for drainage, being rather flat.

748. It is a self-draining soil, being sand, is it not?—Yes; but drains have been made throughout the cantonments in many parts to aid it.

749. (*Col. Greathed.*) Is it not liable to inundations?—Yes; and one took place in 1852 or 1853, which was attended with very serious effects upon the health of the troops. The embankment that keeps out the water of a nullah between Umballa and the hills broke down, as it has done on several occasions, overflowed the station, and the troops suffered very much in that year from cholera and fever.

750. (*Chairman.*) Then it would appear to be a very good barrack built upon a bad site?—Yes, but it is as good as can be found in that quarter.

751. Is it necessary in your opinion to maintain troops in that situation?—That is a military question.

752. Have you the rates of mortality when you were at Umballa?—I think I have supplied them. (*See 709.*)

753. In your own regiments?—The regiments I have served with.

754. Comparing that station with Meerut, the mortality has been apparently greater, owing to the floodings of the place?—The time I refer to was before I went to Meerut. Umballa was comparatively a new station. Many things which have been done since were not done then. I have been told that the health of Umballa has greatly improved of late years, since greater attention has been paid to sanitary arrangements, &c.

755. Where else were you quartered?—At Kirkee, and in Central India for four years and a half.

756. What kind of a station was that with regard to the health of the troops?—Kirkee, with all its present disadvantages as to barracks, &c., is by far the healthiest station I have ever served at in India.

757. What are its disadvantages as to barracks?—They are very old and very bad, with the exception of two barrack rooms built within the last few years. The position of Kirkee is very favourable to drainage, it stands upon a ridge, and therefore very little artificial aid is required to perfect it. The barracks were built, I think, when the 4th Dragoons first went to Kirkee, and with the exception of the two barracks, which were burnt down and rebuilt in the last few years, when the 10th Hussars were there, they remain as formerly constructed; they are old-fashioned, and very badly-constructed barracks, and some of them so little elevated that they are not eight inches from the ground on either side. The floors, except those of the two new barrack rooms, are earthen, and frequently subjected to a filthy nauseating process called

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“cow-dunging.” That is, cow-dung, by the addition of water, is reduced to a semi-fluid state, and the whole floor is varnished over with the mixture and left to dry. The effect, for the time being, is to render the rooms damp and offensive. This disgusting practice ought to be discontinued in all buildings occupied by European troops. At Kirkee, and all other stations where stone is abundant, floors should be flagged. By this means the offensive process adverted to would be avoided and thorough cleanliness promoted. Where stone is not available, floors of burnt brick, or of chunam (as in Bengal), might be substituted with advantage. All the guard rooms at Kirkee are bad, and too confined as to accommodation, &c., with exception, perhaps, of the bazaar guard room recently built. Cells bad.

758. You say that they are situated on a ridge, what is their elevation?—On one side of a ridge, which runs from about north-west to south-east, the most favourable wind generally blows from the north-west. The front line is built along the top of this ridge, and the others below, and to leeward; and then the barracks instead of being in parallel order are arranged in double lines; the second line comes opposite the intervals between the different barracks of the line in front.

759. At that place, did the returns of your regiment show a good state of health?—Better than I had ever seen anywhere in India.

760. What is the nature of the soil there?—In some parts “cotton” or “black soil;” in others a red, crumbling, gravelly soil, resting on trap rock.

761. Do you know the height of the elevation?—The height of Kirkee above the mean level of the sea is 1,855 feet. With regard to the mortality at Kirkee, I may mention that for nearly two years passed there by the 14th Dragoons, 1855–56 and 1856–57, the average annual strength was 709 and 680 rank and file respectively. Out of 709, six men died in hospital during the military year; and out of 680, four men died. I never met with anything like that in any other part of India. At Meerut the mortality used to be, for the last two years the regiment was stationed there, 11 or 12. (See 709.) I wish to refer to one point which applies to all stations at this moment more or less, although not quite so much of late years as formerly; still there is great defect. I allude to the means of personal ablution for the troops.

762. Are there not ablution rooms set apart in every barrack?—In some barracks they can scarcely be said to exist, or if a place is set apart for the purpose it is very inadequate, being often dark, confined, and in every sense inconvenient, even for the ordinary washing of hands and face. In some barracks, and perhaps in some of those more recently built, matters may not be quite so bad; but these, so far as I have seen, and I have not been inattentive to the subject, are the rare exceptions. I have never seen a single instance in which anything like adequate means for the purposes of ablution existed.

763. How then do the men wash themselves?—They just do the best they can; perhaps in the open verandah, if there is no other convenience, or perhaps in some small, confined, dark place off one end of a verandah, where water vessels, &c. are usually kept. Take Kirkee, for instance, where even in the hospital it was only within the last year, 1858–59, that a washing house was added to one wing of the hospital for the use of the patients, who previously had to wash, in all weathers, in one of the open verandahs of each wing of the hospital.

764. How are the men supplied with water?—It is generally brought by water carriers.

765. By hand labour?—Yes, or by bullocks; generally hand labour, when the wells are very near.

766. Have they any baths?—Not always.

767. Are there no means of bathing?—I mean that, usually, there is a general deficiency of proper and convenient means for promoting due personal cleanliness, health, and comfort among the troops in a

climate such as that of India. The means for even ordinary washing of hands and face, as I have stated, are too often scanty and inconvenient; too often also, and perhaps still more frequently, there is no suitable place where, consistently with becoming privacy and decency, general ablution of the body can be performed, however essential may be the practice to health and comfort in the hot months; more frequently still, there is no plunge bath at all; or, if there be one, it is perhaps near one flank (as at Meerut), and so far from one portion of the regiment as not to admit of being used without considerable risk of injurious exposure to sun and weather, in going to and fro. Considering the great heat of the climate of India for most of the year, this point long failed to command that degree of attention its importance demands, as respects its influence on the comfort, health, and efficiency of European troops serving in that country. In 1843, soon after my arrival in India, I was much struck with this evident defect; and since then, seldom has a year passed in which I have not had occasion to allude to it in regimental annual reports, or otherwise. Something has been done, in a partial way, within the last eight or ten years to correct the evil, still not enough; and I believe no plan for maintaining thorough cleanliness, health, and comfort among European troops will be complete, which, in addition to proper spacious washing houses attached to barrack rooms, will not also include a plunge bath for each wing of a regiment, for occasional use under proper regulations.

768. It would be a matter of difficulty, would it not, in many stations to get the water?—No, that is very rarely so; and even when it happens, the difficulty is not insuperable. With the exception of Umballa and Kirkee, and perhaps Mhow, I have been at no station where the supply of water could be complained of, and even at Kirkee it might be obtained, as there is a river close by; they would have to go a little further for it, but it might be obtained.

769. Is there generally a regard paid to cleanliness in the camps and cantonments?—Of late years there has been more attention paid to that.

770. With the exception of the latrines there is a good deal of offensiveness caused by accumulation of soil, is there not?—Yes, and there is often great room for improvement. In addition to that there is a great want of responsibility on the part of some particular person at stations to see that sanitary measures are promptly and effectually enforced whenever necessary, or whenever attention may be called to the subject.

771. Is there no police to look after the cleanliness of the cantonments?—In Bombay, for instance, there are regulations laid down in a revised system of orders published at the end of 1856. There are certain rules laid down applicable to camps and cantonments, which are in themselves very good, to be carried out by the quartermasters of regiments and station officers, under the quartermaster-general's department. But at the same time, although those regulations are tolerably well carried out at certain stations, they are not so in all, and some more decided attention to the subject, and to the representations made at stations regarding it from time to time, and especially at out-stations, is necessary to ensure sanitary measures being promptly and thoroughly enforced in practice. This I know, from experience of no very distant date, to be highly necessary.

772. (Sir R. Martin.) You mean attention on the part of properly qualified persons?—Yes; persons fully supported by authority, whose especial duty it should be to see that sanitary measures are strictly enforced throughout stations, and in their vicinity. I have had frequently to complain of nuisances, and have applied to my commanding officer, and perhaps, through him, to the station authorities. Whatever is required on such occasions may be done immediately, perhaps; or it may not be done for a long time, or not at all, especially if the measure involve expense. A medical officer having represented the necessity of certain measures, his personal responsibility may be

at an end, but the evil continues perhaps, to the disadvantage of all, and the end of sanitary rules is thus completely frustrated.

773. There is no certainty in the matter, in the absence of a qualified person to see to it?—No. And too often representations regarding essential points meet with no apparent attention, and lead to no immediate beneficial practical result.

774. (*Chairman.*) Do you make these representations verbally or in writing generally?—Generally in writing, but where the commanding officer has power, very often a verbal communication is sufficient. In matters beyond the commanding officer's powers, they are usually referred to the brigade or divisional authorities; and occasionally through them to higher authority.

775. The commanding officer cannot give an order?—He may very often do things connected with his own particular lines, but his authority extends no further.

776. He cannot act without the assistance of some higher authority?—Not if it is a matter which involves any expense. If it is within the ability of the establishment allowed to him by Government, he has control within the regimental lines, but for anything beyond that, or in the way of incurring expense, the matter must usually be referred to the brigade or the divisional authorities, and perhaps to head-quarters, and in matters of great importance, eventually to Government.

777. Can you suggest any remedy for that?—I think some more effective means than have hitherto existed ought to be established to ensure representations regarding ordinary sanitary measures, and other points involving the health and welfare of the troops, being instantly and effectually attended to; and that it ought not, as has been too much the case, to be left in the power of any one individual, according to the humour or feeling of the moment, either to attend to or disregard representations on such subjects, and that, perhaps, to the disadvantage of a large body of men and of the public service. I would by no means advocate undue interference with the power of commanding officers of regiments or of other officers in authority. At the same time, I conceive it would be desirable, because for the benefit of the service, to establish some salutary check to prevent unreasonable disregard of suggestions or measures in which the health and efficiency of the troops may often be materially involved.

778. That is to say, if the officer to whom the representations are made does not agree with them, or does not carry them out, he ought to give his reasons for so acting, and they ought to be passed on to a superior authority?—Yes; and in view to the immediate removal of existing evils. It would also be most desirable were prompt, practical attention more fully ensured than hitherto to details contained in annual sanitary reports from respective corps, whether those reports be sent to the War Office or otherwise. By this means circumstances affecting the condition of the troops in different commands and at different stations would be at once known; and whenever called for, immediate steps might be taken, under competent authority, to correct whatever might be amiss. The details given in sanitary reports from corps have not hitherto received the attention required, if, indeed, they are attended to at all; and one consequence is, that glaring evils reported on by regimental medical officers, perhaps year after year, remain unabated. These reports, if properly attended to, are well calculated to effect much good.

779. (*Sir R. Martin.*) Have you considered the question of the appointment of sanitary medical officers, distinct and apart from those who are appointed for the treatment of disease?—Yes. I have thought that matter over, and I think it would be extremely beneficial; provided always, such officers shall have the power to make suggestions, and that those suggestions are promptly and efficiently attended to and carried

out, and under thorough support of competent authority. Without that, such officers would be of no use.

780. (*Chairman.*) Have you ever been in the hills at all?—Merely on a visit.

781. Have you formed any opinion as to the extent to which they might be made available for preserving the health of the troops?—I have no doubt that, the character of localities as to healthiness being duly and properly ascertained by previous careful investigation, and all precautions taken, a change would be of great benefit to the troops; provided always, that while on the hills they are furnished with comfortable barracks, and that proper commissariat arrangements are kept up; that is to say, as to diet, ventilation, and all the other necessities; and, further, that their clothing and all their comforts are properly attended to.

782. That is to say, they should have additional and warmer clothing than they wore in the plains?—Yes, if found to be necessary; and barracks suited to the climate.

783. Do you think that the troops might be permanently kept on the higher stations, and only descend into the plains when they might be wanted for military purposes?—I think that that is very desirable so far as it could be carried out.

784. (*Dr. Farr.*) What are the ordinary drinks of the soldier in India?—The ordinary drink is arrack, and malt liquor—beer and porter. There are often other liquors kept in canteens, which men can obtain, such as brandy, gin, port wine and sherry, and perhaps some others; but they are for particular occasions, and are not so commonly used.

785. Is arrack taken pure or drunk with water?—With water, I forget the proportion.

786. Is much water drunk in India?—A good deal.

787. (*Col. Greathed.*) Is the regulation attended to with regard to watering the arrack?—I think so; the rule was that some officer belonging to the canteen committee should attend to it; it was always done in his presence before it was issued to the men.

788. (*Dr. Farr.*) Much more water is drunk in India than in England, as the climate is hotter?—There is a good deal drunk.

789. It is a matter of great importance, therefore, that the water should be of good quality?—Yes, of course.

790. Is the water that is supplied to the troops generally at the stations you have named of good quality?—I think so; there is often a good deal of saline matter in it, which may often be observed after evaporation from a glass; it leaves a certain efflorescence; but generally speaking it produces no injurious effect upon the men.

791. Have you ever analyzed the water?—Only in a very rough way.

792. Does it contain much organic matter?—I cannot say that it does.

793. (*Chairman.*) The ration issued to the men is good, is it not?—Yes, of late years very good. As to the water, in many places I think the way in which it is kept in the barracks is sometimes objectionable. If that could be corrected and the water filtered at the same time, it would be, although not always necessary, perhaps desirable. The way in which it is kept is either in wooden casks with a square hole cut in the top, say in a hogshead, or in a large earthen jar, and any sediment settles down. The way in which a man draws water is this—he dips a vessel into the cask or jar, and the top being generally open particles of dust drop in more or less, and although the water is good in itself, there is very often, from the stirring up of the wells, more or less sediment. If left alone it subsides, but the way in which the men draw it out is apt to stir it up; they dip in the vessel at the mouth of the cask or jar, and the sediment is apt to be disturbed; I think, therefore, if it could be managed to keep drinking water in some other way, so that the men could draw it out by taps, it being previously filtered into some kind of cistern, it would be an improvement.

794. (*Col. Greathed.*) Do not you know that the

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water is often filtered in barracks?—It is often so, but not generally.

795. Do you know how it is filtered?—Yes; a very common way is through chatties or porous earthen vessels placed in a wooden framework one over another.

796. (*Sir R. Martin.*) But that system of filtering cannot be carried out on a large scale, can it?—There may be difficulties, but engineer officers might possibly overcome them. It is desirable to ensure the men getting thoroughly pure water; when the quantity falls low, and a man goes in the dark, he does not know what he may drink, he may take up a great deal of sediment.

797. (*Col. Greathed.*) Will you be good enough to give the Commissioners your opinion as to the relative merits of the quarters provided for the married people in Bengal and in Bombay, as far as you have observed them?—I have never seen good married quarters in Bengal. I have seen those at Poona and at Kirkee. Those at Poona in the infantry lines (*Gorporie*) form one long building divided into contiguous rooms. At Kirkee they are in detached huts, one hut being allotted to each family; they are placed in double echelon on the right and left flanks of the regiment, and every family has its own arrangements there with perfect privacy, and the places are thoroughly well ventilated, and altogether more comfortable than if on the other plan. The huts at Kirkee, however, are old and not in good condition.

798. Which do you prefer, the hut system or the barrack system?—I like the hut system as carried out at Kirkee; perhaps one building of proportionate dimensions might be made to contain two families, with a central cross wall dividing the accommodation for each family. It might, perhaps, be attended with less expense to build in this manner, rather than to build a complete hut for each family.

799. Have you any observations to make as to the manner in which the families of the men are treated in Bengal as compared with Bombay?—So far as I have seen, they are better off in Bombay than they were in Bengal, inasmuch as there is certain provision for their comfort at Kirkee, whereas at Meerut there was none. There were married quarters at Lahore, but they were not good or well ventilated.

800. Was there any difference in the hospital attendance for the women?—There is a European matron allowed in Bombay—a great advantage. In Bengal no matron is allowed.

801. Are the women averse to bringing their children to the hospital?—I do not think that the women like much to come into hospital if they can avoid it; but that depends very much upon medical officers and existing arrangements. Women are everywhere more or less averse to the restraints of a hospital, although I conceive these to be most beneficial.

802. Do you think it is possible to discontinue the sale of spirits in the cantonments?—I think that it would be very desirable to discourage as much as possible the use of spirits among the troops by every practicable means, and to supply them with beer at a price within their reach. As it is, the sale of spirits in cantonments to soldiers, except what they are allowed in the regimental canteen, is prohibited. The brewing of beer at hill stations in India should be encouraged.

803. You know the men very well; do you think you could, without making the men very discontented, and giving them an opportunity of obtaining plenty of beer, discourage the use of and do away with the sale of spirits?—I think that in a great measure you might, but I think it not advisable to discontinue entirely the supply of spirits in canteens, but I would discourage it by all means. I do not think it desirable to abolish it entirely, because there are occasions on which men may desire spirits, and when it will do them good; and it is better, I think, to ensure, when they do take it, spirits in limited quantity and of good quality, which they will always obtain so long as it is provided in canteens by Government, rather than

compel them to resort to noxious country spirit, which is too easily smuggled into cantonments, and which they can obtain in any quantity at a very low price. I believe the majority of soldiers would greatly prefer malt liquor to spirits, and the only reason for their not using beer almost exclusively is, their means being insufficient to procure it. I also feel assured that the use of malt liquor is far more conducive to health than that of spirits; I believe it would also lead to less crime and irregularity. I have further observed, that the consequences of prolonged over-indulgence in malt liquor are more manageable and less fatal in their result than when produced by a similar abuse of spirits. To show that this is not mere conjecture I may mention some facts, and these facts will, I think, be found recorded in the annual reports from the 14th Dragoons for the periods to be mentioned. It was before stated (704 and 709), that from the time of the arrival of the 14th Dragoons at Meerut early in 1851, until their departure for Bombay early in 1855, the health of the regiment had been better, and the mortality less, than during any previous period from the time of their arrival in the North-west Provinces in 1846. At Meerut, English malt liquor was more easily procurable, and at a cheaper rate, than had previously been the case. There was also, at first, a light description of draught beer brewed at the station, and sold a little cheaper than English beer. Both were, for a time, very generally used. About this time, also, an allowance on a given scale was granted to regiments, exclusively for the purpose of reducing the price of malt liquor issued in canteens. The result of all this was, that the consumption of malt liquor increased, and that of spirits decreased. General health also improved, and mortality diminished. On inquiry made at the time, among those who had the best means of knowing the real feeling of soldiers on the subject, I was more than once assured that most men, if they only could afford it, would greatly prefer malt liquor to spirits. In support of this, too, it may be mentioned, that at no time in 1851–52 was the proportion of arrack allowed by regulation, according to the number of men present at head-quarters, drawn from the commissariat for the use of the regiment. The same may also have occurred in 1852–53 and 1853–54. It is, however, certain, that in these years, when malt liquor was obtainable at a low rate, the proportion of spirits issued daily in the canteen frequently did not amount to the rate of *one dram* per diem, and sometimes not to more than *half a dram*, for every man actually present at head-quarters. In the latter part of 1853 the supply of beer in some measure failed, and its price increased. Afterwards, by a general order of the Governor General in Council, dated 27th October 1854, and under instructions from the Court of Directors, the regulation respecting malt liquor was modified, and the allowance of beer to be provided by Government lessened. Since then, so far as I remember, a soldier is allowed by regulation to have, at an established rate, two drams of arrack a day, without any malt liquor, or one dram and one quart of malt liquor—all to be drunk within the canteen. According to a general order issued by Sir Charles Napier, and which appeared to be attended with good results, the issue of any liquor from the canteen, until the men have dined, is prohibited. This rule, although often departed from in the field, it would be most desirable to carry out to the letter while in cantonments.

804. Are the men very averse to going into hospital, I mean at particular seasons, when they suffer from bowel complaints?—There are occasions on which they are negligent of themselves, often perhaps from dislike to the necessary restraints of a hospital.

805. Would it be a good rule to establish universally in regiments, that the men should be watched at those periods?—When any epidemic is going on I think that is always done; there is always a quiet system of observation established—at least I have been accustomed to see that done.

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806. But I mean a regimental police observation, I do not mean on the part of the medical officer, I mean a squad observation, that the corporals of squads and the lance corporals should be directed to watch the men?—I think if it could be done it would be a very good plan, and to extend not only to that, but to other points; for instance, as to whether men are irregular and drinking too much, and carrying it on secretly, as some men are occasionally apt to do for days together, and then they come with delirium tremens, and perhaps die.

807. (Sir R. Martin.) Speaking generally of the stations at which you have served, were the surface grounds irregular, having saucers or hollows retaining stagnant and impure waters?—In many stations they were, but some change has taken place in levelling, although never to the extent required.

808. Generally, you would say that the ground required clearing and levelling?—Yes, and a more thorough general attention given to sanitary arrangement throughout all the stations at which I have served.

809. You would say the same as to deficiencies in surface drainage and sewerage?—Yes. There are some other points which I think it of importance to mention. One is the dress of the men, particularly the head dress, and riding and other drills at certain seasons of the year, and its effects. The regiments of dragoon guards who have lately gone out to India have taken with them the brass helmets worn in England. It appears to me that any metal head dress is altogether unsuited to a hot climate, and particularly that of India, and especially when there is a liability, as I have seen occur, to have the men exposed in that dress in the hot weather on an afternoon parade.

810. Do the men now wear the metal helmet?—I have seen a dragoon regiment on an afternoon parade in the month of May, on the Queen's birthday, with those helmets, and without any cover whatever to guard against the effects of a scorching sun.

811. (Col. Greathed.) Has there not been another helmet substituted for the metal one?—It is in orders, and I think it is most desirable, with regard to the health of the troops, that the brass helmet should be discontinued in the hot climate of India, under all circumstances, whether with or without a cover.

812. (Chairman.) Do the infantry wear the shakos?—Lord Clyde has lately introduced wicker helmets.

813. Does that apply to the infantry as well as to the cavalry?—I believe it does, but it has not yet been universally carried out. I have a very strong feeling on this subject. I do not think that metal helmets ought to be allowed in India, and particularly to be used in that reckless manner, to the disadvantage of a body of men, and to the great risk of health and life.

814. (Sir R. Martin.) Neglect in these respects leads to sun-stroke, does it not?—Of course it does, and that is one of the most fatal diseases of the North-west Provinces in the hot months.

815. (Chairman.) With regard to the other clothing, is there any point you wish to refer to?—The leather stock, I believe, is done away with in India, by order from the Horse Guards.

Flannel under-waistcoats should be worn under all circumstances and in all seasons, care being taken to ensure cleanliness by frequent change; likewise drawers, either flannel or thick elastic cotton, in the cold months, and light calico, if preferred, in the hot season. Some *flannel shirts*, either in addition or in lieu of some of the cotton shirts now used, would be of great service, particularly in the cold months and in the field. A loose woollen coat, strong but not too thick in texture, and sufficiently long to reach to about the middle of the thigh, would be most beneficial as a fatigue dress and for use about the barracks. This would be especially suitable in the climate of the Deccan, as well as in many other situations, and particularly for dragoons while at stables, during rainy weather,—as at Kirkee &c. &c., where the horses are not stabled. For want of some dress of this kind, which might, if

desired, be of uniform make and colour, men frequently go about barracks in their shirt sleeves in all weathers, besides being exposed to drafts in their rooms, and having to attend morning and evening stables in the open air.

The loose *Khakee summer clothing*, introduced in India during the mutiny, is, as regards comfort with free and unrestrained use of the limbs, a great improvement, as compared with the white and too closely fitted clothing previously in use; besides, from its colour and not requiring to be washed so frequently, having advantages for field services.

The *wicker helmet*, with quilted covering (also commonly used during the latter part of the mutiny) is likewise an improvement, although liable to the serious objection of not being uniform in density throughout, and being therefore likely to favour, more or less, penetration of the sun's rays. The best material for a soldier's head dress in India—having in view durability and uniform thickness of material throughout—I believe to be a helmet made of light-coloured drab felt, of considerable thickness and firmness to resist considerable pressure, and so constructed as to favour, as far as practicable, free ventilation. The helmet should consist of an inner portion, judiciously perforated with air holes, to receive the head of the wearer; and an outer portion or shell terminating above and towards the point in a beak about three inches high, and the beak having fixed in front a brass ring with a circular hole about one inch in diameter, to admit of the free passage of air. Between the inner shell for the head and the outer having the hollow crest terminating in the beak in front, there ought to be an air chamber with an intervening space of at least half an inch. The inner and outer shells, below where the head is received, should be kept separate by the insertion of solid buffers of gutta percha, about an inch and a half apart; the spaces between each being left perfectly open to favour the admission and free circulation of air through the air chamber around the head of the wearer. The outer shell of the helmet should terminate in a projecting peak, sloping slightly downwards, before and behind, so as to protect the forehead and eyes from heat and glare, as well as the back of the head from the sun's rays. There should also be on each side a certain breadth of brim continuous with the peaks on each side, say from $1\frac{3}{4}$ to 2 inches broad.

The helmet should have two quilted covers for change, properly fitted, with a curtain behind four or five inches in depth, or sufficient to protect the back of the head and neck from the sun. The quilted cover and flap should be firmly sewn together, so as to form one complete piece, as otherwise, the curtain, a most essential portion of a cap cover, is apt to be lost or left behind, by which the cover is often rendered comparatively useless. The form and extent of flap behind, while left sufficiently long for protection, might be so modified as to admit of being neatly folded up and secured by hooks to the back part of the helmet, when not required to be worn low down. The quilted cover should consist of an outer and inner layer of white calico, with an intervening layer of thick, fleecy flannel, well shrunk before being cut into shape, instead of a layer of cotton wool as commonly used. The reason for using flannel in preference to cotton wool is, that once properly made, the cover, when washed, will always remain of uniform thickness throughout, and thus everywhere present the same degree of obstruction to the penetration of the sun's rays. In covers made with cotton, on the other hand, the cotton is apt, from the first, to be of unequal thickness, and when the cover is washed, the cotton is apt to be rubbed into knots at one point of the spaces between the rows of stitches, leaving the remainder of the space without any cotton wool, and with the outer and inner layers of calico in contact, offering but little resistance to the penetration of heat.

With regard to drilling of troops, I have seen both systems tried; that is to say, the system of drilling men

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all the year round in India, through the six or eight months of hot weather, as well as in the cold months, and I have seen the men spared almost entirely during the hot weather, having only parades and light duties, just sufficient to keep up proper order and discipline amongst them, and to save them from fatigue, particularly in Bengal. It appears to me that it would be a great point towards the efficiency and health of the troops in the North-west Provinces, and other places, if drills and all laborious duties were prohibited, as far as possible, during the hot and rainy months of the year, and were confined entirely to the cold weather, and then vigorously pursued when the men can do anything with advantage. I have seen the effects, over and over again, of persisting in drilling in the hot weather, and I have seen also the effects of the opposite system.

816. (*Dr. Farr.*) What are the effects of persisting in drilling the men under a hot sun?—Very frequently the recruits arrive about the end of the cold season. The military authorities are naturally anxious to have their regiments in efficient order, and of course there is a great temptation to drill the recruits, and to effect some improvement in them against the cold season, and generally the effect of that is that the men break down, and the system rarely, if ever, answers its purpose. It fills the hospitals, and it breaks down the men's health indefinitely, and sometimes, I have no doubt, men go to the grave from it.

817. (*Sir R. Martin.*) They take fever and have bowel complaints?—Yes. If a man, say, for the first month, learns anything, he, too generally, soon goes into hospital with fever, or some other serious ailment, and continues there perhaps for the remainder of the hot season, and by the time he gets out of hospital, if he gets out at all, at the beginning of the cold season, he has entirely forgotten all that he learnt before, so that it would have been much better if he had been left alone until the proper season for drill arrived.

818. (*Dr. Farr.*) Does the drilling affect men of all ages equally?—Yes, more or less in the hot months and rains.

819. (*Sir R. Martin.*) But the recruit most?—I have not the slightest doubt of it. To the opposite system pursued for several years in the 14th Dragoons, I cannot but attribute much of the comparatively good health which they enjoyed, and the small mortality amongst them, and when the time for active service in the field came these men were just as efficient as any others.

820. (*Chairman.*) At what period of the year would you allow the troops to be drilled, and for what length of time?—I suppose that at Meerut about the middle of October would be soon enough to commence regular field days, and to last till March; but of course a good deal would depend upon the particular season, and all duties, at all times, ought to be conducted so as to expose the men as little as possible to the sun and weather. Inattention to this point must always be a source of great risk to the health of the troops, and probably more so at the present time, owing perhaps in many instances to inexperience as respects the injurious effects of exposure to climate at particular times. It would be well, as a uniform rule, to furnish commanding officers of regiments and detachments, on arrival in the country, with explicit sanitary regulations for their information and guidance on this and other points bearing on the health of the troops.

821. During the rest of the period would not the men become extremely listless, having no exercise imposed upon them?—They might have parades and quiet movements, just sufficient to keep them together, but without over exertion and fatigue, but the less beyond that, in the hot season and rains, the better. To a recruit, perhaps young and delicate, it is no trifling matter, especially as he cannot choose his own pace or the time for which it is to be kept up, to be handed over for two or more hours to the tender mercies of a rough-rider, in the hot months. The

great probability is, that he will break down, and go into hospital, perhaps for a lengthened period; so that, in reality, nothing is gained; and at the beginning of the cold season, after having been exposed to much useless risk, he has to commence anew. There is another point of great importance, which is, that instead of sending young men to India undrilled, they should be sent out drilled, and in a great measure, if not entirely, formed soldiers, and instead of sending young recruits of 18—I do not think that any man ought to go out under 20, or from that to 25—and then he ought to be a drilled soldier; for arriving as recruits do at the end of the cold season, there would not be the same necessity or temptation to drill them at improper periods of the year, and anything that they should acquire would be easily brought up in the cold season. It might lead to a little expense, but the effect would be good, and the efficiency of the army in India much increased. In regiments of Her Majesty's service, it has always been customary, when men have suffered much in health, and are not soon likely to become efficient in India, to send them to Europe for change of climate and to join their respective dépôts until recovered. This has not been the case as respects European soldiers of the Indian army, and it appears a great hardship. It must have a bad effect in many ways; and one, I have no doubt, is the loss of many men to the service. European soldiers of the Indian army should have the advantage of being sent home for change of climate, when sick, equally with men of Her Majesty's service.

822. Why would it lead to expense?—I do not exactly know, for the Government would have to keep them anywhere; but it was considered a disadvantage when the East India Company used to pay the troops in India, as keeping up the service companies to an effective number, and sending out exclusively drilled men, might, perhaps, involve the necessity of keeping up stronger dépôts at home. There is another thing which I beg to mention; it is very desirable that all duties should be managed so as to avoid exposure to the sun. With this object it was usual in Bengal, during the hot months and rains, to assemble all courts-martial, or committees at which the attendance of European soldiers was necessary, either to give evidence or other purposes, at an early hour in the morning, so that before the day was far advanced the men were frequently back in their barracks, and under shelter for the day. In Bombay, this arrangement is not attended to, at least with any thing like regularity. At Poona and Kirkee, for example, it is not uncommon for district and general courts-martial to assemble at 11 o'clock in the forenoon in the hot months and rains; and it frequently happens, as I have known, that a good many men are required to attend during the sitting of these courts. I have known men there from 11 o'clock a.m., until 4 p.m., while the thermometer placed in the open air, exposed to the sun, stood at 128° Fah. These men, too, are often imperfectly protected under a porch; and, occasionally, mounted orderlies are required to take orders to and fro, between the courtroom and barracks. Whenever at all possible, it should be arranged for all courts-martial, &c. to take place early in the morning during the hot months and rains, and the order, to be effective, should extend to stations and divisions. Courts-martial, purely regimental, almost always took place early in the morning at Kirkee, arrangements being then entirely in the hands of the commanding officer. Much unnecessary exposure was thus avoided. For the same reasons, European troops in Bombay should, as in Bengal, in the hot and rainy seasons, attend Divine service early in the morning, and not, as is too commonly the case, in the middle of the day. At Poona, one of the European infantry barracks (*Gorporie*) is distant from the church about one mile, by the ordinary road. This, together with the delay on parade previous to marching, renders the men liable to serious exposure,

especially as in the most cloudy weather, during the rains, the sun is apt to come out suddenly and with great power.

823. (*Col. Greathed.*) Is not the climate in Bombay much less severe than in the upper provinces of India?—Yes, there is not that excessive and long continued heat, but still in the heat of the day it is far too severe to expose the men to it. Although, moreover, the rainy season at Poona is for the most part cool and cloudy, and very pleasant within doors, sudden bursts of sunshine and great heat at different times of the day are not uncommon.

Staff Surgeon DAVID FIELD RENNIE, M.D., examined.

827. (*Chairman.*) You are in the Queen's service?—Yes.

828. You have, I believe, been quartered in Australia?—Yes, for six years and a half.

829. In what part of Australia?—At Fremantle, in Western Australia.

830. Are you acquainted with any other part of the continent besides that?—I am not practically acquainted with any other portion of Australia but the western settlements—with the whole of which, however, I am familiar; having had occasion to visit them periodically as principal medical officer. They extend over a space of about six hundred miles from north to south, and one hundred and twenty miles from west to east, consequently affording ample scope for observing the general character of the Australian climate.

831. What is the temperature of the different seasons?—At Fremantle, the mean temperature of the winter months, extending from May to October, is 60°, and that of the remainder of the year about 73°. I believe these figures may be taken as a fair average of the temperature over the colony generally, and certainly neither of them in excess; being if anything rather over than under the average ranges of the thermometer in other parts of Western Australia.

832. Is that average formed upon great extremes, or is there very little variety?—There are no great extremes. It would be difficult to imagine a more delightful temperature and climate generally than that of Western Australia; more especially the winter, which, though invigorating in the extreme, is never very cold. The summer is warm, but the average heat does not very materially exceed that of the warmer portions of the winter months, and, as a general rule, it is free from any depressing effects; readily admitting of active occupations and ordinary labour being carried on in the sun, by the European settlers, military emigrants, and convicts, without detriment to health.

833. What sort of heat is it as compared with England?—The mean annual temperature of England is estimated, I believe, to be 50°, the mean summer temperature being about 63°, and the mean winter temperature 37°; making a difference of twenty-six degrees between the means of summer and winter. The mean annual temperature of Fremantle is 66°, the mean summer temperature being 73°, and the mean winter temperature 60°; making a difference of only thirteen degrees. The Western Australian winter, therefore, may be said to bear a close resemblance to the ordinary English summer. I may as well mention, that the averages now given were calculated by me with considerable care in the early part of 1855, and that the Western Australian seasons do not materially vary, there being a remarkable sameness in the thermometric ranges of one year with another.

834. What is the Australian summer as compared with an English summer?—I should be inclined to compare it, on an average, with what represents about the hottest portion of an English summer; but, in making this comparison, it is right to state, that it is based on what my recollections are of summers in England eight and ten years ago; not having

824. Have you ever known orderly duties performed by European soldiers?—Of what nature?

825. Taking messages, for instance?—It is usually uncommon in India, but it is so at courts-martial. I have known it constantly in my own regiment while courts-martial were sitting.

826. Are you not aware that it is contrary to the strictest orders?—Where it is done the orderly is in attendance at the court, and is wanted to go suddenly for any one who may be required from the barracks; it frequently occurs, but I do not say always, still too frequently for health.

experienced one since 1851. I believe they have been much warmer of late years; consequently, the comparison may be hardly a fair one at the present period. I have heard one or two old colonists, who have recently visited England, complain of finding the heat more oppressive and disagreeable to them during certain portions of the summer there than they had, as a general rule, found it in Western Australia; and which is very possible, though the actual heat might not have been so great, owing to differences in the humidity of the two atmospheres—that of Western Australia generally being remarkably dry.

835. Can you give the mean temperature of each month?—Yes; here is a table I prepared of the means of the thermometer and barometer for the years 1853 and 1854. I have compared it with the temperature of later years, and find that it still continues to give a very correct average mean of each month:—

	Thermometer.		Barometer.	
	1853.	1854.	1853.	1854.
January - -	75°	76°	29·972	29·984
February - -	74°	75°	29·818	29·915
March - -	71°	70°	29·991	30·080
April - -	62°	66°	30·075	29·967
May - -	59°	63°	30·176	30·132
June - -	52°	55°	30·149	30·098
July - -	57°	57°	29·958	30·067
August - -	59°	57°	30·109	30·023
September - -	61°	62°	30·085	30·108
October - -	66°	63°	30·109	29·963
November - -	70°	68°	29·953	30·107
December - -	71°	72°	29·927	29·995

The data contained in this return were procured by me from the Royal Engineer Meteorological tables kept at Fremantle by Captain Wray, R.E.

836. Is anything known of the internal heat, and does it agree with the observations made in other countries?—I am not aware that any observations have been made relative to internal heat, in fact I should say that the colony is not yet sufficiently developed to have afforded scope for research on the subject.

837. (*Dr. Farr.*) Nor the temperature of the rivers?—No.

838. (*Chairman.*) What are the elevations of the ground?—The town of Fremantle, the chief port of the colony is situated at the level of the sea, on the southern side of the entrance to the Swan river, in latitude 32°, longitude 116°; there are elevations, however, in its immediate rear, on the slope of which public buildings have been erected. The other coast settlements, namely, Champion bay, Bunbury, Vasse, and King George's Sound are situated also at the sea levels, with high lands in their vicinity.

839. There are altitudes, I suppose, further inland?—Yes, there are various ranges of hills scattered over the interior of the colony, some of them of considerable extent, and very striking appearance; more especially Moresby's Flat Top Range, six miles inland from Champion Bay. A portion of this range in the distance resembles a series of gigantic fortifications, presenting well defined bastions with their connecting

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curtains. The appearance of the flat-topped hills is very peculiar, some of their summits being defined by lines which, at a distance, seem mathematically straight; little or no timber grows on them, and in their immediate neighbourhood copper and lead mines of great promise abound. A chain of thickly wooded hills, called the Darling Range, runs from about forty miles to the north of Fremantle, to within a few miles of Cape Leuwin, 170 miles to the south of it. This range is situated inland about 26 miles, and separates the agricultural districts of York and Toodyay from the original Swan river settlements.

840. Which are the more healthy parts of the colony?—The whole colony is healthy; endemic disease is unknown, and epidemic influences are rare in the extreme; I have only seen one during my residence in the colony, and that was a very slight influenza epidemic, which occurred in April 1858, just as the hot season was terminating, and which evidently arose from some atmospheric cause connected with an absence of the rains which usually set in at that period of the year. The young were those chiefly attacked, and its effect passed off in about three days, the symptoms being of the mildest character. I may also mention as an illustration of the general salubrity of the climate, that small pox, scarlet fever, measles, &c., are as yet unknown in Western Australia, and I may add that the same almost applies to acute pulmonary affections, their occurrence being rare in the extreme.

841. What is the nature of the soil?—The character of the Western Australian soil varies considerably in different portions of the colony, but as a general rule it may be said to be very sandy, though abundance of light loams, red and black clays exist from one extreme of the colony to the other, but generally, with one or two exceptions, occurring in rather circumscribed patches, with the light sandy soil intervening; which for the most part is thickly covered with large-sized timber; the Western Australian forests, as a general rule, growing in those soils, which the bulk of the colonists are, by some oversight, in the habit of looking on, as altogether sterile, because they will not unaided by manure, grow cereal and other non-indigenous crops.

842. What is the general aspect of the colony? Is it much cultivated?—The colony is not much cultivated, and its general aspect is that of a very primitive settlement, presenting vast extents of forest land, covered with mahogany and gum trees of considerable size. Two hundred miles, however, to the north of Swan River, a fine open pastoral and agricultural country exists, where but little timber grows. It is now the most advancing portion of the colony, and was discovered many years ago by Sir George Grey, whose accurate account of its topography and general capabilities for colonization was turned to no practical purpose by the settlers until 1852, when a cattle company was formed, who leased extensive tracks of it for grazing ground. Since then a steady tide of emigration has set in towards it from the southern districts of Western Australia. It is in this portion of the colony that the rich copper and lead mines have been lately found. By the last census returns which have been published in Western Australia, namely, those for the year 1854, 12,000 acres only were under cultivation; of which 5,969 were wheat, 1,585 barley, 364 oats, and 2,422 hay and green crops, the remainder consisting of rye, maize, beans, peas, potatoes, vineyards and gardens. Since these statistics were prepared, there has been an annual extension of cultivation, though not to such an extent as in any way to have altered the exceedingly primitive appearance of the colony; with a few exceptions, the cultivation consisting of isolated patches, with vast tracks of forest and other uncultivated land intervening.

843. Will it ever become much cultivated?—That will altogether depend upon population.

844. And upon the soil?—Though the general character of the soil is very sandy and densely tim-

bered, there is no scarcity of fine open land, fertile plains and valleys; some of which, such as the Greenough Flats at Champion Bay, are now beginning to attract a good deal of attention in the colony. They are situated about 220 miles to the north of Fremantle. I visited them in October 1857, with his Excellency Governor Kennedy; they are of great extent, and if only very partially cultivated might grow wheat and other cereal crops for the whole colony. The soil consists of a light loam, of great depth, covered with rich natural pasturage; the extreme richness of the soil here and there, displaying its exuberance in the form of dense thickets, which, however, are readily cleared away, and the presence of which is always looked upon as an indication of rich land, by the practical agriculturalist. I may also state that soil in Western Australia which, to the eye, looks utterly sterile, and as far as appearances go, cannot be distinguished from ordinary sea sand, can with a little stable manure, be rendered very productive. While population is an essential to the development of agriculture in Western Australia, an other essential (on which an increase of population may be said to be contingent) is the continuance of a large Government expenditure in the colony, similar to what has been the case since June 1850, when the few remaining colonists were rescued from total ruin, and the colony from complete prostration, by its being converted into a penal settlement. Without the continuance of some such aid, notwithstanding its vast natural resources, I am satisfied, from what I have observed during my residence there, that the progress of the colony will be once more rapidly downward.

845. Are there any parts that have been noted as particularly salubrious?—Fremantle, the station I am most familiar with, is exceedingly healthy, but it would be difficult to particularize one part of the colony as being more healthy than the other. The colony generally, from Champion Bay to King George's Sound, is very healthy; upwards of 500 miles intervening between them.

846. What is the position of the mountains and hills as to the inhabited parts? Do they come down close upon them?—At Fremantle a range of low lime stone hills, are in the immediate vicinity of the town; on their slope, the new convict establishment and other public buildings have been erected. Perth, the capital of the colony, situated on the northern bank of the Swan River, about fourteen miles from Fremantle, stands at the base of an eminence of moderate height, known as Mount Eliza. The Darling range is entered about 15 miles from Perth, and two lines of very irregular road traverse it, the one going in a due easterly direction to York, the other, in a north-easterly direction to Toodyay; their lengths respectively averaging about 45 miles. Both York and Toodyay are important agricultural districts, where cultivation is principally carried on in valleys at the foot of hills branching off the Darling Range.

847. Is the climate much influenced by the neighbourhood of the sea?—I think it cannot fail to be so; the whole of the inhabited portions of the colony being within the influence of the sea breeze, which sets in as a general rule every afternoon. It is distinctly perceptible at York, 70 miles inland from Fremantle.

848. Are there any parts which are unhealthy?—I am not aware of any inhabited portion of Western Australia which can be said to be unhealthy. Near Perth there is a suburb called Mount Eliza, where the houses are built immediately above some swampy ground on the bank of the Swan River, and I have often been surprised, considering the injudicious locality chosen for residences, that the inhabitants did not suffer severely from malarious disease. I know no portion of the colony that I should be justified in saying is unhealthy.

849. Cultivation has not hitherto been carried to an extent to affect the healthiness of the country in any way?—It has not, and there is no prospect of

possibility of its being so during the existence of the present generation, owing to the peculiar, and, to a certain extent, unfortunate way in which the earlier attempts were made to develop the colony, namely, by forming a number of isolated settlements separated from each other, in many instances by a hundred miles and more, in place of radiating from one common centre. To this cause (which the "large grant system" may be said to a certain extent to have rendered necessary) may, in my humble opinion, be attributed much of the backward, and at best, slow progress which has characterized Western Australian colonization. Had the colony been founded on the "eighty acre section" principle, my belief is, that the disasters which characterized its early history might have been, to a certain extent, obviated.

850. What are the prevalent winds?—North-westerly and south-easterly. The westerly winds are the most prevalent; they blow right in from the Indian Ocean.

851. In what part of the year?—Generally most marked from May until the commencement of October.

852. Those are the hot winds?—No, they are cold; that is the cold season. The hot winds are easterly breezes during summer.

853. How comes it that a north wind is a cold wind in Australia?—Such is the fact in Western Australia.

854. (*Sir R. Martin.*) You stated that it blew off the ocean?—Yes; it is a sea breeze, and the principal gales are from the same direction.

855. (*Chairman.*) There is a rainy season, I suppose?—The cold season is the rainy season.

856. How long does it last?—Not long. It generally commences about the end of April, when light showers set in and continue during May, at rather distant intervals. The heavy rains do not set in as a general rule before June, and they usually terminate about the end of July or commencement of August.

857. Do you know the amount of the rain-fall during that time?—Yes.

858. Could you supply it?—This table is taken from some meteorological data, furnished by me in an annual report some years ago.* The quantity of

rain which falls is not very great; as it is very unusual for it to rain continuously for any length of time, there usually being frequent intervals of fine weather.

859. Does it produce great humidity?—As a general rule it does not; owing to its percolating very rapidly through the sand.

860. It is a self-draining soil?—Yes, the sandy soils are usually self-draining; accumulations of water, however, temporarily form during the rainy season on the stiff clay soils. There is no humidity at Fremantle, owing to the loose sandy soil.

861. What rivers traverse the country?—Swan river is the only one of any extent.

862. Is that a large body of water?—For fourteen miles, namely, from Fremantle to Perth, it is a considerable body of water, at one part (Melville water) being about three miles broad. As far as Perth, however, its general characters are more those of an estuary than a river. The entrance to it at Fremantle is narrow, and remarkably well defined by two prominent headlands, known as Arthur's and Rouse's Heads. A few miles above Perth, Swan river degenerates into an insignificant stream and becomes lost in the Darling range.

863. Does it ever overflow?—I believe it did once or twice in the earlier days of the colony, but it has not done so for a considerable number of years.

864. What are the productions of the country? are provisions plentiful?—The natural productions of Western Australia, which have as yet become articles of export, are, mahogany, sandal wood, bark, kangaroo skins, gums, copper ore and lead. The mahogany is a very superior wood, and vast forests of it are scattered over the colony; chiefly, however, between the Swan river and the country to the west of King George's Sound. It is impervious to the sea-worm and the white ant, properties which render it very valuable for public works; a considerable trade in it is now going on with India, where it has been found to be well adapted for sleepers and other railway works. Of the productions which have been introduced by colonization, the only exports as yet are wool and horses; a small trade in the latter having been carried on for some years back with Singapore, and latterly with India, two large shipments having lately been supplied to Her Majesty's Government for cavalry purposes. The wool trade as yet is very small, one vessel of 600 tons being sufficient to take to England the whole of the annual yield, with the exception of a small quantity that goes from King George's Sound. For colonial consumption the following are the chief articles raised, wheat, barley, oats, Indian corn, hay, potatoes, and vegetables of every variety, grapes, peaches, nectarines, lemons, oranges, loquots, bananas, melons, pumpkins, apples, pears, almonds, olives, pomegranates, mulberries, raisins, figs, &c. The fruits are remarkably plentiful and very cheap. The grapes are not to be surpassed in any portion of the world, the vine grows with astonishing luxuriance, and Western Australia might be made the vineyard of the world; the very worst soil that can be found in the colony being that best adapted for the growth of the vine, which, however, grows with a wonderful degree of fertility in almost any soil in Western Australia, provided the vines are judiciously planted in reference to certain winds. Provisions generally are plentiful, and are becoming more so every year.

865. And cheap?—Yes, by contract; they are very moderate in price.

866. Is cattle plentiful?—Yes.

867. And vegetables?—Very plentiful, and of superior quality.

868. What should you say are the physical effects of the climate in Western Australia?—Exhilarating and invigorating in the extreme. It is almost impossible by any description I can give to do justice to the Western Australian atmosphere; to be appreciated, it must be experienced: many and many a morning on leaving my house to commence my daily duties, have

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* Extract from Meteorological Observations taken at Fremantle during the years 1853 and 1854.

1853.

MONTHS.	Barometer read at 9½ A.M. daily, corrected and reduced.			Thermometer in shade at 9½ A.M. daily.			Wind pressure on One Square Foot.		Rain.	
	Maximum during Month.	Mean Height.	Minimum Height.	Maximum during Month.	Mean.	Minimum during Month.	Maximum during Month.	Average Maximum during Month.	Inches during Month.	Number of Days on which Rain fell during each Month.
January	30.143	29.872	29.725	91.0	75.7	67.5	2.50	1.51	.48	4
February	30.052	29.818	29.600	83.0	74.6	64.5	3.50	1.38	1.14	5
March	30.188	29.991	29.777	80.5	71.3	65.0	4.50	1.29	.45	3
April	30.385	30.075	29.593	69.2	62.2	54.0	6.25	1.97	3.38	9
May	30.409	30.176	29.886	67.0	59.6	51.0	5.57	1.40	4.15	4
June	30.458	30.149	29.477	68.5	52.9	47.5	7.00	1.71	4.57	11
July	30.242	29.958	29.768	63.5	57.1	49.0	7.00	2.64	11.30	22
August	30.343	30.109	29.759	65.0	59.2	55.5	8.25	2.51	3.49	15
September	30.374	30.085	29.674	73.0	61.5	54.0	11.00	3.03	4.38	10
October	30.251	30.109	29.943	77.0	66.2	55.0	5.60	2.11	.05	1
November	30.178	29.953	29.777	87.0	70.7	61.0	3.50	1.38	.62	4
December	30.152	29.927	29.687	81.0	71.4	67.0	4.00	1.84	.21	5

1854.

January	30.142	29.984	29.776	94.5	76.3	67.5	5.00	2.34	—	—
February	30.192	29.915	29.848	86.0	75.6	67.4	3.75	1.73	.30	1
March	30.339	30.080	29.886	79.0	70.4	63.0	3.00	1.60	—	—
April	30.375	30.067	29.475	79.5	66.6	58.0	12.50	1.70	1.38	11
May	30.258	30.132	29.959	70.5	63.3	56.5	2.75	.66	2.80	8
June	30.541	30.098	29.674	63.0	55.9	32.0	12.00	1.69	5.54	10
July	30.339	30.067	29.643	67.5	57.9	51.0	13.50	3.92	9.33	23
August	30.498	30.023	29.556	64.0	57.2	52.0	18.00	4.56	7.07	20
September	30.318	30.108	29.949	67.5	62.0	54.5	5.00	.98	2.62	9
October	30.320	29.963	29.447	73.0	63.8	56.0	11.00	3.18	3.85	11
November	30.265	30.107	29.713	79.0	68.7	59.5	4.50	2.42	.31	1
December	30.222	29.955	29.823	84.5	72.8	66.0	4.75	2.26	.21	3

From these tables it will be seen that there is very little variation in the temperature of Fremantle.

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I been struck with the wonderful elasticity of body and mind, which the cloudless sky and refreshing atmosphere seemed to develope. My impressions in this respect are by no means singular, they are those of residents there generally. I have been assured by old settlers, that at a time when the affairs of the colony presented the gloomiest aspect, and everything connected with it was calculated to depress, still their minds refused to yield to the pressure from without, and their spirits kept up in a manner so remarkable that they could account for it only by referring it to the clear and exhilarating atmosphere at the place in which it was at that time, in a financial point of view, their misfortune to be residing.

869. You spoke of the rainy season, you have a hot season too?—Yes, from about Christmas to the end of February, as a general rule, the weather is rather warm, more especially during land breezes, which, however, are not frequent, and when they do occur their duration is not long.

870. During that time is the health of Europeans affected by the heat?—I cannot say that I ever observed the ordinary population (including the troops) in any way seriously affected by it, though I have known the convicts suffer a good deal from sickness during the summer, but which sickness I never attributed to the hot weather, but to the conditions under which the men were living during the hot weather; every elementary principle of hygiene being overlooked in their management. They were much over-fed, in addition to which they were located at night in double tiers of hammocks in crowded association wards, with urine and manure tubs placed in their centre at intervals of about 25 feet from each other, and shut up with them the whole night; the amount of cubic feet of air also was very deficient, amounting only to 280 feet per man. When I first became connected with the convict service in the early part of 1853, the convicts who performed ordinary prison work, such as tailoring, shoemaking, and the lightest forms of out-door labour, received the following ration daily:—Fresh meat 18oz., bread 27oz., potatoes 16oz., soup, thickened with oatmeal or rice one pint, tea two pints (one morning and evening) containing $\frac{1}{3}$ oz. tea, and $1\frac{1}{2}$ oz. sugar, with one extra ounce of sugar in lieu of 2 oz. of sweet milk (which formed a portion of the ration, and was not procurable at that time), one drachm pepper, $\frac{1}{2}$ oz. salt, $\frac{1}{4}$ oz. tobacco, and $\frac{1}{6}$ of an ounce of tea to be infused and used as a beverage during the day, while work was going on. The diet, as I have now detailed it, constituted the ordinary prison ration, but in addition to the articles therein contained, the convicts who had labour to perform calling for a greater amount of muscular exertion, such as sawyers and blacksmiths, and the men who attended them as labourers, received an extra issue of 8 oz. meat, and 6 oz. bread, making their daily allowances respectively 26 oz. of the former and 33 oz. of the latter; the number of men receiving this latter ration amounted to about 15 per cent. of the prison population. Not very long after entering on the duties of surgeon to the convict establishment, the extraordinary prevalence of diseases of the digestive organs (chiefly cutaneous eruptions, ophthalmia and dysentery, for the most part occurring by the process known in medicine as metastasis; that is a disease suddenly disappearing in one portion of the body, and immediately reappearing in another) revealed to me the mischievous effects which the large ration was producing amongst the prisoners generally. I accordingly drew up a lengthy report on the subject and urged that a considerable reduction should be made in it as a primary sanitary measure. My views, however, were strongly opposed by the convict officials, on the grounds chiefly that diet, in excess of what might be actually physically necessary was essential to discipline. Not being able myself to recognize this application of diet I persevered in my remonstrances, and succeeded in drawing the serious attention of his Excellency Governor Fitzgerald to the question, who ordered a medical board, consisting

of staff-surgeon Dr. Galbraith, Mr. Ferguson the colonial surgeon, and Dr. Jones of the 99th regiment, to inquire into the correctness of my allegations respecting the diet. This board, after careful personal investigation, decided that the diet was much in excess, and recommended that it should be reduced to 14 oz. meat, 22 oz. bread, 12 oz. potatoes, with a pint of soup twice weekly in place of daily, as formerly; the tea, sugar, and other items remaining the same, with the exception that the extra tea for a day beverage, and the ounce of sugar in lieu of milk were abolished. Governor Fitzgerald directed the recommendation of the Board to be immediately carried out, and the result was, that an improvement, far exceeding my most sanguine expectations, became perceptible on the general sanitary condition of the convicts in a very short time afterwards. This change in the dietary (which involved a reduction of upwards of 20 oz. of solid and fluid aliment daily) occurred in May 1855, just as the cold season was setting in, and the improvement in the health of the prisoners showed that the new ration was well adapted for the winter temperature; because, while the former diet was in operation the convicts suffered as much from disease during the winter as during the summer months. On the return of the hot season, however, the following year, they again began to suffer from diseases originating in disordered digestion, though by no means to such an extent as in former years, nor of anything like the same severity. This sickness, coincident with the setting in of the hot weather, was so clearly attributable to the conditions under which the prisoners were living being unsuited to the increased temperature, that I again urged on the convict authorities the necessity for an extension of the sanitary movement which had been commenced so successfully the previous year, as the only effectual mode of removing the morbid influences to which the convicts were undoubtedly exposed. I therefore placed my views on record in a report dated 31st July 1856, in which I pointed out that the means of doing so were very simple, consisting of the following reasonable propositions:—1st, reducing the number of men sleeping in association to one-half, coeval with the setting in of the hot weather; 2nd, abolishing the system of double tiers of hammocks, at least during the hot weather; 3rd, removing urine tubs and means of defecation from the wards during the night; 4th, reducing the number of lights burning in the association wards to the smallest possible number; 5th, modifying the diet so as to meet the change of season, by reducing the quantity of animal food and of fermented bread; 6th, introducing compulsory ablution of the whole person; 7th, abolishing sea bathing, unless an issue of marine soap could be made to the men; 8th, issuing bran bread or biscuit, in place of the ordinary ration bread, as a preventive of the constipation, which prevailed extensively amongst the prisoners, and formed the basis of many of the ailments they suffered from; 9th, abolishing the issue of a quarter of an ounce of tobacco, which constituted a part of the daily ration. These recommendations were opposed by the superintendent of the convict establishment, on a variety of disciplinary grounds; but Captain Wray, who had temporarily assumed the duties of comptroller-general of convicts a short time previously, ordered the greater portion of them to be carried out, and the result which followed was most satisfactory; the general health of the prisoners improving in a very remarkable manner. I have entered into these details with the view of affording a practical illustration of the necessity which exists in supervising bodies of men, for carefully distinguishing between diseases originating actually in climate, and those which originate in habits and conditions of life unsuited for particular conditions of climate; inclining, as I do, very much to the belief, that a very large proportion of those ailments which are familiar to us under the name of “diseases of tropical climates” are in reality the diseases resulting from habits and circumstances of life generally unsuited for tropical climates, the

relation which food (including alcoholic stimulants) bears to temperature being seriously overlooked in the dieting of bodies of men in the public service, constituting a branch of hygienic science that has not yet, in my humble opinion, received that attention which its importance merits.

871. I suppose you never have a season so cold as to affect the health?—No, certainly not.

872. What are the principal diseases of the country?—It is difficult to mention any disease that can be said to be peculiarly prevalent in Western Australia, though, as I have already stated, the convicts suffered at one time extremely from ophthalmia, cutaneous eruptions, and dysentery, but which could not in any way be identified with the climate, as the other sections of the community were altogether free from them. I attributed them, in the first instance, partly to general excess of food, partly to a large issue of rice which was at one time given the convicts in lieu of fresh vegetables; further experience satisfied me that there were other morbid agents at work, and which morbid influences I found to be overcrowding, defective ventilation, and the use of tobacco.

873. Yet the use of tobacco is prevalent in all hot climates, is it not?—Yes, it is, but at the same time I am fully satisfied that at any rate for the European and more especially the Anglo-Saxon (whose habits generally are so unsuited for the tropics and other warm latitudes), it is very injurious, and that opinion is not one based upon any theoretical objection to the practice of smoking, but upon observation on a tolerably extended scale; an opinion, in fact, which professional experience has forced upon me.

874. Do Europeans attain to a great age?—Yes, they do; in illustration, I may mention a lady now residing at Fremantle who was 73, when she came to the colony 25 years ago. When I left Fremantle in September last she was in the full possession of her mental and physical powers. There is also a gentleman now living in Perth, considerably over 90, remarkable not only for his bodily activity, but for the acute powers of his mind, as indicated by the ingenious mechanical inventions with which he is constantly occupied. Though these two illustrations are possibly rather extreme cases, still Europeans, as a general rule, do live and retain their mental and physical capacities to a very considerable age in Western Australia. I may here mention a not uninteresting fact which has been long observed in the colony, namely, that females who have come out from England, several years after they have ceased child-bearing, very frequently re-commence it after but a short residence in Western Australia. Several illustrations of this have occurred during my residence in the colony, the intervals between the pregnancies varying from nine to fifteen years.

875. How does the climate affect the children born in the colony?—It cannot be said to affect them injuriously. They enjoy a remarkable immunity from the infantile diseases which are so fatal elsewhere. The Registrar-General of the colony, in his report accompanying the last census returns, drew attention to the fact that one-fourth of the population of Western Australia consisted of children, as a proof of the comparative exemption which the colony enjoyed from infantile disease of a serious nature. The only peculiarity I have observed is, that the children have a tendency to lose their teeth early.

876. Their first teeth?—Both their first and second, but more especially the second. People born in the colony, as a general rule, have not good teeth, though there are many exceptional cases.

877. How do you account for that?—From the fact that they are from their birth brought up with a strict adherence to English customs in the matter of diet, clothing, &c., in a climate where nature demands, to a certain extent, a modification of them. As a general rule, I have observed the infants as carefully clothed and fed in the height of the Australian summer as if they were being reared at the North Pole:

many is the occasion I can call to recollection when I have been summoned, during the hot season, to see a child reported to be dangerously ill, where I have found the mother sitting with it in a room (frequently close to a fire), with the air carefully excluded—the little sufferer with the flushed face, burning skin, hurried respiration, and other indications of fever, and where I have stood by, and seen these symptoms gradually disappear, by no other treatment than opening the window and the door, and making the mother denude the child of the rolls of flannel in which it was tightly enveloped, substituting in lieu thereof a loose single garment. The premature decay of their teeth I believe to arise from injudicious dieting in childhood disordering, in some obscure way, the digestive organs, and developing certain secretions, which act injuriously on the teeth—either constitutionally, through the blood, or mechanically, by salivary excretion; probably by a combination of both causes.

878. Are they over-fed?—Yes, that is the opinion I have formed from what I have observed in the colony, more especially in reference to the quantity of animal food which is given to them.

879. Does that apply also to children not born in the colony, but who arrive there?—It will depend a good deal on their age at the time of their arrival; should they be infants, it will apply to them as much as to children born in the colony; but it will be less and less applicable to them in proportion to their age on coming to the colony.

880. What are the habits of the European residents, do they live entirely according to the English system?—Entirely, and to a certain extent in excess of what I should call the ordinary English system.

881. Can they do so without suffering?—Without apparently doing so. The per-centage of deaths in the whole colony by the last census returns was only 0.55 per cent., or $5\frac{1}{2}$ in the 1,000. Frequently, on taking into consideration the habits of many of the people, I have been astonished at the apparent immunity from disease they enjoyed, and could only account for it from the fact, that they were living in a primitive atmosphere, and in a settlement free from any of the ordinary external exciting causes of disease; also, that their occupations were active, and their circumstances of life such as to a certain extent counteract the injurious tendencies of their special habits.*

* In August 1855, when I was surgeon of the Convict Establishment at Fremantle, I recommended a further reduction to be made in the diet of the prisoners during the summer months, on the grounds that if 22 ozs. of bread and 14 ozs. of fresh meat were sufficient in winter, they were too much in summer; also that the amount of animal food not only exceeded by 2 ozs. that allowed in any of the English prisons, but was also supplied to the convicts in a climate where the chemical demands of the system for animal food were considerably less than in the colder climate of England. My views, however, in this respect were not adopted by staff surgeon Dr. Galbraith, who was then acting as Principal Medical Officer of the Convict Service, and who based his grounds of dissent chiefly on the fact I have mentioned in my reply to Question 880, namely, that the settlers in Western Australia, to a certain extent, live in excess of the ordinary English system, without apparently seriously injuring their healths. In some observations which Dr. Galbraith wrote on the subject, dated 12th November 1855, he stated:—"Too much importance seems to me to be attributed by Dr. Rennie to the difference of climate. "During a great part of the summer months in this part of Western Australia, the climate is peculiarly temperate, and, except during the extreme heats, which are of comparatively infrequent occurrence, and do not continue for more than three or four days together, whatever animal chemistry may say, our own sensations inform us that we both look for and enjoy substantial meals scarcely less than during the colder season, when, to say the least, we experience no inconvenience from living exactly as in the colder climate of England. In hot climates smaller quantities of food are required to supply the combustion of the tissues; but at the same time, it must be borne in mind that the natives of those climates almost invariably make use of a vegetable diet remarkable for its bulk. Among the many advantages held out as inducements to the emigrant to Australia, no one has ventured to promise him a climate where he will require less food than in his native land; and certainly, when he does settle here, he is in the habit of using a diet which at home would be considered almost extravagant, both in quantity and quality. Yet this is not found to have any detrimental effect on his health, for the general salubrity of the Australian colonies has long been acknowledged." Dr. Galbraith, when he expressed

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882. Have you any accurate information as to the mortality of the different races, especially the natives, as compared with Europeans?—The numbers of the native population are stated to be rapidly decreasing, and it is difficult to account for it, as there are no causes of mortality that have been introduced amongst them by the white man. This decrease is attributed by some to syphilitic causes; by others, to intercourse between the native women and white men, interfering with the fecundity of the former. I have carefully inquired into both of these alleged causes of decrease, and have been unable to find that any grounds whatever exist for believing them to be correct. The cause to which I am inclined to attribute it is, simply, that the aborigines have now the means of gaining a livelihood much more easily than they had before the arrival of European settlers. Formerly the hunting of the kangaroo was a difficult and elaborate process, a great deal of physical exertion being entailed on them before they could procure animal food in any quantity; but now they have adopted the European method of running the kangaroos down with dogs, and can catch as many as they require with little or no trouble; in fact, they are not now called on to exert themselves as nature intended, and to the complete change which has taken place in their original habits, I attribute the physical deterioration they are now undergoing.

883. (*Sir R. Martin.*) They have formed habits of repletion in exchange for habits of previous abstinence?—That is exactly the opinion I have formed.

884. (*Chairman.*) Then they will ultimately disappear?—Such has been the case in Tasmania, where only seven of the aborigines are now remaining. The native also, is no doubt gradually disappearing in the other Australian colonies. The aborigines of Western Australia, however, are so numerous that though their numbers may annually decrease, they cannot become extinct for a very considerable period, unless some hitherto unknown causes of mortality are introduced among them.

885. Do they copy bad habits from the Europeans?—They are very prone to do so, especially tobacco smoking and the use of spirits. The smoking of tobacco in pipes is now universally adopted by the natives (female as well as male) of the settled portions of Western Australia, and is adopted by the children even of tender years; the first request which the native makes of the traveller in the bush is for tobacco, and to the extraordinary hold which the habit has taken of them may also, possibly, to a certain extent, be attributed the gradual decrease which their numbers are undergoing, more especially those tribes whose run is in the vicinity of the larger settlements.

886. Have you seen soldiers quartered in Western Australia?—Yes, I had charge of a company of royal engineers and a force of enrolled pensioners for six and a half years at Fremantle; in addition to which, for nearly two years of the time I had the general medical charge of the troops in the colony, including a company of the 12th Foot stationed at Perth.

887. What was their state of health, generally speaking?—As a general rule very satisfactory, but particularly so at Fremantle, as a proof of which I may mention, that from the 3rd October 1858, to the 12th August 1859 (when I ceased doing regimental duty there), I had not found it necessary to admit a single man into hospital, and which is the more remarkable when it is taken into consideration that upwards of 100 of the men constituting the garrison of Fremantle are old pensioners who have all been dis-

charged from the service for chronic disease and physical disabilities more or less severe. Any sickness, or indications of ill health, I have seen amongst the troops at Fremantle, have resulted from special causes, altogether unconnected with climate.

888. What were their rates of mortality per thousand?—They were very low, I cannot give the precise rates at present, but, if necessary, I can procure them. I may mention, however, that the 20th Company of Royal engineers have in eight years lost only four men, five have actually been buried in the colony, but the fifth cannot in any way be connected with Western Australia; as the soldier was one of a detachment of 27 men sent out as a guard in the "Nile" convict ship in the latter part of 1857. He arrived at Fremantle in January following, and was then in a very advanced stage of chest disease, under which, from his history, he must have been labouring at the time of embarkation. I also ascertained from him, not long before his death, that he had been discharged from the Life Guards for debility, six months prior to his re-enlisting in the Royal Engineers, a fact tending to show the very dubious sources from which recruits occasionally are taken, and also the little reliance which can be placed on their statements as to their antecedents.

889. Do you know anything of the seamen?—Yes, I have had a good deal of experience as regards the capabilities of the climate of Fremantle for restoring constitutions that have become impaired in the course of seafaring lives; Fremantle being a very common place of resort for American whalers who generally land their invalids there, and as they were always placed under my professional care by the consular agent for America, I had ample opportunities of observing the effects of the climate upon them, and never failed to observe that they derived great benefit from it.

890. Have you ever contemplated the possibility of a sanitarium being formed for Indian troops in Western Australia?—Yes, I have. About a year ago, perceiving that attention was being drawn to the subject in the English press, I addressed a letter to the Director General of the Army Medical Department on the matter, placing detailed information before him, and pointing out the general capabilities of Fremantle for an Indian sanitarium; and which letter the Director General has authorized my referring to for the information of the Commission.

891. Is there any other point upon which you wish to be asked any question?—I should like to mention, that there is every convenience at Fremantle for its immediate conversion into a sanitarium; a very fine and extensive range of buildings, capable easily of accommodating upwards of 1,000 invalids, being now in course of completion there as a convict establishment. That the erection of this building at Fremantle is an error, I think every candid person having any practical acquaintance with the colony will readily admit; as the fact is now self-evident, that the general body of the convicts are not required at Fremantle, but are wanted in detached parties in the country districts, making roads, bridges, &c., and improving generally the means of transit between the agricultural and pastoral settlements and mineral districts in the interior, and the seaports; the roads throughout the colony at the present time being in a very primitive state, consisting for the most part of mere cleared tracks through the bush, which are of little or no use as means of land conveyance for the purposes of commerce. I perhaps can give no better illustration of the defective state of the roads at the present time than by stating, that while the English mail arrives in Western Australia in 42 days from London by the overland route, seven days, or one-sixth of the whole passage from England is occupied in transmitting it from King George's Sound to Perth, a distance of only 250 miles. As the plans of this large establishment at Fremantle were prepared, and its construction carried out under the supposition that transportation would be carried on to Western Aus-

this opinion, had been 14 years resident in Australia and New Zealand, seven years of the time having been stationed at Swan River. As I have already stated, I believe the injurious effects of the feats of dietetic excess here recorded to be in a great measure modified, and in many instances altogether averted, by the extraordinary purity of the atmosphere, the influence of the sea breeze, and the active operations which the emigrants are enabled to follow during the hottest weather in Australia; the sun there being altogether free from those debilitating effects which usually characterize great solar heat elsewhere.

tralia on a much more extensive scale than has been found practicable, the building consequently is now only partially occupied, and in all probability will become less so every year. Under these circumstances I venture to suggest its being converted into a sanitarium, should it be determined to form one in Western Australia. It is beautifully situated on a slope, half a mile from the sea, which it faces, and is well ventilated by the sea breeze. Thousands of acres of open and forest land are available for exercise and pleasure grounds in its immediate rear. It stands on a rocky basis, and is abundantly supplied with water of remarkable purity; in fact it possesses every natural and artificial advantage, rendering it exceedingly well suited for the purpose I have proposed. It contains a fine chapel and hospital, an extensive and elaborate cooking range, a large establishment of offices, including a lithographic and printing press. There is also a carpenter's and blacksmith's shop within the walls, both of which might be made very useful adjuncts to an invalid establishment. I may also add that there are six private residences attached to it, and a large vegetable garden. Prior to venturing to suggest this application of the building, I consulted Captain Wray of the Royal Engineers, who was employed for six years at Fremantle superintending its construction, and he is of opinion that it might be converted into a sanitarium with very little trouble and expense. Captain Wray is now employed in the office of the Inspector-General of Fortifications. This application of the building need in no way interfere with the present convict system at Fremantle, as the buildings are still available where the penal establishment, as it now exists, was carried out from June 1850 to June 1855. For the reasons I have already given, Fremantle will become a mere place for the reception of convicts on arrival from England, prior to their being transferred into the interior; also a place for the returning of convicts to, who have misconducted themselves on ticket of leave, and who then become what are called reconvicted prisoners. Supposing the present establishment was converted into a sanitarium, these men might be located in the former prison, or in hulks moored in the south bay, or even inside the Swan river, provided they were of a size admitting of being floated across the bar at its mouth. About two hundred is the general average of the reconvicted prisoners at Fremantle; the number of convicts arriving from England average about 260 twice a year; they are kept now but a short time at Fremantle, being speedily sent into the interior, especially, at present, to Perth, where a number of them are now employed building a new Government House and improving generally the streets of the town. The former prison can be easily made to accommodate 400 or 500 men, with a due regard to health. I have frequently seen upwards of 700 in it; but, from over-crowding, their health suffered.

892. What is the duration of the average voyage to Western Australia, say from Calcutta?—The passage could be made at all seasons from Calcutta to Fremantle with an ordinary fast steamer, say a ten knot boat, at an average of 20 to 24 days.

893. And in sailing vessels?—That will depend upon the season of the year. By a smart sailing vessel leaving Calcutta from the 15th of October up to the end of March, the passage will occupy from 34 to 40 days; from the latter date to the former 45 to 50 days. The most favourable months for leaving Calcutta to make a rapid passage will be the latter end of November, the whole of December, January, and February. The best period for invalids arriving in Western Australia from India will be about March, when they will land in a fine genial temperature not too warm, and becoming gradually cooler for the six ensuing months.

894. (*Sir R. Martin.*) It has been stated that a powerful steamer would do it in 14 days?—It might be done in that time, provided vessels were employed similar to those the Peninsular and Oriental Company

run between Alexandria and Marseilles, which average 12 and 13 knots.

895. (*Chairman.*) Will you forward a separate paper to the Commissioners, giving your opinion upon the effect of the use of spirits in hot climates, and the best mode of preventing their ill effects?—I will do so.

ADDENDA.

No. 1.

EXTRACTS from a LETTER, dated Fremantle, January 12, 1859, addressed to the DIRECTOR-GENERAL of the ARMY MEDICAL DEPARTMENT by STAFF-SURGEON D. F. RENNIE, M.D., then Principal Medical Officer in Western Australia.

"The question of a sanitarium in this colony for the Indian Army has been discussed for some time back, and considerable hopes entertained by the colonists that one will be ultimately formed. I should have addressed the late Director-General on the subject myself, had I thought it probable that the Government would adopt any of the various propositions which were from time to time appearing in the public journals; or in fact form a sanitarium at all, elsewhere than in the hill regions of India.

"As the subject, however, now seems to be attracting a good deal of attention, I have thought it as well to submit to you a few observations having general reference to the question.

"The climate of Fremantle, in common with that of Western Australia generally, is certainly one of the finest in the world; there is a total absence of endemic disease, and anything resembling epidemic influences are rare in the extreme.

"A glance at the returns of sick I have forwarded you of late, will show the remarkable immunity which the troops enjoy from disease; notwithstanding that the larger proportion of them are enrolled pensioners, who have been discharged from the service for physical disabilities and chronic disease more or less severe.

"The requisite supplies for an invalid establishment can be procured at Fremantle by contract at very moderate prices, that is, as far as the actual necessities of life are concerned; but articles coming under the head of medical comforts, as a measure of economy, would require to be imported from the Government stores in England.

"Fruit, including fine grapes, peaches, and figs, are both plentiful and cheap; the former averaging about 2d. per pound.

"Vegetables of all kinds are moderate in price (by contract), of excellent quality, and very plentiful; full information, however, with reference to the contract prices of all such necessities as flour, fresh meat, tea, sugar, and potatoes, will be found at the Treasury amongst the documents having reference to the convict service. I may, however, remark, that the contract prices for the convict supplies are at present, flour, 2½d. per lb.; meat, 4¾d. per lb.; potatoes, 1½d. per lb.; tea, 1s. 10d. per lb.; and sugar, 3¾d. per lb.

"It has been stated in the public press that advantage might be taken of the establishment of a sanitarium at Fremantle, to dispense with the services of the troops of the line detached from Sidney; and it might have been added, also, of those of the enrolled pensioners stationed at Fremantle, and of the numerous small detachments of the same force doing, for the most part, merely nominal military duty in the country districts; who, while they are on what is called the "duty force," receive from 2s. to 2s. 6d. per diem, in addition to their pensions, the former being the fixed rate of pay, the latter extra pay for good conduct. This force amounts to about 200 men, and the majority of them receive the 2s. 6d., while those doing duty at Fremantle receive, in addition, rations, fuel, and light, and, for the most part, are found in quarters.

"This force is kept up by the arrival of fresh pensioners sent as guards in the convict ships. They generally come out in detachments about thirty strong, on the arrival of which, the like number is discharged from the "duty force," when they fall into the labourer class, and receive no government pay beyond their pensions. On their being discharged from the "duty force," they very frequently procure transfers to the more attractive Australian settlements.

"The garrison duties of Fremantle might, in my opinion, be easily performed by invalids, as well as might the other military duties in other parts of the colony. The establish-

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ment of an Invalid Battalion recruited from the sick of the Indian army in Western Australia, I have no doubt would enable the services of all the other troops to be dispensed with, and thus the cost of the sanitarium be materially reduced.

"The climate of Western Australia is vastly superior to that of any of the other Australian Colonies including Tasmania, and my sole object in troubling you with these remarks is to place you in possession of reliable information, should the question of an Australian or Tasmanian sanitarium for the invalids of the Indian army become officially discussed in England.

"The barracks at Fremantle, at present occupied by the pensioners with their wives and families, can afford ample accommodation for about 500 invalid soldiers. They are admirably situated on a rising piece of ground facing the sea, and about a quarter of a mile distant from it. They are also well ventilated by the sea breeze constantly blowing through them.

"The period of the year best adapted for the arrival in Western Australia of invalids from India, will be from about the middle of April to the latter end of June; through which, as a general rule, they will be able to enjoy six months uninterrupted cool weather, and if sufficiently recovered, return to India as the cool season is setting in there.

"Without interfering with the present barrack accommodation of the married pensioners, or any of the other military arrangements, buildings well adapted for a temporary sanitarium, situated close to the sea beach can be hired at a moderate rental in Fremantle, and made capable of accommodating 500 invalids, should an experiment be deemed worth trying.

"With the services of a company of Royal Engineers and a large amount of convict labour on the spot, the necessary arrangements could very speedily be made."*

D. F. R.

No. 2.

REMARKS ON DIET, ALCOHOL, &c. in WARM CLIMATES.

In attempting to express an opinion respecting the probable effects of alcohol on European soldiers in warm climates, it is difficult for me to do so in a connected manner, without entering into some preliminary details in reference to the chemico-physiological relations existing between man and the external influences to which he is chiefly exposed,—namely, the air he breathes, and the food he daily consumes.

That diet should be in proportion to temperature, the results of all modern research tend to prove—science, however, has only elaborated the details, as the fact is sufficiently apparent without the aid of chemistry, if we compare the food used by the natives of warm climates with that required by those of cold ones—the difference between them being as marked as it is in their clothing; rice and calico representing the types of the one extreme, while fat and fur represent those of the other.

The adaptation of clothing to temperature, our instincts in the most cases lead us readily to recognize the necessity for—but we are not equally ready to believe that the same applies to food, nevertheless, such is the fact; its quantity being regulated by the number of our respirations, by the temperature of the air we are at the time breathing, and by the amount of heat given off to the surrounding medium: our clothing to a certain extent acting as an equivalent for food; from its lessening the oxidation of the system,—in the words of Liebeg:—"No isolated fact apparently opposed to this statement can affect the truth of this natural law, without temporary or permanent injury to health; the Neapolitan cannot take more carbon and hydrogen in the form of food than he expires as carbonic acid and water; and the Esquimaux cannot expire more carbon and hydrogen than he takes into the system as food, unless in a state of disease or starvation;" and thus it is, that we find the Laplander feeding on blubber,

and such other highly carbonized food, while the Italian lives chiefly on macaroni, which nourishes without over-heating him. According to Liebeg the food prepared by nature for the inhabitants of southern climes, does not contain more than 12 per cent. of carbon, while the blubber and train oil, which constitute the food of the inhabitants of polar regions, contains 60 to 80 per cent. of that element.

Oxygen, in the form of atmospheric air, is the essential element of life—remove every particle of food from the system and the vital functions, nevertheless, will continue uninterrupted for a certain length of time, the duration of which will be materially influenced by the supply of water—thus, man will exist for a certain time on air alone, and for a longer period on air and water combined—but give him any amount of food and deprive him of air, and life will be extinguished with a rapidity proportionate to the extent he is removed from its influence.

Organic life, therefore, essentially depends on the chemical combination of the oxygen of the atmosphere with the tissues of the organism, which would be thus consumed in a certain time, provided materials were not introduced into it, capable of repairing the structures removed from the blood by the action of the atmosphere through pulmonary and cutaneous respiration, as well as other excretory sources. This is done by the introduction of elements in chemical composition resembling that of the organism—these elements, in the form of food, undergo a series of chemical changes, and ultimately become converted into blood; which is thus the vehicle through which the system hands itself over to the atmosphere, and at the same time, the vehicle through which the elements of nutrition are introduced and circulated for its renovation. The true use of food therefore is to counteract the oxidising power of the atmosphere—the more oxygen which enters the system the more food will be required—the less oxygen, the less food consequently will be necessary; and as equal volumes of air in different latitudes contain very unequal amounts of oxygen: the quantity becoming less as temperature increases, it is not difficult to perceive why different dietaries are required in the tropics and in the arctic regions.

Certain scales of diet have been determined on for bodies of men under different circumstances of life—that calculated by the eminent physiologist, Dr. Carpenter, as being sufficient for a labouring man exposed to the ordinary vicissitudes of an English climate, allowing from 30 to 35 ounces of animal and vegetable food—though, adds Dr. Carpenter,—“A healthy condition may be kept up on scarcely more than half this allowance, if the muscular powers are but little exerted, and the surrounding temperature be high.”

The diet of the English soldier serving at home may be represented as having hitherto consisted chiefly of 12 ozs. of meat, 20 ozs. of bread, and 16 ozs. of vegetables, which makes 48 ozs. of animal and vegetable food, and allowing a loss of 8 ozs. for bone, cooking, and waste, brings it down pretty close on the physiological estimate of Dr. Carpenter. That this diet, as a general rule, is quite sufficient, I think admits of little doubt—at any rate, the mass of recruits vastly improve in appearance on it, and from the number of them that come into hospital after but a short course of it, labouring under disordered digestion, there is reason to believe, that it is a considerably larger ration than many of them have been accustomed to prior to their entering Her Majesty's service.

That the ration of the soldier serving in England has hitherto been sufficient for supporting his system, exposed as it is to the vicissitudes of a cold and changeable climate, is further established, from the fact of the question having lately been made the subject of investigation, and the following general scale determined on, which is now in operation:—

1½ lbs. bread	} For this ration the soldier pays a stoppage of 6d. per diem from his daily pay of 1s. 1d.
¾ lb. meat	
1 oz. coffee	
1 oz. tea	
1½ ozs. sugar	
1 oz. salt	
¼ oz. pepper	

In addition to the articles here detailed, the soldier buys at his own expense about one pound of vegetables, and expends also, as a general rule, one penny on beer, and a trifle on milk, which, with washing and stoppages for regimental necessities, leaves him not more than three halfpence or two-pence per diem for tobacco and pocket money.

This ration, therefore, is deemed ample for the climate of England, where the average temperature of one half of the year is 37°, and the other half 63, the mean consequently being 50°.

It is necessary, however, now to follow the soldier to the plains of tropical Hindoostan, where he probably will be found panting under a heat of 87° or 90° in the shade, with

* In the event of a sanitarium being formed for the sick of the Indian Army in Western Australia, one of its first results will be, that the services of the company of the 12th foot detached from head-quarters at Sidney will cease to be necessary, as well as will those of a large "duty force" of enrolled pensioners, also very probably the company of Royal Engineers, and as accommodation which would thus be vacated, would become available for the purposes of the Sanitarium; more especially for such invalids as might be accompanied by their wives and families, I have prepared some details with reference to the general character of the accommodation, which I can furnish, should they be required.

fever and dysentery raging around, and on looking to his diet, the following will be found to be the ration established by law and served out by routine to all British soldiers serving in India:—

1 lb. bread
1 lb. meat
1 lb. vegetables
 $\frac{1}{2}$ lb. rice
 $2\frac{1}{2}$ ozs. sugar
 $1\frac{3}{4}$ ozs. coffee or
 $\frac{7}{8}$ oz. tea
1 oz. salt
3 lbs. firewood.

This ration is not only issued free to the European soldier in India, but he receives in addition "a spirit ration," amounting to about one gill and a half of rum daily.

A comparison of these two diet scales and of the temperature in which they are respectively consumed, demonstrates one of two things, namely, either that the soldier in India is very much over fed, not only as respects the quantity but the quality also of his food; or else, that the researches of modern chemistry as applied to physiology, conducted by such men as Liebig, Dumas, and Bousingault on the continent, and Gregory, Johnston, and Playfair in England, are mere visionary speculations, and nature herself in error, when she indicates special articles of food for special regions of the earth.

We will look to results, does the large ration maintain the health of the European soldier in India? Most certainly it does not; a vast amount of disease and mortality occurs in connexion with it. Hear what Colonel Sykes says, in his *Vital Statistics of the Indian army*:—"I never followed a farinaceous or vegetable regimen myself in India, nor do I recommend it to others; but I ate moderately and drank little, and I have a strong conviction that much of European disease in India is traceable to over stimulus, and that the mortality amongst the European troops will not be lessened until the European soldier is improved in his habits, until he is made to understand that temperance is for the benefit of his body, libraries for the benefit of his mind, and savings banks for the benefit of his purse. The climate of India is less to blame than individuals, for in case foreigners find the people in a country healthy, they should to a certain extent conform to the habits of the natives to be healthy also." In a very instructive pamphlet which has recently appeared from the pen of Dr. Mouat, of the Indian army, Inspector-General of Jails in Bengal, entitled the "*British Soldier in India*," he with great truth remarks, in reference to the question of food, "Most Europeans in the tropics, in easy circumstances, consume more animal food and stimulant beverages than is good for them. The soldier in particular, except in the field, eats too much meat, drinks more of strong liquor than his system can dispose of with impunity, and takes too little exercise to ward off the effects of his stimulant dietary. The result is that he attains the condition of a Strasburg goose, of which disease and death are the penalty."*

The European in tropical India breathes an atmosphere containing an amount of oxygen materially less than he has been accustomed to in his native climate, and yet he takes as a general rule, as much food as he was in the habit of doing there—consequently a considerably larger quantity of carbon and hydrogen enters his system than he can expire as carbonic acid and water, and as these chemical combinations are principally formed by the action of the air introduced by respiration, it is easy to understand how it is that in men thus exposed to impaired oxygenization of their bloods, arising from a deficiency of oxygen in the air they are breathing, accumulations of carbon and hydrogen must

take place—and which accumulations result either in disease as indicated by ordinary symptoms, or in an abnormal development of fat; which, however, is not necessarily apparent to the eye, too frequently taking the form of fatty degeneration of internal organs, especially the liver—and also, I believe, to a material extent of the lungs, though the latter organs have not yet been recognized as a common seat of fatty deposit, still from a considerable number of facts which have come under my notice, I am satisfied that they are so,—also, that fat in the form of a lardaceous deposit is very frequently diffused through the lungs and when recognized on post-mortem examination confounded with tubercular matter. Dr. Mouat, in the pamphlet already quoted from, states in his remarks on diet: "Mr. Macnamara in India, and Mr. Gaunt in England, have shown that the results of the over-feeding of men and cattle are nearly identical. The excess of carbon is not consumed, and being deposited in the form of fat in the liver, kidneys, heart, and muscular tissues proves rapidly destructive,"—and to these admitted seats of fatty deposit, as results of defective elimination of carbon and hydrogen from the system, I would add the lungs, feeling satisfied that such, sooner or later, will be recognized to be the case.

The effect, then, of alcohol on constitutions suffering from excess of carbon and hydrogen, derived from a superabundance of food and a deficiency of oxygen, will be simply that of adding so much fuel to the flame; in as much as, alcohol is a concentrated combination of carbon and hydrogen, for which the oxygen of the air has a greater affinity than for the other hydro-carbons of the system, consequently it is the first removed, and the tendency to the accumulation of carbon and hydrogen already existing necessarily becomes materially increased; the results of a continuance of which, being the development of disease, varying in degree from external obesity to the graver forms of fatty degeneration of internal organs.

In an annual report forwarded to the late Director-General of the Army Medical Department, from Western Australia, about three years ago, I drew attention to an impaired condition of the lungs, unaccompanied by any of the ordinary symptoms of chest disease; the existence of which could only be detected on stethoscopic examination, and seemed to depend on a species of hypertrophy of the lungs, resulting from excessive nutrition and defective excretion, as consequences of habits unsuited for the peculiar circumstances under which those so affected were living; more especially the use of alcohol in combination with an over ample allowance of food, and in the report alluded to I made the following remarks in reference to alcohol as a cause of disease, from its favouring defective excretion:—

"Apparent or obscure disease (the latter including morbid nutrition of internal organs) is an inevitable result of defective excretion, and, consequently, whatever causes are likely to favour defective excretion must be viewed in the light of slow poisons, the most common of which I believe to be—the habitual use of diet in excess of the systemic demand, the habitual use of alcohol, and defective ventilation, under which head I include the habit of smoking.

"The use of alcohol is peculiarly obstructive to excretion, not from its inherent poisonous properties, but from the fact of its being taken as an adjunct to an otherwise ample supply of food.

"Amongst those classes of society which are sufficiently fed and clothed science affords very convincing proof of the injurious effects of alcohol.

"Our ordinary diet consists of two distinct kinds of matter, which have been divided into elements of respiration and plastic elements of nutrition—in other words, matter intended for the renovation of our bodies, resulting from the daily waste to which they are liable; and matter specially required for the development of animal heat, produced by the combustion, or rather oxidation, partly of effete matter, and partly of the carboniferous portion of our food. Oxygen, therefore, is not only essential to the production of heat, but to the combustion and carrying off of the effete matter from the system. Alcohol, however, has so strong an attraction for oxygen, that it absorbs it in large quantities, giving out a certain amount of heat, but leaving the effete matter, which should have been carried away, remaining in the blood. This, according to Dr. William Gregory, the distinguished Professor of Chemistry in the University of Edinburgh, is the true origin of gout, calculus, rheumatic, and other secretory diseases.

"The nervous, muscular, and secretory organs undergo a certain amount of waste every day, becoming partly decomposed, and the decomposed portions requiring to be removed from the system, which is done by various methods all requiring the presence and action of oxygen, which, should it not be supplied by respiration, or be diverted and absorbed by alcohol, the decomposed matter must accumu-

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* In a report that I addressed to the convict authorities, in Western Australia, dated 10th January 1857, in endeavouring to prove that the system which then was, and still is, in force in England, of confining prisoners for the first 12 months of their sentences in warm cells in sedentary occupations, and giving them a very large allowance of food, (considerably exceeding that of the soldier in England), was and is productive of several bad results, amongst others of insidious organic diseases, masked by a fallacious appearance of health, as indicated by external fat. I stated, that "Prisoners so confined were subjected to a modification of the treatment which the Strasburg geese undergo, prior to the conversion of their livers into the *paté de foie gras*, namely, deficient exercise, a high temperature and a large allowance of food." I also gave, at the same time, several illustrations tending to show how very common fatty disease of internal organs was amongst convicts who had undergone this mode of imprisonment in England; an instance of which was recorded in the "Times" newspaper a few months afterwards. A convict employed at Portsmouth having died suddenly, and as the medical officer could assign no cause for the death, the coroner directed him to make a *post mortem* examination of the body—when it was found, "that nearly the whole of the internal organs were covered with an enormous quantity of fat, to the extent in some places of two or three inches in thickness. This accumulation of fat was observed also over the whole of the body; causing congestion of nearly the whole of the system, more especially the brain. The jury returned a verdict of died from congestion of the brain, caused by an extreme accumulation of fat."

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late, and be diffused through the blood—and to this defective excretion, resulting from a want of oxygen, whether as a result of a high temperature, an excess of food, the use of alcohol, or defective ventilation,* including the use of tobacco, I believe is attributable the illustrations of morbid nutrition I have brought forward in this report.”

In these general remarks I have endeavoured as briefly as possible to demonstrate the chemico-physiological objections which exist to the use of spirits by Europeans in tropical climates, more especially in those, where other aliments are taken in excess, and which there is no doubt is the case with the British soldier in India, who, while he receives, without any deduction from his pay, a larger ration than he can afford to buy when serving in England, also receives, free, a ration of spirits, which leaves him the greater portion of his daily pay to indulge in further alcoholic and dietetic excesses, and thus, to repeat the words of Dr. Mouat, “speedily attain the condition of a “Strasburg goose, of which disease and death are the “penalty.” The soldier serving in India has thus, I submit, undue facilities afforded him for ruining his constitution (impaired as it too frequently is prior to enlistment), facilities the soldier at home has not, because when the different items he is compelled to pay for messing, washing, and regimental necessities are deducted from his daily pay of thirteen pence, common sense forces the conclusion, that it will be but a very moderate amount of physical deterioration from alcoholic excess, that he will be able to develop on his surplus cash of three halfpence (or twopence at most) per diem, and which (as the most of soldiers smoke) will be still further reduced by what he expends on tobacco. For these reasons, if intemperance is a cause of disease amongst soldiers at home, it results not from what the soldier buys himself, but from what he receives from his friends, and as it has always appeared to me very improbable that soldiers in the mass are able to secure for themselves, such a continuance of liberality on the part of their friends, as can (*per se*) produce any very injurious constitutional effect in a cold climate like England, I consequently have never been inclined to attach much importance to alcohol as a cause of serious disease amongst soldiers in this country; its ill effects, where men are otherwise healthy, being in my humble opinion chiefly confined to individual acts of intoxication, coming (unless when carried to extremes) more under military than medical cognizance.

With the soldier in India, however, I have endeavoured to show that the case is vastly different. There the habitual use of alcohol must be viewed in the light of a slow poisoning process—and as such, there can be little doubt, that indulgence in spirits, whether habitual or occasional (unless when ordered medicinally), should be discouraged as much as possible amongst European troops while serving in tropical countries.

This constitutes my reply to that portion of the query (895) which relates to the physical effects of the use of spirits in hot climates, and I shall now state the conclusions I have formed in reference to the other portion of the query, namely, that relating to the best mode of preventing their ill effects.

* In the report, under quotation (dated 31st March, 1857), I drew attention to the fact, that the health of the company of Royal Engineers, stationed in Western Australia, was suffering from defective ventilation, and that the barrack accommodation was altogether insufficient for the number that were crowded into it. At the same time I urged on the local authorities the necessity for immediately hiring extra barrack room, which recommendation was carried out, and shortly after a fair allowance of cubic feet of air was obtained for the company, the indications of general ill-health, which had become very apparent, not only amongst the men, but amongst the women and children also, (the whole of the company at that time consisting of married men,) rapidly disappeared. Practical illustrations of this nature are useful in demonstrating the frequency with which defects in the general sanitary condition of associated numbers of human beings are liable to be attributed to external, in place of internal atmospheric causes,—and climate and other external influences blamed for what, in reality, results from a defective acquaintance with the natural laws which regulate human existence; and it is not out of place here for me to state, that when I first drew attention to the fact, that the company of Royal Engineers were suffering from defective ventilation, there was an unwillingness in the colony to receive my statement as correct, and the sanitary defects referred to the old-fashioned explanations of “climate and season;” but which alleged causes I pointed out were altogether inadmissible, as the pensioner force (considerably stronger numerically in men women, and children than the other corps) were totally free from those general signs of defective health, which were becoming every day more apparent amongst the soldiers and their families of the engineer company; and which immunity on the part of the pensioners was easily explained, from the fact, that while the sappers (individually), with their wives and children (the latter increasing annually with inconvenient rapidity), were, for the most part crowded into one small room, with defective means of ventilation; the pensioners were chiefly located in barracks, freely ventilated by the sea breeze, and each married man provided with two fair-sized rooms.

A question relating to the best method of obviating the injurious effects of spirits in India, superficially looked at, might be supposed to admit of a ready and brief reply, to the effect, that as spirits are prejudicial to health in warm climates, the best mode of preventing their ill effects is to adopt every possible means of keeping the soldier from them. But such a reply will not meet the case under investigation; the question involving the consideration of three very important points relating to the management of the British soldier in India, namely: the practicability, by any known moral or physical means, of preventing soldiers procuring intoxicating liquors in warm climates; the question of continuing the spirit ration as it is now given to them, in the event of the impracticability of keeping them from procuring it elsewhere being established, and if adopted, leading to a consideration of the means most likely to modify its injurious tendencies; and in the third place, an examination of the question as to whether or not there is a large proportion of men serving in the army in India, whose physical energies are unequal to the depressing influences of the climate, and who would break down but for the artificial and evanescent stimulus which their nervous systems receive from the use of spirits.

1st. The practicability of preventing European soldiers procuring spirits in India is a question involving an acquaintance with the different stations and circumstances generally under which the troops are located, consequently one, which, as I have never served in either the Bombay, Madras, or Bengal Presidencies, that I do not feel myself competent in any way to express an opinion on, and I shall therefore proceed to consider—

2nd. The propriety of continuing the spirit ration, in reference to which I am of opinion, that should it be determined by those capable of forming a judgment on the matter, that it is impossible to prevent soldiers procuring spirits, it becomes a question as to whether the issuing of the ration of rum daily is not productive of a certain amount of negative benefit; inasmuch as, it secures to the soldier at any rate a good quality of alcohol, and may be the means of preventing many of them from purchasing a more injurious form of it in the bazaar, or at other places where it is sold.

If, therefore, on the principle of between two evils choose the least, the continuance of the spirit ration unfortunately should be found unavoidable, the question arises as to the means most likely to prevent—or rather modify, its ill effects, and which my experience of the dieting of bodies of men, living in association in warm climates, leads me to believe will consist of the following:—

(a.) Reducing considerably the quantity of animal food contained in the present ration, and avoiding, as much as practicable, those aliments containing excesses of carbon, such as fat and oily substances. The bulk of the soldier's diet in India should be represented by bread, vegetables, and tea, with a very moderate allowance of fresh meat, varied in its manner of being cooked, but, as a general rule, given in the form of vegetable soups and stews; from the fact of their bulk (owing to the large amount of water they contain) conveying that feeling of sufficiency, without which the soldier will never be made to believe he has had enough,—while their chemical composition is such, provided the animal food is kept within proper limits, as adapts them better for the climate, than less watery and more concentrated forms of food: long attention to the subject, and a tolerably extensive experience, having satisfied me that bulk, to a certain extent, is an essential in the dieting of all bodies of Englishmen, whether in the Baltic or at Singapore, and I do not believe it practicable ever to persuade the soldier serving in India to moderate the quantity of an ordinary English diet to his altered circumstances of life. Consequently, the only course that can be adopted to save him from the injurious effects of excess, is for those intrusted with his sanitary management to provide him with a diet, while from its bulk it pleases his eye, and pretty well distends his stomach, at the same time is so constituted as to be much less likely to favour disease, when combined with the use of alcohol, than the one he is now in the habit of daily receiving.

(b.) By enforcing certain regulations relating to soldiers in barracks, as will insure their making an amount of physical exertion daily, calculated to promote activity in the excretory functions, and, at the same time, so increase the systemic tear and wear as to afford sufficient employment for the nutritive or nitrogenous portions of their food, and thus obviate such a state of matters as Dr. Mouat describes to be characteristic of the ordinary routine of a soldier's life in barracks in India, and which is represented according to the following detail:—“After sleeping through the night “in the very hot close air of the barracks, he rises at gun-“fire and goes to parade, after which he employs himself

"in cleaning his accoutrements till breakfast time—eight o'clock. This meal over, he lies down and sleeps till dinner time, and after dinner he generally retires to his bed again, and sleeps more or less till five o'clock, the temperature of the barrack being frequently as high as 104° F. at that period of the day. About five o'clock he has to prepare himself for parade; this over, he saunters about till half-past nine, and then turns in for the night." This is given by Dr. Mouat, as a picture from nature by Mr. Macnamara, of the ordinary routine lives of the soldiers of the 1st Bengal Fusiliers at Dinapore.

(c) The barrack accommodation to be freely ventilated, and an amount of cubic feet of air secured, amounting to at least double that considered sufficient for the soldier in this country,—conveniences also to be provided enabling urinals to be abolished, where numbers of men are sleeping together, and I would add, as coming under the head of defective ventilation, that smoking should be carefully prohibited in the barrack rooms.

(d) Endeavouring as much as practicable to suppress the habit of smoking; the use of tobacco in the form of vapour, simply amounting to a perversion of the natural purposes of the lungs, which are provided us, chiefly to enable the products of the combustion constantly going on in our systems to be removed, and yet we deliberately pervert their functions, and apply them to the inhaling (in the form of tobacco smoke) of compounds analogous to those that nature is always struggling, through the agency of the lungs, to rid herself of. When it is remembered how fearfully on the increase the practice of smoking is, particularly amongst the young, and how devoted those become to it who have once acquired the habit, I am fully aware how difficult, nay, probably hopeless, it will be, to attempt to wean the soldier in India from his pipe; more especially so long as he sees the same habit indulged in by his officers—and I have for several years back held the opinion, that if abjuring the use of tobacco, constituted one of the conditions under which the young ensign as well as the young recruit, were admitted into Her Majesty's service, there would be considerably less sickness—and less invaliding from warm climates than is now the case, and fewer pale faces, with disordered digestion and functional disease of the heart, to be found amongst the young of our army at home.*

* The practice of smoking is justified by a considerable section of the medical profession on the grounds that it is the abuse and not the use of tobacco which is productive of injurious results. I believe it, however, to be impossible to draw a line of demarcation between them; as the one so gradually and imperceptibly merges into the other, their essential difference existing only in degree. Facts, therefore, which are calculated to prove that a very moderate allowance of tobacco, particularly if indulged in in a warm climate, is injurious, are of importance and not foreign to the question under consideration. The circumstance which satisfied me that tobacco, in what is considered moderation, is productive of a certain amount of physical detriment were the following. From the period of my taking the medical charge of the convict establishment at Fremantle in the early part of 1853, I was struck with the superior health a small section of the convicts, known as "the re-convicted prisoners," (convicts returned to prison for misconduct while on ticket-of-leave in the colony), enjoyed, as compared with that of the general body of the convicts ("probation prisoners");—and, in the first instance, I attributed it solely to the fact that they received only 20 ozs. of bread and 12 ozs. of meat; while the probation prisoners were receiving according to the work they were employed at, 27 ozs. or 33 ozs. of the former, and 18 ozs. or 26 ozs. of the latter daily. When the reduction in the prison diet, mentioned by me in my evidence, came into operation, the re-convicted prisoners were placed on the same allowance of food as the other convicts. I carefully watched the results for several months, and though the difference in health between the two classes of prisoners became by no means so marked as it was formerly, owing to the very great improvement which had gradually taken place in the probation prisoners after their diet was reduced, nevertheless, there was an unmistakable superiority in the general sanitary condition of the re-convicted prisoners still apparent, and which I could account for in no other way than by referring it to the fact that the quarter of an ounce of tobacco which had hitherto constituted a portion of the daily ration of the probation prisoners had always been withheld as a punishment from those of the re-convicted class, as they were similarly circumstanced in all other respects. I was thus led to take up the question of tobacco on sanitary grounds, and succeeded in getting it abolished as an issue to the convicts on the 5th May 1856. The results which followed were these, the improvement in the general sanitary condition of the probation prisoners which had ensued on their reduction of diet became considerably more apparent, and in the course of a few months no difference whatever was perceptible in the relative sanitary states of the two classes of convicts. Experience in the convict establishment having thus placed before me facts that I should not have been justified in discarding, very clearly proving (as indicated by slight disorders of digestion) the injurious effects of the habitual use of moderate quantities of tobacco, I was led to prosecute the inquiry as affecting other sections of the community, and arrived at conclusions satisfying me that the practice of tobacco smoking is one productive of several injurious consequences which creep on insidiously, and may not become apparent for a considerable period; also, that every possible means should be adopted to suppress the habit amongst soldiers, especially when serving in warm climates.

While such measures as those I have now detailed, very probably, if fully carried out, might tend materially to modify the bad effects of spirits in India, my own observation of the results of indulgence in alcoholic beverages in high temperatures leads me to fear that the serving out of a spirit ration is calculated to act as an exciting cause of intemperance, from the intense thirst which very frequently follows the use of both spirits and beer in warm climates: accounting to a material extent, for the very large quantities of the latter which are consumed in India and other tropical countries. In Australia, experience, unbiassed by any temperance theories, has compelled the bushmen and the agricultural settlers generally to adopt tea as the most thirst-quenching beverage, and at the same time the only one suited for those who have to undergo exposure to the powerful summer sun of that continent, in the course of their daily outdoor avocations;—and the substitution of a beverage ration of tea, for the one of spirits, now issued, would be a most important hygienic experiment, fraught with much benefit to the army generally in India, but more especially to the young soldiers on their first arrival in the country, who would thus be saved from the pernicious consequences of the slow alcoholic poisoning to which they are exposed from the first day they land. In reference to this question Dr. Mouat says:—"The practice of issuing 'rations of rum to young recruits should at once cease; 'many a fine lad has been ruined by it.' Than the use of alcohol, from the tendency which it has to cause visceral congestions, I believe there is no more common cause of the sun stroke,† which is so fatal to the British soldier in India.

3rd. In respect to the question, as to a considerable proportion of the army in India requiring alcoholic drinks on medicinal grounds: not from specific disease, but from their physical energies being unequal to the climate, from what I have observed in Hong Kong and other tropical countries, I am inclined to believe that such is probably the case, and consequently that men of this stamp are altogether unsuited for tropical service, and should be sent home and never re-embarked for similar climes; as it is hopeless to

† As having an indirect relation to the question of sun-stroke, it has occurred to me that it would tend greatly to the comfort, and possibly health, of the soldier in India on the march, if he was relieved of the weight of the cartouch box and its contents pressing on one shoulder, by dividing the quantity of ball cartridge, and placing it in two pouches, suspended across each shoulder by belts made of some light material (cavass, for instance, so fabricated as to ensure its keeping flat on the shoulder); the pouches also to be of light material, waterproof, and so shaped as to fit comfortably on the upper and back part of each hip. It may be argued against this proposal, that such an adjustment of the cartouch boxes would interfere with the soldier wearing his haversack; but it need not do so, as it could be worn behind, in place of on one side, as the present custom is. The weight of the haversack also, as now worn, may be, perhaps, supposed to counterbalance the weight of the large cartouch box on the opposite shoulder: but I should not consider this a valid objection to a partial division of ball cartridge, inasmuch as the haversack is liable on the march to much greater varieties of weight than the ammunition box is. No doubt the "reserve ammunition pouch," attached to the bayonet belt round the waist, which has recently been introduced, is calculated to a certain extent to relieve the shoulder from the excessive pressure to which it is subjected when carrying the full weight of the sixty rounds. But in so relieving the shoulder, I believe the inconvenience to have been transferred to a more physically injurious site, inasmuch as it is calculated to compress the waist; and whatever does so necessarily diminishes the abdominal and thoracic cavities, and is apt to favour congestion in the lungs, the liver, and the spleen—morbid states that these organs are very prone to in hot climates, and which, when occurring in aggravated forms, more especially in the lungs, I believe to be one of the chief predisposing causes of sun-stroke. I would therefore recommend all incumbrances round the waist to be dispensed with, and the bayonet and "reserve ammunition pouch" suspended from a shoulder-belt. The cummerbund, or cholera belt, which is frequently adopted by soldiers in India, should be worn loosely; otherwise tight girding with it is open to the same objections that apply to the wearing of the bayonet and reserve cartouch box by a waist belt.

My attention was first drawn to the physically injurious consequences of compressing the waist in men, by observing on *post-mortem* examinations of convicts who had formerly belonged to the labouring classes, and also of old soldiers, the frequency of very remarkable adhesions between the large end of the stomach and the spleen, which a little reflection led me to identify, to a certain extent, with the practice which so commonly prevails amongst the lower orders of supporting their trousers by leather waist belts, in preference to braces: and which practice, from its diminishing the size of the abdominal cavity, may very possibly also be one of the predisposing causes of rupture. This question, as having an important relation to the *hygiene* of the soldier in India, is one that I am satisfied cannot be too closely looked into. The injurious consequences of diminishing the waist in females have been long recognized and generally admitted; and it appears to me reasonable to assert that the physical results will be the same, whether the pressure is applied from a mistaken sense of what constitutes grace in the female figure, or from erroneous ideas on the part of men as to the method of supporting their trousers most consistent with health. The "body belts," also, which the lower orders (military as well as civil) are so fond of wearing, will, when applied too tight, be productive of similar practical results.

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expect men so constituted ever to become acclimatized—in reference to which important question, I have been led to the conclusion, that the system which has hitherto been followed of transmitting bodies of men to India, according as it falls to the lot of a regiment bearing a certain number, to proceed on foreign service has been productive of much practical evil: though I admit, that as the army is at present constituted, it is difficult to see how it can be obviated. I will endeavour briefly to point out the objections to which the system, in my humble opinion, is open.

I. To secure an effective European army in India, the point which appears to me to demand the first and most important share of attention is that relating to the selection of the men in England—my belief being, that those only should be embarked, regarding whom, such an amount of information is on record as to warrant the conclusion, that they are possessed of constitutions sufficiently strong to combat the peculiarities necessarily attendant on Indian service, and which constitutional capacity, I feel myself justified in alleging, is by no means equally distributed amongst British soldiers in the mass.

II. The British army physically consists of two classes of men—the first being composed of those who have been enlisted with constitutions strong enough to have resisted the various morbid influences which have been and will always be to a certain extent inseparable from a soldier's life, and who consequently were *bona fide* healthy men at the period of enlistment—the second class consisting of men whose integrity of constitution has been more apparent than real when enlisted, and therefore whose systems are prone readily to break down under the ordinary routine of a soldier's life, more especially when subjected to the debilitating influences of tropical climates.

III. That such is practically the case, is proved by the records of the service, which show, that, while a large proportion of disease, deaths, and invalidings occur amongst the young soldiers, particularly those under three years' service—a very considerable proportion also, go through their full periods of service, and after bearing the brunt of every climate, as well as the various sanitary defects which have lately been pointed out as having interfered with the health and longevity of the soldier, are still hale and active men, enjoying pensions for years after their discharge—and which fact tends practically to negative the generally received opinion that the soldier's is a picked life.

IV. The result of several years attention to the subject has satisfied me that in a large proportion of enlistments the very opposite is the case, and that one of the chief causes of mortality in the army, more especially among young soldiers, arises from the fact that numbers of men are enlisted with defective constitutions and the victims of latent disease, especially pulmonary consumption—which, however, it is possible, the ordinary routine of military life may be the means more speedily of developing, than might occur if the individual remained in civil life—though I do not consider this by any means certain, when we take into consideration the classes from which our army is recruited and the sanitary defects which characterize their daily habits of life.

V. Thus it is with a regiment ordered to India, it consists of the two classes I have indicated, and though it is the rule of the service, that every man is medically inspected prior to embarkation, the surgeon is not called upon to offer any speculations regarding the probable climatic

qualities of the young soldiers—all he has to do, is to certify that the soldier is "fit to embark," which means that he has no known chronic or acute disease or surgical ailment likely to interfere with his doing routine military duty on his arrival in India—the question of age as respects the young soldier is not considered, and consequently a very large number of men are thus transmitted to India, who only land to succumb to climate and die or be invalided: the seeds of disease laying dormant in their systems, there becoming rapidly lit into activity.

These constitute the chief objections to which, in my opinion, the present regimental method of sending men to India is open, and it has occurred to me that perhaps the most efficient way of ultimately remedying the evils attending it, will be by constituting battalions for Indian service,* to be recruited from the army generally, no men being allowed to embark who have less than five years *bona fide* service, and who must be certified by the regimental surgeons as having shown the general indications of good constitutions during that period.

The discarding of men under five years service from a regiment ordered from this country to India would in all probability be productive of so much confusion as to render it impracticable, as according to the present organization of the army, it might virtually entail the discarding of nearly the whole regiment—nevertheless, notwithstanding the many difficulties with which the question is beset, I do not think, that any soldier should be allowed to embark for India who has less than five years service or more than twelve, and then it should be understood that it is for the remainder of his effective service; because if he is fit at all to embark, with proper care, he ought to be able to complete his service there, more especially, as it is proposed to have a sanitarium out of India, which secures him, in the event of his health failing, a sea voyage and a change to a cool climate.

The constitution of the soldier, however, forms the mere basis of an effective European army. However good our selection of men may be, disease and death, more or less, will overtake them in India, unless, to a certain extent they can be led to adapt their habits to the altered circumstances of climate under which they are placed—habits which many of them may have been accustomed to indulge in in England or our colder colonies with apparent impunity, becoming under the sun of Hindoostan processes of slow, and not unfrequently rapid poisoning;—excess in eating, drinking, and tobacco smoking being three vices in India, that, if the truth could only be ascertained, have sent more European soldiers to their graves, than ever resulted from the unaided influence of climate.

D. F. R.

* Converting the present second battalions into "battalions for Indian service" (as soon as the difficulties unavoidably attending such a change could be got over) would probably form the easiest basis for organizing an efficient permanent European force in India; as the numbers of these battalions might be extended or reduced, as occurrences might demand, and their strength kept up by volunteers (or otherwise), from their first battalion, or from the army generally, according as circumstances might render it convenient. Under an arrangement, such as this, the second battalions of the line would become regiments for permanent Indian service, and be denominated, for instance, "39th Foot (Indian Battalion)," which would thus secure the regimental numbers, and county distinctions of corps being kept up, which must always be desirable in the British army: almost every one of our regiments having its past traditions as stimuli to future deeds.

Lieut.-Col.
R. H. Gall,
C.B.

Colonel RICHARD HERBERT GALL, C.B., 14th Light Dragoons, examined.

896. (*Chairman.*) What is your rank in the army?—I am a lieutenant-colonel, but I have only been in command for about 13 months, in the field, of a wing of my regiment. I have never had the command of a regiment.

897. How long have you served in India?—For about 20 years. I have been at Lahore, at Mhow, and Belgaum, but Kirkee and Meerut I have resided at principally.

898. Is Kirkee a healthy station?—Very healthy. I fancy it is, one of the most healthy stations in India.

899. The most healthy you have been at?—Yes; more healthy than any other. I have been at Meerut, which I also considered a very healthy station, comparatively.

900. Is Kirkee a large station?—No; a very small one. There is generally one regiment there of cavalry; latterly there have been two.

901. Are there other military stations along the same range of country which are in your opinion

equally healthy?—Poona is near Kirkee, but Kirkee has the preference as to salubrity.

902. It would be advantageous, would it not, rather to extend the station there?—I think there might be two regiments by having good barracks at Kirkee, they are very bad now. They will have to dig wells. The water runs dry in some of the wells, and the soil is very rocky; there is a difficulty in sinking the wells, and the expense is considerable.

903. There is a river near, is there not?—Yes, but it is some distance if you want to fetch drinking water.

904. Are the barracks very old ones?—No, not particularly old. I do not know the age of them, but the 4th Dragoons came from another station in Goojerat to occupy Kirkee, and I fancy that the barracks must have been built for the 4th dragoons about 30 years ago.

905. In what respects are the barracks bad?—In hot weather they are very close; they have no venti-

lation, and they are not of any size. Two of the barracks have been recently built afresh. I think two were burnt down; the new ones are decent barracks, but nothing very particular. Generally speaking, the barracks are small and close, and they have no protection from the monsoon, the wind and the rain beat in in the rainy season, during the hot season they are decidedly very hot.

906. Is there not sufficient room provided for the number of men put into them?—They are not as Indian barracks ought to be. I do not consider that the class of barracks at Kirkee are such as any barracks in India ought to be.

907. What should you say are the chief requirements of a good barrack in India?—Loftiness certainly, and good ventilation, but a particular kind of ventilation—not that which depends upon the doors and windows—only not such ventilation as admits of a great deal of thorough draft, and leaves the men exposed to it. There should be sufficient space between door and door, and window and window, to allow the men to be able to sleep without being exposed to a draft. Men should be able to set a table between two beds.

908. They should not be sleeping in the doorway, or in a draft?—No; which from the smallness of the barracks in Kirkee is very often the case.

909. Have the barracks double roofs?—Not at Kirkee.

910. Should you recommend them as part of the necessary provision?—Yes; I think that a double roof is a decided advantage, and a very broad verandah; of course it would involve expense, but such a verandah as the men could walk about in, and perhaps even amuse themselves in some way or other, without exposure to the sun, as that is venomous, would be desirable.

911. Are the stations you have been at generally well drained?—Kirkee is well drained, as there is good natural drainage. It stands on an undulating ground. Meerut is elaborately drained, but the drainage is not good, as the ground is against the engineer. There is a very small rise and fall, and the drains are open; the drainage is so sluggish that it is very often swept down by the hands of sweepers, and nuisances exist connected with it.

912. Of the other stations at which you have been, which is the least healthy?—Lahore is the least healthy station I have been at, I think. I judge from my own feelings, and from the health of the regiment generally.

913. Were you in the old barracks?—Yes. The temporary ones; (those at Meanmeer did not exist.)

914. Those are now no longer used?—I fancy not. I think they could not have been, indeed there were several things connected with them of such a kind, that they scarcely could be allowed to exist, we were huddled together very much.

915. In these barracks, generally speaking, is sufficient provision made for ablution rooms and baths?—In 1853, (I think,) while I was at Meerut, wash-houses were introduced. There was built for each two barracks a wash-house, but it was not sufficient. The men had to come out into the sun to go to the wash-house; and, unless you have one connected with the barracks by a covered way, I do not think it is a great advantage; at least, there not being a covered way is a great objection. A good swimming bath is a great addition to the comforts of the men. It should be very large and deep.

916. That is if you have a good supply of water?—At Meerut there is always any amount of water.

917. (*Dr. Farr.*) From what source is it obtained?—From wells. The water is at no great depth at Meerut. You might sink wells in the sand at Meerut with the greatest ease anywhere. At Kirkee the digging of wells is difficult, but the river is there, and it has been dammed, and the troops have every advantage of that kind. They have bathing parades, and the men are constantly marched down to the river-side to bathe.

918. Are there good means for washing linen,

and so on?—That is a troop arrangement entirely. In every troop or company a man is engaged as washerman, and he engages his own servants, and he washes for the men. The captain contracts on the part of his men for the washing generally. The men pay a certain sum per month, and the captain is the person who is responsible for the payment of the washermen; I think the arrangement is a very good one. The men have no cause to complain whatever.

919. What means have you of maintaining cleanliness in barracks and in camp? Is there any officer specially appointed to watch over them?—The orderly officer in each regiment goes through the barracks every day, and he has to report to his commanding officer that the barracks are clean; that they appear so generally. There is a regulation about it, but I cannot say exactly how often the ceilings of the barracks are cleansed, or when any regular cleansing goes on. There would, however, be an annual committee on the state of the barracks in every station. The barrack floors at Kirkee are of mud; they should be of stone. The custom of washing mud floors with cow-dung is objectionable.

920. Suppose there were nuisances lying about which required to be cleaned away?—Then they would be reported to the orderly officer, and by him to his commanding officer.

921. Suppose you found the drains offensive?—I should report that to my commanding officer: that I had passed through such and such a barrack, and there was a nuisance there.

922. What power would you have to remove it, supposing it required the expenditure of a sum of money?—There are no means of doing it immediately if a large expenditure were involved in the removal. The commanding officer cannot involve himself in any expense, but he would report it to the brigadier commanding the station.

923. Could he deal with it?—That depends again upon the amount. I do not think that the brigadier can go beyond a certain amount, and that a small one; but if it was a nuisance that required to be immediately removed, and not involving great expenditure, there would be no difficulty, for the commanding officer would report it emergent, and the brigadier would issue an order immediately to the executive engineer of the station, “on emergency,” saying, “you will be pleased to do” such and such a thing, “on the request of the commanding officer” of such a regiment. If it was expensive, the executive engineer would have to report it to his superior, and it might be referred further.

924. Are there any printed regulations as to maintaining cleanliness?—There are “station orders,” every officer has a copy of them sent to him, or is bound to make himself acquainted with them. From Poona I had a copy sent to me; they apply generally to all the duties of the station.

925. Have you any authority over the bazaars with regard to cleanliness and good order?—The bazaars are, at a large station, under the superintendence of an official, specially appointed, called the bazaar-master; he is invested with magisterial power, which gives him a great extension of authority.

926. Can he turn out any persons who misbehave themselves in the bazaar?—Yes.

927. Do they sell spirits in the bazaars?—Clandestinely a great deal of liquor is sold; but the bazaar-master's duty is to prevent its being sold to soldiers. No man may sell spirits to European soldiers. Any soldier too found with liquor in his possession would be confined for disobedience of orders.

928. Suppose he detects a man doing it, what can he do to him?—He would have the power of fining him. I will not be certain whether or not, lately, he has the power of flogging; but I know that he has extensive power to punish very severely those who sell liquor without authority.

929. Practically, are those powers exercised?—Decidedly. Any one who has a complaint to make of anything that occurs in the bazaar, makes that

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C.B.*

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complaint to the bazaar master, and he is bound to take notice of it.

930. Where are the camp followers quartered?—Generally at a little distance from our lines, outside.

931. But I presume that they are under the supervision of some officer having authority?—They are still under the supervision of the commanding officer, and anything connected with them would be brought to his notice.

932. Are their cantonments visited and examined periodically to prevent disease or nuisances arising amongst them?—The quartermaster has general supervision of the lines as to cleanliness, and it is his duty in the regiments that I have served in to cart away all rubbish or any nuisance of that kind; daily this rubbish is shot on a particular spot previously fixed upon by a committee under the orders of the commanding officer.

933. The quartermaster would do that if he held the opinion that such and such things were deleterious, but that would depend a good deal upon his own opinion, for one quartermaster might think that want of cleanliness might produce disease, and another might think that it was all nonsense, and could have no bad effect?—Yes, but the cleanliness of the lines is looked to by the quartermaster, and he is held responsible for it. The station orders would direct the quartermasters of all regiments to see to the cleanliness of their lines. In Poona there is an officer called the quartermaster of the week, to whom those matters would be referred.

934. (*Dr. Farr.*) His care extends to the camp followers?—Yes, certainly; and if any nuisance occurred to the barracks in consequence of such camp followers being too near, that matter would be represented by him.

935. (*Chairman.*) Do they exercise any authority as to the women?—The quartermasters do not, as quartermasters; but if they have superintendence of the bazaar the conduct of the women might be brought to their notice: in native regiments the interpreter and quartermaster are one. The commanding officer has authority over all camp followers in his lines.

936. But in order to prevent the venereal disease being spread among the troops, is there any authority exercised over the women?—The commanding officer, and also the person who has charge of the bazaar of the regiment, (in some places it is the interpreter of the regiment,) would see that no persons of improper character were in the bazaar without permission; any such person would be turned out.

937. But with regard to the women, are there any means of preventing them from spreading disease?—I should say none.

938. No attempt has ever been made to do so?—No; that could only be done by medical interference or observation. I know of none.

939. With regard to a woman known to be diseased, would there be any authority by which she could be removed?—The commanding officer would be applied to, to turn her out of the bazaar. In the field, in the case of women causing disturbance and becoming nuisances, I should have taken measures to get them removed.

940. What power have you to get a woman removed?—I might send her to the bazaar-master (at Poona,) who has magisterial authority over all the bazaars and camp followers, and the case would be investigated; he is a magistrate, and he can punish. The Europeans are under the commanding officer. If it was a civil case, which did not come immediately under the investigation of the commanding officer, it might be decided by the magistrate. The commanding officer generally can settle everything in his own regiment, and camp followers are under his immediate control.

941. Is the bazaar-master an European?—Always.

942. Are the bazaars kept generally in pretty good order?—Comparatively very good. Great attention is paid to cleanliness, and they present a favourable contrast with any native town, but where the natives

are concerned there is great difficulty in overcoming their habits; they give offence.

943. What is your opinion of the ration that is issued to the men?—I think it is an ample ration.

944. It is a very large one, is it not, and it embraces a great many materials?—Everything. It embraces meat, bread, and a good supply of vegetables, sugar, tea, rice, salt, and firewood.

945. How are these things issued, is it upon stoppage?—The ration is issued at the rate of three annas and four pies, about 5d. a day in English money. It is stopped from the men; they never see this money, except in the case of back-ration money, returned to them.

946. In England there is a stoppage of 4½d., for which a man gets a bread and meat ration from the commissariat; then there is a ration stoppage, with which he gets his third meal?—The daily rate of three annas and four pice provides the whole ration issued by the Commissariat in India. Any other stoppage is for cooking and such extras as a cook may agree to supply. I think the ration is a very good one, and in the field we even had a pound and a half of meat latterly, which I do not think the men can consume, as meat is often exchanged.

947. They have three meals a day?—Yes. With regard to the ration of meat, they generally make an arrangement with the cook, if they do not like the meat. The captains of troops have the adjustment of this matter. They engage a cook, just as they engage a washerman, to cook for their troops, and the men make an agreement with the cook to supply them with some trifling articles besides attending to the cooking, and if the cook will supply some trifling articles in addition, the men pay him a little more; but that is all done under the superintendence of the officer. For cooking alone the charge is about ten annas per month; for one anna per diem a cook will supply meat for breakfast, milk, and sometimes butter, &c., in addition to cooking. The "large bone" is separated from the meat before it is weighed for issue by the commissariat.

948. What is the usual beverage of the men?—The usual beverage is the spirits they get from the commissariat, and porter.

949. And arrack?—Yes.

950. Do they drink that with water or without?—It is mixed. They are made to drink it with water. The officer is responsible for that.

951. Is it issued to them with water?—Yes, from the canteen.

952. Are spirits sold at the canteen?—Yes, spirits are issued from the commissariat to the canteen, where a man may purchase at the rate of one anna a dram, and he drinks it at the canteen. He is not allowed to drink it elsewhere.

953. Do you think that the spirit ration ought to be continued?—I think it would be difficult to discontinue it for this reason, that there is a very deleterious kind of spirit, which is to be procured all over India at a mere nominal price. It is so cheap that a man may get drunk upon it for a halfpenny, and I think that if the wholesome rum were discontinued entirely, the men would procure the native spirits clandestinely, and the consequences would be bad.

954. Is there much intemperance among the men?—At times, when an issue of money is made to them. One of the issues that I allude to is the "back-ration money." If the rations cost less than three annas and four pies the soldier gets the difference. If they cost more than that sum, he does not pay the excess. But when this money is issued, which it is sometimes, after a lapse of two months, it has accumulated to a rupee or more, and on those occasions he is likely to exceed a little.

955. You have served, I suppose, alongside of native troops?—Yes.

956. Is there any intemperance among them?—They are proverbially sober, generally speaking very

sober men, but they chew opium and smoke intoxicating drugs.

957. Is there sufficient beer issued for the men, or might it be issued as a substitute for spirits?—There is a quart of porter issued and one dram. That is the issue, but if a man preferred porter he could have it instead of his dram. I think the issue of one dram and one quart of porter or two quarts of porter sufficient for any man.

958. Is it of the same value?—No. Porter is three annas, or about $4\frac{1}{2}d.$ a quart, and it is sold cheap to the men. The porter is cheapened expressly, and an allowance is given to the canteen fund of each regiment, about 60 rupees for 100 men drinking the porter, and that serves to cheapen the porter and to exclude the rum, but a man can only get one quart of porter for the price of three drams, they prefer porter generally.

959. Have the habits of the soldier in India, upon the whole, improved?—Yes, I think they have. I may say certainly.

960. And with their habits their health?—Certainly. Their health must improve where there is greater sobriety.

961. Do you think that there is, upon the whole, less mortality and invaliding?—There must be; but I am speaking of places where I have been. I have been in healthy stations, and where great care has been taken.

962. What are the usual means of recreation provided for the benefit of the men?—Cricket, bowls, fives, or hand ball, dancing, theatricals.

963. At what time of the day do they play at those games?—They are not allowed, at certain seasons, to go out and play at games in the sun, but in the winter months, for about four months, they may play at them at any time.

964. Do they resort to the library much?—Yes.

965. And to the schools?—Yes; and they are very good. I judge by the men of the 14th. There are men who have been educated in the schools of the 14th entirely, men who could not write before. The late regimental sergeant-major was, I believe, entirely educated in the regimental school.

966. They have gardens; have they not, at some of the stations?—Yes, and very useful things they are.

967. Do the men take to them?—Yes, and they like them very much. We had flower gardens at Kirkee. I do not think that vegetable gardens are so useful as flower gardens. Flowers greatly amuse the men; there is no labour in the cultivation of them, and I doubt whether they could raise vegetables so cheap as to make it worth their while.

968. Are there workshops provided for the men?—Only regimental ones, and I think they might be larger.

969. Do the men themselves like working?—There was an attempt made some years ago to get up workshops, and reports were sent in, and, from what I recollect, there was some difficulty as to the men setting them up, as they did not like to run the risk of purchasing tools, knowing that they might have to move, and I think the matter dropped for a time, but it would be useful. Men do work as tinmen, curriers, carpenters, and turners, occasionally.

970. Do you think it could be carried out?—Yes. There must be expense at first. You must supply tools and erect a building for them, and take any kind of risk off the soldier at first. He does not like to speculate in the matter.

971. What trades do you think they would undertake?—Regimental trades; the trades of saddlers, tailors, and printing.

972. And shoemaking?—Yes, all work in leather.

973. Have you ever at any time known it to succeed?—I have never known it to be tried; it was mooted at Meerut in the year 1853. Reports were sent in, I was on the committee upon that occasion, and from the evidence that we took, we found that little would be done in the 14th.

974. You never had the means of trying it when

the materials and the tools were provided by the Government?—No.

975. If they did that, could a soldier earn money enough to yield him a profit so as to repay the Government?—I think he might; but there is this danger, that the men who plied these trades would make a certain sum of money, and the question would be how they would spend it; a soldier with a certain sum of money in his hands is apt to spend it ill.

976. Is it not likely that the men who engaged in these trades would be industrious saving men rather, and men of steady habits?—In many cases it would be so, no doubt, but there is that difficulty; it is the only danger that I know of connected with workshops. I have known regimental tradesmen, several of them not very steady men, and the money they made by their trade gave them an opportunity of purchasing liquor. The remedy would be to forbid a man who spent his earnings on drink to work, and grant every reasonable indulgence to the sober and industrious one.

977. Do you think the men save much money; are there many of them who have accounts in the savings banks?—Yes; a good deal is saved in every troop.

978. Is that habit increasing amongst them?—Yes; the number of men who save, I think, rather increases.

979. Are there any verandahs generally, or covered places, or shaded with trees, provided for the men?—There was at Lahore a soldiers garden, but it was a very small place. Generally, there are not.

980. Must not the soldier suffer a good deal from *ennui*?—During a portion of the year it is very hot, and by order they are confined to the barracks, and if they suffer it is from confinement to the barrack, but it is necessary to confine them. The 14th Dragoons were surprisingly healthy at Meerut when the men were confined to the barracks, from 9 a.m. to 5 p.m., during the hot months.

981. Do they move about within the barracks as they choose?—Yes, but they may not go out to walk in the sun. I fancy that that order, strictly carried out, would be that a man is to remain in his barrack, and if he was seen walking out in the sun in the barrack yard, he would be liable to confinement.

982. Have you turned your attention to the dress and accoutrements of the soldier in India?—I think the dress that we had in the 14th latterly in the field answered very well; I think the tunic is admirably adapted for ten months in the year, especially for wet weather, the cloth one; in hot months troops now wear a kind of canvass frock, which I have heard is very good indeed; but generally the tunic is a very useful dress.

983. If it is not too tight?—It should be open under the armpit, and it should be loose in the sleeves; a tight sleeve is objectionable. Flannel should always be worn next the skin.

984. The men, I believe, wear now a different helmet, a wicker one?—It was not so in my time; it may have been so since I left, 13 months ago; we wore on the late campaign the turban and forage cap, we left the shako behind us in quarters.

985. (*Sir R. Martin.*) Do you mean a turban put on over the forage cap?—Yes, bound round it, or a cap expressly made for it; the turban was bound round anything that fitted the head the best, with a flap at the back.

986. (*Chairman.*) With a padded linen cover?—No, merely the ends of the turban. It should be made to prevent the sun from resting upon any particular part, and if it blows about all the better. In my opinion it should be light and not exclude air as well as sun, I have felt a heavy padded flap to be very inconvenient. For the head there can be nothing better than a felt helmet with a peak before and behind, and a white turban bound round it, so as to protect the temples and back of the head, all sportsmen wear this. In the field the hussar boot is preferable to trousers and Wellington boots. In weather at the same time hot and wet a light waterproof cloak, with a hood would be serviceable.

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987. Have you been at any of the hill stations?—I have been at Mussourie, I resided there for six months. I went on private leave.

988. Have you ever considered the question as to how far the troops in India might be, generally speaking, quartered along the high ridges and places of altitude, where there would be a lower temperature, instead of being scattered about in the hot plains?—If it could be done it would of course be advantageous to them to be located in a climate that was much finer than that of the plains: railways will facilitate transport.

989. Do you think that they could be moved periodically into the hills as a relief?—They are now removed periodically. Each regiment to a certain extent takes its turn on the hill stations; as they approach the hills they are sent up. If a regiment was very sickly it might be sent from a distance, however great.

990. Could not that be carried out still further, and large permanent hill stations established?—I think it would be advantageous; the ground about Landour or Mussourie is not adapted for the location of regiments; there is scarcely any ground extensive enough. They are conical hills, but I have no doubt that the health of the troops would be benefited if you could find situations for them at a certain altitude. This is a subject the importance of which cannot be overrated, a considerable body of European troops located on the lower range of the north-western Himalah would not only hold India securely, but it would be prepared to meet at any moment invasion from the north-west, and defend the line of the Upper Indus; were permanent stations established here they would partake of the nature of military colonies: marriage should be encouraged, and inducements held out to settle: children born in those regions of European parents grow up healthy and strong; and, I believe that Europeans generally would enjoy as good health as in Europe.

991. For what period of time are the troops generally kept in one station?—From three to four years. I know of no station except Bangalore that is occupied for more than five. Formerly Cawnpore was occupied for five years by a cavalry regiment, and then that regiment moved up; there were two regiments of cavalry in Upper India, one occupied Meerut, and the other was at Cawnpore; three years is the usual period, and in Sinde two years only, I believe.

992. (*Dr. Farr.*) That applies both to infantry and to cavalry?—Yes, but not to local corps.

993. But not to the artillery?—Yes; they would, I believe, be relieved in the same way. The cavalry, only, occupy a station for five years, and Kirkee might be considered as a permanent station in former years.

994. (*Chairman.*) Why is the time less in Scinde?—The climate is so very hot and unhealthy. I do not think they are more than two years in any one station there. The 78th and 28th regiments suffered greatly in Sinde.

995. Upon the whole it is conducive to health?—Yes; I should except Kurrachee; that is a station in Sinde, but much better than any other, indeed a very healthy one, being on the sea coast, and visited by the south-west monsoon. A change from Kurrachee to any station on the lower Indus would not be beneficial.

996. If you could find elevated stations that were healthy, where the men could be kept, only to descend into the plains for military or political reasons, would not the necessary amount of furlough be diminished, and a great deal of expenditure saved in other ways?—The furlough in India does not involve any expense to the Government by the absence of the officer from his regiment; a certain number of officers must be with the regiment before any one of them can get his furlough on private affairs. I have no doubt that fewer applications for leave would be made if regiments were generally quartered in the hill stations. Here by furlough I understand leave of absence.

997. When an officer comes on furlough to England, who pays the expense of his passage?—If he comes on private affairs he comes at his own expense, but if he comes on sick leave, a subaltern or captain, then an allowance is made to him. I speak of those who serve in one of Her Majesty's regiments, as the 14th dragoons.

998. Which defrays the expense of the passage?—They get their passage money as captains or subalterns.

999. Is the pay continued?—Yes, for six months. If they come under the new regulations which have lately been introduced into India, it is for six months; all officers coming on sick leave receive allowances for that period.

1000. Therefore there is an expense?—Yes.

1001. What regulations are there in the army in India with respect to the marriages of soldiers?—A man cannot marry without the consent of his commanding officer.

1002. As in England?—Yes; if he does marry his wife is not entitled to a certain allowance which is given, of five rupees a month.

1003. Do you maintain the same per-centage as to those who are allowed to marry?—About twelve per cent. are allowed to embark with their husbands for India; it would be about that who are allowed to live in barracks.

1004. Do you think it would be advisable to increase the number to whom permission was given to marry?—I do not think that improvident marriages could result well.

1005. Do many marriages take place without leave in India?—Not many.

1006. Whom do the men marry?—Europeans and natives; they are allowed to marry a native. A native woman receives half the sum that an European would. At Kirkee the married men all lived separately in small bungalows, which are at some distance from the barracks. They do not live in the barracks, with few exceptions.

1007. Why is that difference made with regard to native women?—I suppose on the principle that a native woman can live upon less. She does not require those comforts that are absolutely necessary to a European woman in India. At present there is no sufficient provision for the women in most parts of India.

1008. Have the native women fewer children than English women?—I cannot say, but I should fancy much about the same.

1009. Therefore upon that subject you think that it would be impolitic to increase the facilities for the marriage of soldiers?—I do not think that any good would result.

1010. How do the native wives behave?—Some of them are well-conducted women.

1011. Do they come from India with the men?—Very seldom.

1012. The connexion, I suppose, is at an end then?—If they were married they would have a right to come, but I think that the general result of a man marrying a native woman would be that he would remain in the country, and volunteer into another regiment.

1013. Is there any other point that you would like to refer to?—I deem it desirable that the soldier in India should be provided generally with large barracks, larger in some stations than they are now. I do not think that the barracks in India can be too large, and that if they were built on an extended scale even at the risk of some outlay, in the end it would prove economical. Covered ball courts, and some large buildings in which men might practise single stick, fencing, and gymnastic exercises, are also in my opinion desirable. If workshops were established, an annual exhibition would, I think, be well attended and articles exhibited would find purchasers; but the exhibition should be strictly confined to such as are regimentally useful; the object of workshops is

not only to amuse the men but to furnish skilful artificers who, with little assistance, would supply the wants of a regiment on a distant expedition (in Persia for instance) when communication with magazines, and depôts may be cut off and a regiment thrown entirely on its own resources.

1014. Is there any particular amount of space that you would say ought to be the minimum quantity allowed to each man?—I should say that ten feet for two beds would not be too much. With regard to height 25 feet would be high enough.

1015. Some of the new barracks, built upon the plan of Sir Charles Napier, are very fine, are they not?—Yes. At Hyderabad there are very fine barracks, and I think at Kurrachee. I think that only a few barracks were built on the plan of Sir Charles Napier.

1016. Have you ever been at Allahabad?—No, except when I was very sick, not to reside there, I saw nothing of it.

1017. It is a very large station, is it not?—Now it is, but it used not to be so. The Meerut barracks are very good and quite a model for barracks, speaking generally; not perhaps on so extensive a scale as those at Hyderabad, they are detached buildings.

1018. (*Sir R. Martin.*) The rule that you would apply to the construction of barracks, you would also apply to the construction of hospitals for Europeans?—Yes, in a stronger degree.

1019. (*Chairman.*) Has the soldier any room besides the room in which he sleeps?—No.

1020. No day room?—No, he has the library, or canteen, but no room for general amusement or resort where men would feel themselves perfectly at ease, nor has a private soldier any privacy as non-commissioned officers have; if, however, there were a spare barrack, I have no doubt that the commanding officer would, if the soldiers made any request about it, take care to get it made into a room for them to enjoy themselves in.

*Lieut.-Col.
R. H. Gall,
C.B.*

9 Dec. 1859.

Saturday, 23rd February 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

The Right Hon. Lord HERBERT.
Sir RANALD MARTIN, C.B., F.R.S.
J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.

Colonel GREATHED, C.B.
WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

Captain JAMES EDMUND TANNATT NICOLLS, Madras Engineers, examined.

*Capt. J. E. T.
Nicolls.*

23 Feb. 1861.

1021. (*Chairman.*) At what stations have you served in India?—At Ferozepore, Loodiana, Cawnpore, Allahabad, Agra, Mynpooree, Futtypore, Dugshai, Kussowlie, Subathoo, and Dinapore.

1022. Have you had considerable experience of the stations in the north of India, both upon the plains and on the mountains?—Yes, I have.

1023. What has been the length of your service?—Nearly 20 years.

1024. With regard to any of the stations that you have mentioned, are there any peculiarities respecting them which you think it of importance to mention to this Commission: take them, if you please, in the order in which you have stated them?—Those in the plains are all of one description, the country being perfectly flat with very slight undulations, just sufficient to carry the water into the nullahs which run near. The hill stations are one and all situated on a ridge or spur of a hill.

1025. With regard to the stations on the plains, are any of them surrounded by inundated or marshy ground?—In the rains the station of Dinapore is completely surrounded with water; Futtypore has a few marshes about it; the remaining stations are free from any considerable collection of water.

1026. Are works of irrigation carried out to any extent in the vicinity of any of these stations?—Irrigation is universal in the neighbourhood of the plain stations to a greater or lesser extent, but it is merely sufficient to water the crops and not to produce malaria.

1027. It is not carried so far as to leave the ground for a certain time in a state of marsh?—Nothing of that sort; it is merely sufficient to make the crops grow.

1028. (*Lord Herbert.*) Does the water run?—No, it dries up quickly; for the most part it is drawn from wells.

1029. It is not like an English water meadow?—Not at all.

1030. (*Chairman.*) Are there in any of the stations at which you have been, or in all of them, sufficient natural facilities for drainage, or are any of them deficient in that respect?—Does your Lordship mean underground or surface drainage?

1031. Take, if you please, both?—There is every

facility for surface drainage and none for underground drainage or sewerage.

1032. Do you mean that there are no drains?—There are no sewers; there is not fall enough.

1033. If there is fall enough for a surface drain, is there not fall enough at the same equivalent depth?—Not generally speaking, because when you go several feet down and take a drain any distance, you get below the level of the nullah or river.

1034. (*Dr. Gibson.*) It is always surface drainage?—Yes, as the rule.

1035. (*Chairman.*) What is the method of draining adopted at those stations?—Shallow surface drains.

1036. (*Lord Herbert.*) Are there any cesspools?—No.

1037. How is the ordure carried off?—By hand and in carts.

1038. (*Sir R. Martin.*) Is it used for agricultural purposes?—No, it is buried.

1039. (*Lord Herbert.*) It is merely buried?—Yes, that from cantonments. In the towns there is a curious way of scavenging, the pigs generally performing the duty of scavengers.

1040. (*Col. Greathed.*) Is it not often burned?—Not human ordure.

1041. (*Dr. Gibson.*) It is not consumed in the towns?—The refuse of stables and cowhouses is constantly burned, but nothing human to my knowledge.

1042. (*Col. Greathed.*) Have you not seen it put into a pipe and burned?—No.

1043. (*Dr. Farr.*) Is the mode you have described of disposing of the ordure the one that is adopted round all the stations of the troops at which you have been?—Yes; not for the native population, but for the troops generally there is an establishment whose duty it is to cart away the refuse, and they bury it or burn it.

1044. (*Dr. Gibson.*) What do they do with the urine?—That is all thrown away.

1045. Are there any such things as urinals?—Not except for the troops.

1046. (*Chairman.*) Will you be so good as to state what is the practice followed in selecting sites for stations; what inquiry is made into the local climate and diseases; into the nature of the surface and sub

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soil, the drainage and water supply of the district, and into the other points bearing on the health of the troops?—The necessity for a station having been determined upon, for military or political reasons, a committee is ordered to assemble in order to decide on the eligibility of the ground proposed, and it is the duty of this committee to consider the question fully in all its bearings. Its constitution is two military officers, two medical officers, and the civil officer of the district. The engineer of the district attends the committee, and furnishes a report if called for, and gives his advice. It is a standing order of the Government that if the committee is not unanimous every dissentient member shall record his opinion, with his reasons in full.

1047. To whom does the report of that committee go, or is it acted upon without any further proceeding?—It goes to the Commander-in-Chief through the usual channel, and is decided upon by the Government in communication with the military authorities.

1048. No station is ever established without the direct sanction of the Governor-General and Commander-in-Chief?—No, not as a rule.

1049. Have you known of any exceptions, and if so, will you mention in what cases?—I have not known exceptions, although I think it is very probable that on the first occupation of the Punjab stations may have been temporarily fixed upon without reference to superior authority, and that they may have afterwards grown into permanent ones.

1050. (*Dr. Farr.*) All the early stations, I suppose, were selected without passing under the review of such a committee; for instance, Fort William and other stations?—I should fancy so.

1051. (*Chairman.*) Do you know how long the rule that you spoke of has been in operation?—It has only been in operation, I think, for two or three years.

1052. Therefore, in point of fact, it applies only to the new stations, and the bulk of the existing stations have not been selected by any such careful process?—Just so.

1053. Have you yourself assisted at any one of these committees for the purpose of choosing a station?—I have assisted in selecting sites for buildings, but never for a whole station.

1054. Can you say how far, in the choice of a site, sanitary considerations have been taken into account?—I cannot say; but I think that more or less attention is always paid to this point.

1055. With reference to the stations at which you have served, are there many of them having within sight, or within a reasonable distance, hills or table land which could be occupied as military stations with as much advantage as the present stations?—No, with the exception of Umballa.

1056. Will you take the stations that you have mentioned seriatim, as those with which you are acquainted? Ferozepore is in a plain, I think?—Yes, more than 100 miles distant from the hills.

1057. How is Loodiana situated?—That is now given up as a station, except for a small detachment.

1058. (*Sir R. Martin.*) On account of its unhealthiness?—No, for political or military reasons. It was a frontier station once.

1059. (*Chairman.*) And I presume its importance has ceased as the frontier has extended?—Quite so.

1060. The next you mentioned was Cawnpore?—That is totally out of sight, and a long distance from any hills, and the same remark applies to Agra, Mynpore, Futtypore, Allahabad, and Dinapore.

1061. (*Dr. Farr.*) These are all upon the rivers?—Yes, with the exception of Mynpooree and Futtypore.

1062. (*Chairman.*) In point of fact, as you go up the great valley of the Ganges, there are no hills within any moderate distance of the existing stations?—There are not.

1063. Do you know of any instance in which military reasons have overborne considerations of health in the selection of sites, where a site notoriously un-

healthy has been occupied, it being considered a necessary measure of military precaution?—No. On the contrary, I have known a large military station given up for its unhealthiness.

1064. I have asked you what is the course of proceeding in choosing a station; will you now state generally to the Commission what is the mode of constructing a station as regards boundary, enclosures, arrangement of buildings, and so forth?—A station is generally marked out in the form of a rectangle, the longer side facing the prevailing wind. On the side towards the prevailing wind the parade grounds are marked out so as to allow the air in front of the barracks to be as pure as possible, and to keep the cultivation at a distance. Next to the parade come the barracks, generally in two rows in echelon, the rear row occupying the intervals between the barracks and the front row.

1065. So that they flank each other?—So as to allow each barrack to get the full benefit of the wind. In the rear of the barracks are the out-offices, cook houses, and privies; in rear of those the various other buildings, such as canteens, schools, racket court, and so on. On the flank, in an airy situation, is the hospital, and in rear of the buildings for the men are the subalterns' bungalows; in rear of those the captains; and in rear of those the field officers and mess. The bazaar is sometimes in rear of those, and at other times on the flank. The ground round all the barracks and public buildings is perfectly unenclosed, with the exception of the hospital, which generally has a low or sunken wall. The officers' bungalows are always surrounded with walls, generally low. In the new stations, such as those in the Punjab and Umballa, there is great regularity; but the older stations are very irregular.

1066. From the description you have given it would appear that the object most aimed at is to secure ample ventilation?—It is.

1067. Military defence is apparently not considered at all?—It has not been hitherto.

1068. Is there any examination made as to the nature of the subsoil, the quality of the water, and the means of drainage?—No; there is no particular examination; these matters do not vary much in near localities.

1069. (*Dr. Farr.*) At the stations in the plains?—Yes.

1070. (*Chairman.*) In the valley of the Ganges they do not obtain a change of soil or a change in the quality of the water, except by going to a great distance?—Not without going out of it.

1071. With regard to the water, is there, to your knowledge, any complaint made of the quality of the water, or the difficulty of obtaining it?—The water is very much the same throughout. It varies in distance below the surface from about 20 feet to 70. All the water for troops is taken from wells.

1072. We may take it, I suppose, that all your later answers refer to stations on the plains?—Yes.

1073. With regard to the hill stations, I suppose there can be no attempt at regularity of building? It is necessary, I suppose, to follow the fall of the ground?—Quite so; the building space is so restricted that there is necessarily not much room for selection.

1074. And the object of getting as much air as possible is not there considered equally important?—That depends a great deal upon the height of the station and its position. If it is very much exposed it is often a consideration to get the barracks somewhat sheltered; but if the station is comparatively at a low level, the object is to get the barracks in a position of prominence, with a free circulation of air all round.

1075. I think you said that there is no drainage?—There is none.

1076. With regard to the removal of impurities, all that, you say, is done by hand?—Yes; and by cart.

1077. Therefore what drainage there is is merely to carry off the rain water; the surface water?—Yes.

1078. Will you describe the usual privy or latrine arrangements for barracks and hospitals. Are cesspits permitted within barracks or cantonments?—The privy hitherto has been a detached building with a row of masonry seats, with openings through the rear wall to admit of the ordure being taking out that way and put into the carts. The most recent arrangement is to have a wooden seat running the whole length with metal vessels underneath, and at certain periods those vessels are removed through openings in the rear wall, and emptied of their contents which are carted away. I have never seen cesspits but once, and that was at Dinapore.

1079. (*Dr. Farr.*) Were they common at Dinapore?—They were the only arrangements for the barracks at one time, and appeared to have affected the quality of the water in the wells nearest to them, so much so, that the wells had to be shut up and disused.

1080. (*Chairman.*) Have you ever known nuisances arise from the usual arrangements as you have described them?—No, on the contrary, in the Fort of Agra, during the mutiny, where 3,000 or 4,000 people were congregated, the arrangements, which were such as I have described, were so effectual that no disagreeableness was felt. You might have lived next door, or even been taken blindfold into most of the privies, and not have been aware of your neighbourhood.

1081. What provision is made in the stations for washing rooms and baths for the men?—The regulation is to have plunge baths for both men and women, and also ablution rooms in separate buildings. Urinals are generally attached to the ablution-rooms, so as to facilitate their being cleaned by means of the water that has been used in washing.

1082. In the stations you have mentioned are the buildings generally one or two stories in height,—the barracks and hospital buildings?—All of one story.

1083. What are the usual materials used in their construction?—Brick and mortar, or brick and mud for the walls, and chunam floors, thatched or tiled roofs, and sometimes flat roofs.

1084. Are the buildings usually raised off the ground?—They are generally about a foot and a half or two feet, no more.

1085. The chunam floor, as I understand it, effectually excludes damp?—It does.

1086. Does the air pass underneath the floors so as to cut off damp and malaria rising from the ground?—No, there are no means to allow it to do so.

1087. Are there arched basements, or what is the form of the construction?—The space below the floor is filled in with earth or bits of broken brick, and over that the floor is put.

1088. With regard to the materials, do you consider that the materials actually used are as well adapted as any that can be obtained on the spot?—They are.

1089. In point of fact are they the ordinary materials used for building purposes?—Yes.

1090. Are there any other materials attainable for general purposes?—No, except at a ruinous cost.

1091. What form of construction is adopted for keeping the interior cool besides that which you have mentioned, of the exposure of one face of a building to the prevailing wind?—There are double verandahs, and a large number of openings with punkahs and tattaies.

1092. Are double roofs commonly used?—No.

1093. (*Sir R. Martin.*) You would, I suppose, very much recommend a double roof on the principle of the double window used in Europe, which excludes heat, cold and sound, to carry off the heat of the sun?—It would undoubtedly make a building much cooler.

1094. (*Chairman.*) Can you suggest any improvement in the general arrangements of the buildings of stations, and in the materials, plans, and construction of barracks and hospitals?—I think the

general arrangements are good, but I think that improvements can probably be made in some of the details of the construction of barracks and hospitals. I am not, however, at this moment prepared to make any detailed suggestion.

1095. Would it be possible, in your judgment, to adopt a uniform system of plans and construction of barracks and hospitals for the whole of India, varying the materials in different localities?—Yes, as regards buildings in the upper provinces, subject of course to trifling alterations, in fact the Government of India has already issued standard plans for adoption as far as possible throughout the country.

1096. When was that done—within the last few years?—It has been going on for very many years past; but within the last few years a revised set of plans have been issued.

1097. (*Dr. Farr.*) Do you think that those plans are the best that can be adopted now in India, in the present state of engineering science and architecture?—I do, subject to the exception noticed above (Quest. 1094).

1098. Can you suggest any improvements in them?—I am not prepared to do so at this moment.

1099. (*Chairman.*) With regard to the question of water supply, can you suggest any improvement in the manner of obtaining, storing, and distributing the water?—I do not think that there can be any improvement made as regards stations in the plains; but there is great want of an efficient arrangement for the hill station, where the water is often a long distance between the ridges on which the barracks are built, and has to be carried by a long winding path on mules. This matter is, and has been, receiving great attention from the Government of India. It is important financially, as well as in other respects, as the cost of the mule establishment is very large.

1100. (*Dr. Farr.*) Do you think that well water is the best water that can be obtained?—Yes, in the plains.

1101. Have you examined it chemically?—No, I have not.

1102. Are you aware that it is generally very impure in the plain stations?—I am not.

1103. (*Chairman.*) Are you aware of any means that have been used for purifying the water when it has been unwholesome?—The water is always filtered, but I am not aware of any other means being employed as a rule.

1104. With regard to the arrangements you have described as to the latrines and privies, do you conceive that no improvement could be introduced into that?—I do not think that there is any better plan than that now in use of carting away and burning or burying all refuse matter of all kinds, whether from privies or elsewhere.

1105. Is that done daily or twice a day, or how often is it done?—It is done daily.

1106. Have you any improvement to suggest in the sanitary police of camps and stations generally?—None.

1107. Is there any other information or suggestions that you can offer to the Commission on the subjects contained in the paper which you have seen?—No.

1108. (*Sir R. Martin.*) Have you served a considerable time in the mountain ranges in your official capacity as an engineer officer?—I have been there about three years altogether.

1109. Do you consider the ridges and spurs of the mountains which you have mentioned favourable or otherwise for the preservation of European health?—Decidedly favourable.

1110. Generally speaking are there not in the rear of the ridges and spurs you have mentioned elevated positions having greatly less rain fall, and being therefore better suited for European occupation than the front spurs?—Such situations undoubtedly exist, and would be far preferable to the outer ones, as regards health, but I cannot speak from personal knowledge of any.

1111. The station of Chenee in the Himalayas is

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one of the nature that I have referred to—are you acquainted with that personally?—No.

1112. But you are aware of its advantages?—I know that it has a most healthy situation, and vastly superior to those nearer the plains, and it is such that you can almost choose any climate you may wish, from considerable heat up to perpetual snow, by merely ascending the mountain.

1113. Must not the relatively advanced position of many of the hill stations result in their having to bear the brunt of the south-west raining monsoon with an excessive rainfall?—I should think it was so. But in my opinion one of the greatest disadvantages in the hill stations is the force of the monsoon to which they are exposed; the clouds are continually hanging about them; they disperse and reform again very quickly; and at one moment you may be in sunshine, and feeling inconveniently warm, and shortly afterwards you may be in a cloud, experiencing a considerable chill.

1114. That description would not apply, would it, to the stations in the rear which I have mentioned?—I do not think it would.

1115. (*Dr. Gibson.*) Why not?—Because the fall of rain is less. There is a certain point in the ranges where you are almost above the rain; at Chenee, for instance, or part of it, you get above it.

1116. (*Col. Greathed.*) How far is Chenee from the plains?—More than 100 miles.

1117. (*Sir R. Martin.*) The injurious consequences of selecting a front mountain station were especially found in Assam, in the Chirra Poonjee range, were they not, where the rainfall is counted by fathoms?—I have no personal acquaintance with that part of that range of hills.

1118. But you have, I presume heard of them?—Yes.

1119. Taking the hill stations on the average, will not the approaches by roads be made altogether under Government direction, supposing you selected a new station?—Certainly.

1120. In finding a new hill station, would it not be an advantage, on the score of military and medical police, to restrict the number of such approaches from the plains, and not to have too many of them?—I do not think it would be of such advantage as to counterbalance the other benefits derived from roads.

1121. Suppose that such communications were restricted to one or two roads, having sentries upon each of them; would you not, by such means, greatly impede the introduction of syphilis, and also of the injurious prints which are manufactured and sold in all the bazaars of India?—Not to any great extent. The population round about the hill stations are quite independent of the roads; and if it is worth their while, the want of a road would not stop the introduction of liquor, or of anything else.

1122. Not even where the approaches were very precipitous?—I do not think that the nature of the hills is such that a road or two more or less would materially affect the matter. Where there are no roads there are generally pathways, up which liquor or women could be brought, without any very great additional difficulty.

1123. As compared with other cantonments in the plains, surely there would be greater facilities for exclusion by such a plan as I have referred to?—Compared with the plains there would be.

1124. You are aware, I presume, that great difficulties are found in the other cantonments to arise, from the impossibility of establishing any system of military or medical police, which shall prevent the introduction of what I have referred to?—Yes.

1125. What description of barrack or hospital would you recommend on a mountain range, under trial as to climate; would you recommend the huts of the country, or brick and mortar structures?—I should think that temporary constructions, as huts, but not the huts of the country, should be made in the first instance, so as to give the locality a fair trial.

1126. Do you think that those huts would be

proper for such positions?—I should think they would.

1127. (*Dr. Gibson.*) Would not the troops suffer during the monsoon season in such kind of buildings?—I do not think they would for a short time; the huts would be air-tight.

1128. (*Dr. Farr.*) And water-tight?—Yes.

1129. (*Sir R. Martin.*) If the roofs were constructed on the principle of the double window, so as to carry off the redundant heat of the sun, it would be an advantage, would it not, to have iron huts constructed upon the double roof principle?—In the hills?

1130. Yes?—I scarcely think it would be necessary, the heat there not being sufficiently great to require it.

1131. But on the plains you think it would be necessary?—Yes, it would be very advisable.

1132. (*Dr. Farr.*) Do you think that the present hill stations are not the best that might be selected in a sanitary point of view?—A better climate could undoubtedly be found further in the interior.

1133. At what distance from the existing stations could that better climate be found?—At a very considerable distance.

1134. At what distance?—I dare say 60 or 70 miles. It is the great distance, and the expense of buildings, roads, and transport, that has kept the hill stations so much on the outer ranges.

1135. Then such a place would not be accessible at present by roads?—Most likely not.

1136. Roads must be constructed?—Yes.

1137. At great expense?—Yes, most probably.

1138. If that difficulty could be got over, and the troops were stationed there, would they, in your opinion, be equally serviceable for military purposes?—They would be so much removed from the scene of action.

1139. (*Chairman.*) The objection to their going further into the hill ranges, assuming the roads to be made, is that the distance would be greater to bring them into action, and greater to take them back, and the expense of conveying provisions and necessaries of every kind would be enormously increased?—It would.

1140. I presume that in the interior of the mountain ranges no supplies could be obtained, except those that are brought up from the plains?—The greater part of the supplies would probably come from the plains.

1141. (*Col. Greathed.*) Do you know of any station in the Himalayas where a regiment of soldiers could be exercised with ease and freedom?—No. Such positions would be on the low levels, and to be objected to on considerations of health.

1142. (*Sir R. Martin.*) But they can be brought down on to the plains during the cold season for exercise with facility from all those stations?—At present they can, and this is now done.

1143. (*Col. Greathed.*) Have you ever heard that the men in the hill stations in the Himalayas become excessively wearied from inaction?—Yes, and I believe they dislike those stations for that reason.

1144. (*Dr. Gibson.*) Do the men prefer the stations on the plains to the hill stations?—I think they do generally, and I imagine greatly for the reason which has just been mentioned that liquor is more accessible, and debauchery and that sort of thing more common. In the hills their movements are more fettered by the want of roads, and the impossibility of moving except on a road.

1145. (*Chairman.*) At most of the existing hill stations, I apprehend, there is only one or two roads on which it is possible to go backwards and forwards at all?—At a station itself there are generally four or five roads, and leading into it one or two.

1146. (*Dr. Gibson.*) In the higher ranges is there ground in which vegetables can be grown?—Yes; vegetables could be cultivated to any extent required for troops, and the cultivation in the hills throughout being carried out in terraces, there is no absolute necessity for having flat ground.

1147. (*Dr. Farr.*) Then ultimately in those stations which you think so desirable, they would be able to grow vegetables enough to supply the troops?—Yes; any necessary amount of the best English fruit and vegetables, I have no doubt, could be grown. Hill potatoes are excellent.

1148. Could they get cattle and other animals to supply them with animal food?—They would have to be imported from the plains.

1149. But alternately could not sheep and other animals be raised on those high mountain stations where the climate is so agreeable?—They could undoubtedly be raised, but I am not prepared to state in what quantity, or whether it would be worth while to do so.

1150. (*Dr. Gibson.*) What is the nature of the present herbage on the hills and in the interior? Does grass grow on the surface?—Yes; to a great extent.

1151. (*Col. Greathed.*) Is there not a poisonous

The witness withdrew.

Dr. JOHN McLENNAN, F.R.C.P., Physician-General, H.P., Bombay Army.

1154. (*Chairman.*) Will you state how long you have served in India?—Thirty-one years.

1155. How long is it since you have left India?—Six years.

1156. Have you served with Queen's troops, with local British troops, or native troops?—I have served with all.

1157. In what presidencies, and what stations, have you served?—In the Bombay presidency, and principally at the presidency town; that is to say, I have served for 27 years out of the 31 in Bombay. The others I can mention in their order. I was at Matoungah six months, in the Persian Gulf nine months, and in Poona 15 months, at Malligaum two years, and in Bombay 27 years.

1158. Will you describe the stations at which you have served with reference to their healthiness or unhealthiness?—Four years after I left Matoungah it was abolished as a station principally on account of its unhealthiness. The Persian Gulf, in reference to healthiness, varies with the seasons, and it has likewise varied much in different years. At some periods fever and cholera have greatly prevailed among the European residents and visitors there, and also in the crews of ships lying in its roads and harbours, and in consequence of the great heat of its hot season, the evils arising from high temperature are frequently experienced. Poona is a healthy climate, and Malligaum tolerably so; but formerly, 30 to 40 years ago, the outposts in Candiesh occupied by detachments of the native regiments serving in Malligaum were most deadly. Since then, however, they have been withdrawn, or reduced, and the duty has been taken by men of the Bheel corps, who have suffered less than sepoys of the regular native army. Bombay may be described to be an island consisting of two somewhat parallel ridges of volcanic rocks of slight elevation, running in a northerly and southerly direction, containing between them a level plain of sand and shells overlying argillaceous shale, of about two miles in width. On this plain, and on ground sloping slightly to the eastward, is situated the native town and the habitations of $\frac{2}{10}$ ths of the population. The houses of many of the European and wealthier native inhabitants are on the heights Colaba, an island close to and formerly separated from Bombay by a narrow ferry, though now joined to it by a causeway, is a long, narrow, rocky strip raised a few feet only above high water mark. Here are barracks and an hospital, &c. for one European regiment, though, for years back, only occupied by a weak wing, relieved yearly. Here, too, is the depôt for Her Majesty's troops, generally used as a quarter for a few weeks only in the cold season by the unfits previous to their embarkation for Europe. In the fort there are the town barracks, used of late years only for the garrison band and some weak ord-

grass in the Himalayas which is very apt to poison a whole flock of goats at once?—There may be, but I never heard of it. A medical officer told me once that the water supplied to most of the stations was collected from ground in which many poisonous plants grew, and he thought it had imbibed a certain amount of their poisonous qualities; and his suggestion was that the water should not be taken from the surface, but that the hill should be excavated for some distance and the water taken more from the inner part of the hill, where the springs were.

1152. The water is collected in tanks, and the troops are not supplied with it from wells?—They are supplied from springs; there is generally a small reservoir for the people to fill from, but it is constantly running water. It fills from the spring, and the surplus, if any, flows out.

1153. Then the surface water would run into that?—It runs down into the valleys, and goes into the drainage of the country.

nance details, and properly disused, too, since they are close to the bazaar and main street, and with very imperfect separation from both. Hence it was scarcely possible to repress irregularities. Fort George, an outwork of the Bombay fort, contains barracks and an hospital, &c., for a regiment; but of late years it has been occupied by a weak battalion of artillery only, rarely consisting of more than one or two companies; and in the cold season, for a few weeks, by the unfits of the local European army before they embarked for England. From the previous description, it will be apparent that the soil opposes no obstacles to drainage, although the very slight fall does, and thereon depend some of the most important sanitary defects of Bombay. Its average temperature is about 80°, average daily range of thermometer 11°, average yearly fall of rain 70 to 80 inches, occurring generally in from 80 to 100 days in the months of June, July, August, September, the S.W. monsoon. Sea-breezes only, prevail in these months and for more than half the remainder of the year; so that on the whole it may be said they blow for 19 hours, while the land breezes only prevail at the rate of five hours. Bombay is unhealthy both for European and native troops, and also even as regards the native community; but to answer this question properly would require time and space, and much information thereon can be got from the public records of the medical department, as also from the Transactions of the Bombay Medical and Physical Society; and as to its native civil population, from Dr. Leith's most valuable Mortuary Reports for the last ten years, published by the Government of that presidency.

1159. Are there any sources of dampness or malaria within, or in the neighbourhood of these stations you have described; if so, will you state what those sources are?—As such sources affecting the locations of the troops in Bombay, there is the ditch around Fort George, and on the esplanade face of the fort generally, and also the abominable nuisances on the beaches not far from Fort George, and the town barracks, and lines of the native troops. The beach nuisance, in a slighter degree, affects one side of Colaba, and there perhaps chiefly, because the tide does not so completely cleanse, or sweep the beach, of Back bay, as at other parts of the circumference of the island. The bad drainage of the greater portion of the densely inhabited part of the native town of Bombay (on the flats, are grown crops of rice during the monsoon); the improper disposal of the dead; the filling up of cavities, and raising the level of parts of the island by foul dung-heaps, and the use of cess-pools, must all be fertile sources of malaria; at least, as affects the civil population. Moreover, there are extensive salt-marshes on the neighbouring island of Salsette, which are shown by Dr. Leith, in the Mortuary Reports previously alluded to, to have a preju-

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dicial effect on the health of those divisions of Bombay island most adjacent to them.

1160. Is the subsoil dry, or damp and undrained?—The subsoil of Bombay could be better drained; it is not so well drained as it ought to be; the slight fall opposes an obstacle to it.

1161. Is there any portion of these stations, or of the vicinity, subject to flooding by overflow of water?—During heavy monsoons, and when much rain falls for many successive hours, portions of the esplanade of Bombay, of the flats, and even of small portions of Colaba, are flooded, but generally do not remain so for any long period; it is mere surface water.

1162. Probably that temporary flooding is rather beneficial than otherwise in removing nuisances?—I think so; I do not think it is prejudicial.

1163. Are the latrines, urinals, ablution-houses, and washhouses sufficiently drained to remove their contents to a distance?—The latrines of the barracks of Colaba and Fort George project into the sea, but their deposits are not sufficiently removed. The Medical Board of Bombay, writing of sanitary matters, in July 1854, stated, "It cannot have failed to be noticed that the habits of the native inhabitants of Bombay are very different from those of the inmates of barracks, or from those of the residents in European towns, who all resort to privies, &c., while in Bombay they resort daily, by thousands, to the beaches and to open places, and scarcely any part of the island is quite free from disgusting smells from this cause, while the sea face of the Fort, and the beach in Back bay, are really enormous and most abominable necessities, washed over; it must be added, by the tide twice daily." In respect to the urinals, ablution-houses, and washhouses of the civil community, there were none public in Bombay, of which I was aware, and the drainage from those in private dwellings passed into what was termed the main drain, which, from its slight fall, may be described rather as an enormous open cesspool, which constituted a monster nuisance, not, however, affecting any barrack, the outlet to which, moreover, being below low-water mark, did not prevent the partial influx of sea-water, which added to the other sufficiently noxious and impure exhalations. On the open beach, close to the outlet of the sluices of the main drain, the night soil from some public necessities, and from the Jemsetjee Jeejeebhoy Hospital were deposited, and rendered the vicinity most disgusting.

1164. From your description it would appear that there was a deficiency in the police regulations, as much as a deficiency in sanitary accommodation?—Yes, there is very great difficulty; unless the soil were burned, I believe it would be almost impossible to get rid of it; it is taken out to sea and washed back.

1165. Did you consider that the drainage of the station, taken as a whole, was sufficient for health?—Certainly not, at the time I left India, previously to 1855.

1166. Is the water supply in a satisfactory condition?—The water supply is now abundant and good; it is brought into the town from Vehar in Salsette; but is not laid on into the houses yet. The tanks and wells were at all times regularly cleaned out, and were free from vegetation and decomposing organic matter. Tanks in which there might be danger of contamination from infiltration of impure fluids were appropriated for washing purposes, and for watering the roads, &c. Attention was paid to that.

1167. Could you suggest any improvement with regard to the water supply generally, as to the sources from which water is derived, the means of storage in use, and the means of distributing it?—The Vehar water will, in future provide for all wants.

1168. Do the arrangements made include the laying on of the water into private houses?—They do, I understand; but that has not been done yet. The water is brought into the city, but it has not yet been laid on to the houses.

1169. Will you describe to the Committee generally the construction of the barracks, and the materials with which they are built, also the usual construction of temporary huts and tents used for barrack or hospital purposes?—Throughout the presidency permanent barracks are generally built of brick, with tile roofs. Temporary barracks are built of wood cadgans and matting, with thatched or cadgan roofs. Tents, when pitched for troops, in lieu of temporary barracks, are generally placed under a thatched or cadgan roof, and at times have partial mat or cadgan walls. On Colaba the barracks are of plastered bricks, with tile roofs and stone floors; in Bombay, of the same materials, excepting that the upper stories have wooden floors.

1170. Are the floors raised above the level of the ground, and if so, how much; or is there a free circulation of air beneath?—Floors are generally raised from one to four feet; but it would doubtless be better that they should be raised on arches, which might be made so high as to permit the space beneath to be used as a place of assembly, or for amusement and work. There is generally a free circulation of air within the building, a matter of great importance in hot climates. I have known floors in the Colaba barracks and hospital to be damp. I have known a temporary barrack to be temporarily more unhealthy than the rest, from damp, in consequence of insufficient protection on its weather face, as also in another from defects in its sub-drainage.

1171. Then there is not a free circulation of air, as I understand you, beneath the floors?—There are two upper-storied hospitals in Bombay, which are raised on a ground floor, and where there is a circulation of air below; but generally in the Bombay presidency the hospitals are built upon a solid substratum; the windows are like lofty venetianed and glazed doors down to the floor, and there are openings above; but there is no circulation below the floor, which is solid, or in some cases there have been air-channels permeating the space below the flooring, and with gratings opening into the apartments; but I believe they were not found to answer; refuse, and fragments of meals, &c., have been thrown in by the gratings, and soldiers are often careless and thoughtless in such matters. I rather think it was doubted whether it was much to be desired to have such mere channels for circulation of air. Raising them on arches is doubtless the best.

1172. What is the number of cubic feet usually allowed per man in the barracks with which you are acquainted?—1,200 cubic feet are the regulated amount. I do not doubt that it may be less than that now, since so many troops have been added. I extracted from a report that I saw, the number of European troops in the Bombay presidency in 1858; viz.,—

Cavalry	2,287
Artillery	2,881
Engineers	273
Infantry	13,270
Total	18,711

and there must have been much deficiency lately; but 1,200 feet are the regulated amount. When I left, all the barracks were being made to afford 1,200 cubic feet per man, for the strength to be quartered there.

1173. The departure from that rule, I presume, was during the mutiny?—Yes.

1174. Can you state what is the superficial area of floor which is allowed to each man?—I do not recollect exactly; but there was space between the barrack cots, and a considerable space between the two lines of cots on either side.

1175. Are double roofs in use?—I have not seen any.

1176. Are the side walls sufficiently protected by verandahs?—I should say generally so. The verandahs were from seven to 12 feet wide.

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1177. Have you known the verandah itself used for sleeping accommodation for the troops?—Yes.

1178. Do you think that is a healthy or an unhealthy practice?—Supposing the centre ward of an hospital to be full, it is unhealthy; but I have often taken men from the centre ward and put a few in the outer verandah, for the sake of obtaining greater coolness and openness; but to use the verandah in that way as sleeping accommodation habitually is bad.

1179. Generally speaking, is there enough of shade in the stations to enable the men located there to take exercise in the heat of the day?—I think not, generally speaking.

1180. According to your experience, in what manner do the men generally pass their time during the heat of the day?—I am afraid only in the barrack rooms, and in the canteen, or on the parade ground, and fives court at play.

1181. What means of ventilation are used in the barracks?—The buildings are very open, with ventilators frequently all along the roof.

1182. Are punkahs employed?—In a few stations only—some five or six in hospitals. In some barracks, I think, an allowance is given for that purpose; but a small one.

1183. Are thermantidotes, or any other contrivances of that description, used for cooling the air?—I think not; they may be used in Upper Sind.

1184. Are they used in the hospitals?—I think they may be in a few.

1185. In what condition have you found the air of the barrack rooms at night?—At times, in the cool weather, close. Soldiers will shut themselves up.

1186. Have you any suggestions to make as to any improvements in the materials, or form of construction of the barracks, and barrack and hospital huts and tents, or in the ventilation of barrack rooms, and in cooling the air in them?—No.

1187. You do not consider, perhaps, that upon the whole the existing barracks in these respects are very defective?—I think, as a whole, that the barrack accommodation in Bombay is very deficient; but I think much is done when it can be done, and that one very rarely meets with authorities who are more ready to do all that is wanted, or more active in doing it when they can.

1188. (*Dr. Gibson.*) But still you think the barrack accommodation is not in a high state of efficiency?—I think that the barrack accommodation in Bombay is not good. There are superior new barracks in Sind and Poona.

1189. (*Chairman.*) Have you anything to state with regard to the sanitary state of guard-rooms, as to ventilation or overcrowding?—Generally speaking, the guard-rooms are in a good condition, and I have not known of their being overcrowded. The guard-rooms I have seen have been good.

1190. With regard to military prisons, what is the sanitary condition of them as to the cubic space allowed to the prisoners, and the drainage and ventilation?—I believe tolerably good; but they are dark, and without many free openings, and in some places they are insufficiently protected by verandahs, and are consequently hot, which should be corrected, there being a verandah only on the front face, but not on the three other sides.

1191. Will you describe to the Commission the means of personal cleanliness that are provided in the way of ablution rooms and bath rooms, existing at the stations which you have described?—I think much remained to be done to make the soldier as comfortable as he might be made in such matters. At some barracks it appeared to me that expense had been gone to to make a plunge bath, which had not been so constructed as to be inviting in appearance, being both dark and damp, and with an insufficient supply of water. I allude now to that of the horse artillery at Poona. In the Ghorpoorie barracks, at the same station, there was an excellent one in constant use. I think if they were more cheerful and

open, not so dark, and had fresh water frequently supplied, the men would very uniformly go to them.

1192. Is not the darkness a means of keeping the water cool?—It is so; but I think that that was more than counterbalanced in that I have alluded to by its very uninviting appearance.

1193. (*Dr. Farr.*) At Poona they could not have any difficulty in getting plenty of good water, I presume?—It could be got, for there is a river; but there was a difficulty in it, for the barrack I alluded to was far removed from the river.

1194. (*Chairman.*) Do you consider the present means of cleanliness sufficient, or what improvements should you recommend?—I think that there is a want of ablution-rooms in barracks, and that the soldier is not as comfortable as he might be made. To every barrack there should be attached sufficient ablution-rooms for soldiers not upon the same but on a lower level, and with urinaries on a still lower level.

1195. (*Col. Greathed.*) Was there an easy means of ablution for patients in the hospitals?—Yes, always; better there than in the barracks. The patients, of course, who were very sick, were attended to in the wards, and the water was brought for their use to their cots. In the hospital there were rooms for the patients who were not bedridden to go to for the purposes of ablution.

1196. (*Chairman.*) Can you describe the means provided for barrack cooking, and state whether you consider them sufficient?—The cook-rooms are neither commodious nor convenient, and might, I believe, be much improved; they are too small. I consider them bad.

1197. The only fault that you find with them is that of their being too small?—They are not convenient; there is a want of comfortable accommodation; there are no chimneys in them, and the smoke goes through interstices between the tiles, and through smoke openings in the roof. There is simply an open platform with fire-places along the entire length, something like a hot plate; but in the fire-places wood, and not always charcoal, is used as fuel; in fact, I think they were very primitive.

1198. Can you give the Commission any information as to the materials, and quantities of the men's rations, or have you any suggestions to make as to any improvement that might be made?—The rations consist of beef and mutton, bread and vegetables, tea or coffee, condiments and sugar, &c., with an allowance of fire wood, all excellent of their kind, and in liberal quantities. The quantities vary at some stations and in certain seasons; the amounts I forget, but information thereon can be easily procured. I have no suggestions to make.

1199. As a general rule, you consider the rations given to the men sufficient?—Yes, I think so.

1200. You are not aware of any fault that has been found with the quality of the rations, or of their not being sufficiently varied?—There are the regimental authorities to look after that, and if they have a bad quality it is their own fault. I believe that the commissariat contractor would be fined or punished if he supplied improper provisions.

1201. (*Col. Greathed.*) Do you know whether the decision of the regimental committee is final on that subject?—I think generally it is so, and that if the provisions are bad other food is brought.

1202. (*Chairman.*) Do you consider it would be beneficial to the health and discipline of the troops to abolish the spirit ration altogether?—I certainly think it would. It would in my opinion be most advantageous to abolish the spirit ration, and the sale of spirit in the bazaars.

1203. (*Col. Greathed.*) Have you any reason to know that any spirit ration is issued?—That I am not able to speak to now, but long after I was in India a spirit ration was issued.

1204. What has been, within your experience, the system upon which spirits have been allowed to the soldiers?—I think it is very rigidly laid down that the spirits sold in the bazaars shall be good, and that

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Europeans shall not be permitted to have liquor without a pass from their officers. I believe that temperance would be very much promoted if that regulation were properly carried out in every place; but in Bombay, which is a large town, the men can go and get what they please, and are quite unquestioned.

1205. (*Chairman.*) Do you believe it is possible altogether to do away with the allowance of spirits to the troops, substituting for it beer or porter?—I think so; but I apprehend that beer or porter ought to be taken with considerable moderation if health is to be retained in India.

1206. (*Sir R. Martin.*) But do you not think that a comparatively liberal issue of beer or porter would be far less injurious than an unlimited recourse to ardent spirits?—I think it would produce a different class of disease. I believe that great beer drinkers and great porter drinkers do suffer.

1207. (*Chairman.*) Are there any other drinks which, in your opinion, it might be advantageous to supply to the soldier?—I think there might be something done by making the canteens, if it could be managed, attractive; but I speak upon this point somewhat theoretically. If the soldier were amused and entertained he would probably take to weaker drinks. I am supposing that the canteen could be supplied with ice, soda-water, and so on.

1208. What means of amusement or occupation do the soldiers enjoy?—At all barracks there are five courts and barrack libraries, and the men play at long bowls and cricket; but besides these I know of no means of recreation at Bombay, which has always been a bad quarter for the soldier, from the temptations by which he is surrounded. At some stations there are soldiers' gardens, which might be encouraged by prizes being given for those best kept, and for the best vegetables and flowers produced, as was done at Poona, by the late Lord Frederick Fitzclarence.

1209. It is impossible, of course, at Bombay to keep the European soldier out of the town?—Quite so; that is to say when they do go out; they were formerly very much kept to the barracks, but I think that the soldier has improved in his morale in the last 20 or 30 years, and is more to be trusted.

1210. (*Sir R. Martin.*) The former excessive restraints had rather an injurious tendency?—I think so; and that the men in consequence broke out of barracks and committed crime.

1211. (*Chairman.*) Can you describe to the Commission the daily course of the soldier's duties as to drill and guards, and so on?—I have no suggestions to make on that point.

1212. Have you any suggestions to offer as to the component parts of the soldier's dress and accoutrements?—Perhaps if red shirts, or shirts of that kind, suited to the climate, were worn, the soldier might give up his cotton. The most obvious suggestions, I believe, have been urged repeatedly, and many improvements are being often made. If woollen shirts were made the regulation, then cotton ones might be discarded from the soldier's kit. I believe it would be better to have flannel always next the skin.

1213. (*Dr. Gibson.*) Do you think that the flannel which a soldier could afford to buy would be wearable or bearable in the climate of India?—No; not with his red coat over it; with khakee it might be. I have seen the native troops on parade with the cross-belts over the nankeen; it would not do to wear a coat over flannel at all times.

1214. (*Chairman.*) What is the objection to the cotton shirt as worn at present?—Merely that I think if a soldier is to have flannel shirts, cotton ones would be a superfluity, and that he need not have both.

1215. With regard to the head-dress, have you anything to suggest?—I think in India the head-dress on the whole was good with the padded flap for the back of the neck and the side of the head. I have nothing to say against that; the head should always be well protected.

1216. Lightness, although an important object, is of less importance than great protection from the sun?—I think so; particularly at the back of the head and neck.

1217. Have you any observations to offer as to the weight carried by the soldier on the march?—No; I think there is much contained in the regulations, which leads to a good deal being done for the soldier on the march; a good deal of his kit is carried for him, his bag, bedding, and necessities, weighing from 60 to 75 lbs.

1218. It is perhaps probable that in these respects some alterations and improvements have been made since you left India?—Yes, I think so. I have referred to the regulations published since I left as to the amount of baggage that was carried for the soldier, and I think it is for the private 75 lbs., and for sergeants even more.

1219. Have you any suggestion to offer as to the manner in which the health of the troops is looked after when on the march?—No. I think that their health is well looked after, and that the marches are well arranged.

1220. Will you be good enough to describe to the Commission the manner in which sites for stations are selected, and mention any improvements that you think could be introduced?—I believe generally by military combined with medical officers. There is a Government General Order of 1849 of the Bombay Presidency, which sets forth this:—"It being essential to the health of the troops that great attention should be paid to the aspects and position of all barracks and hospitals, and other buildings to be occupied by troops, Government directs that previous to laying the foundation of such buildings, in all future cases the superintending surgeon, or in his absence the senior medical staff officer at the station, shall invariably be consulted on the subject, and commanding officers shall conform to the opinion of such medical officer officially given in writing, or refer the question, should they see cause, with all documents connected with it, through the military board for the decision of Government as speedily as possible." The spirit of the above order, regarding the opinion of medical officers, is extended to cutcherries, jails, and jail hospitals. I do not know that any improvement could be introduced into this service.

1221. Have you observed any facts bearing upon the causes of epidemic diseases that might have prevailed at the stations where you have been?—Cholera is known to have a certain connexion with damp and moisture—with imperfect drainage, with the use of impure water, and of improper articles of food, with close badly ventilated sleeping places, and generally with what may be briefly termed a bad sanitary state; but, apart from all these, there is much that is mysterious and inexplicable in its onset and attacks as to its unequal and partial distribution and extension. In Bombay those natives living in the lowest, worst ventilated, and dampest parts of the island, particularly in such places on the shore, suffer most. Its following the course of rivers, as likewise its extension along high roads and lines of thoroughfare, have been noticed. In Bombay I have seen epidemic cholera in the marine battalion, composed exclusively of low caste Hindoos and Mussulmans, in the proportion of $\frac{5}{6}$ of the former to $\frac{1}{6}$ of the latter, the strength of the battalion at the time being 500, in which, while not a Mussulman, man, woman, or child, was attacked, from 80 to 100 of the low-caste men and their families suffered. These men, mostly Purwaries, a caste careless as to their diet, and who will eat even of animals which have died, attributed their illness, I believe, justly to having for some days lived on fish not very fresh. The Mussulmans living in the same lines, but who are much more particular as to diet, escaped. Cholera and bad fever at one time frequently prevailed in the European crews of vessels undergoing repairs in the dockyard, a close, badly ventilated situation, not far

om the opening of a drain running into the harbour. The marines of Her Majesty's ship *Endymion* in 1841 suffered very severely from fever, distinctly attributable to night duty there; it has consequently been then been a rule that the crews of vessels undergoing repair shall not sleep on board while the ships are in dock. An epidemic diarrhoea occurred in a native regiment at Hyderabad, in Sind, from using the stagnant impure matter of a water-course. Pannell, the first station on the road to Poona, in a low situation on the banks of the river, and Campolee, a village situated close under the Ghauts, have long been avoided as halting places for troops, in consequence of the frequency of attacks of cholera, fever, and bowel complaints among parties halting there. I have not myself noticed such causes, but I have heard of instances in which, from the men of particular barracks having suffered from cholera in excess of those in others, on strict investigation, impurities at a distance from, but nearer to these barracks than the others, have been supposed to be the cause, and were accordingly removed. Intemperance, fatigue, exposure, and over much night duty powerfully predispose to disease. Exposure, when suffering from the effects of intemperance at night, have in many instances seemed to bring on cholera; temporary deficient clothing might in these instances have added to the evil, but, excepting in such cases, I know of none from deficient clothing, and none from deficient clothing in Europeans. Heat, cold, and moisture seem to exercise powerful influences. In Bombay, among Europeans, cholera is most prevalent in the hot sultry month of May, before the monsoon, and during the monsoon months. Among natives it is more prevalent in the cold months. Diarrhoea and dysentery are most prevalent generally during the hottest and wettest months; but in Bombay during the cold weather, and in the four months of the monsoon. The deaths from dysentery, in proportion to the numbers attacked, are more in the cold months than any other. Fevers in Bombay are most prevalent during the monsoon months and in November. Dysentery often follows fever, and is then most fatal.

1222. Can you state what precautions of a sanitary nature are adopted when epidemic disease appears at a station?—The troops are moved from their quarters into tents, and, if cholera be prevalent among the population, isolated as much as possible, particularly during marches. Barracks and native lines thus occupied are thoroughly cleansed and whitewashed. The precincts, streets, and places of assembly are purified, and the drainage looked to. Frequent medical inspections are made, and the duties and fatigues of the men lightened; the canteen is more carefully supervised. Qualified assistants are posted in the native lines with medicines, and generally all means are had recourse to which a consideration of the circumstances under which the visitation had occurred rendered likely to be beneficial; for example, on extensive occurrence of fever in Bombay the regiments and wings of regiments have been removed to other stations, or the sick embarked on board ship and sent to sea for a cruise. When regiments are attacked on the line of march with cholera, besides the adoption of such measures as those referred to, the corps is moved to some spot (probably off the line of road) deemed likely to be healthy, and there a system of purification of tents, baggage carts, and baggage, particularly those of the numerous camp followers, is instituted, aid being given to those followers in many ways; the men's kits, and in one instance I remember their arms even, being carried for them on the suggestion of the medical officer in charge. In such cases, corps are not allowed to enter camps or cantonments till the disease has entirely disappeared, and they have been reported on.

1223. Are there any regulations bearing on those objects?—Circulars to the service, and general orders on such matters, have been often distributed, and they are about to be incorporated with the regulations, and the mutiny, I believe, may have put a stop to that.

1224. Can you suggest any improvements in the present mode of procedure in such cases?—No.

1225. Can you give any information as to the various classes of disease which you have observed at the stations at which you have served; has liver disease prevailed to any extent?—It has; climate has much to do with its prevalence; since the greater number of European children under five or six years of age (that at which they are generally sent to England), who require to be sent thither at an earlier age on account of ill-health, suffer from affection of the liver, and from bowel complaints, consequent thereon. Ladies, who are careful and temperate, also suffer considerably, as do natives in a greater degree than is generally supposed. I am sorry that I can suggest nothing new, only care in regard to diet, clothing, and exposure. In adults I should expect more from temperance, or perhaps total abstinence from liquor, and the avoidance of rich stimulant, or full diet, than from any other change. In answer to question 61, with regard to the prevalence of rheumatism, I should say that it did not prevail very much. Apart from causes dependent on venereal, or the previous maladministration of mercury, cold seems to me to be a very general cause. Rheumatism is most prevalent during the cold months, and during the prevalence of easterly winds, or when there has been exposure to great and sudden variations of temperature; also in feverish districts. It most attacks the weakly and convalescents, and is a not very infrequent consequence of intermittent fever. I think the wearing of flannel next the skin holds out the prospect of greatest effect in diminishing its frequency. And in reply to question 62, which refers to scurvy and Guinea worm, I may say that I have once seen scurvy prevail extensively among European troops. Many years ago, in a strong detachment of Her Majesty's 2nd Queen's Royals, consisting of weakly young recruits, who, on the voyage to Bombay, in an Indiaman, having met with bad weather in the Channel, lost their bedding, or rather had it destroyed for them, and were subsequently, during a stormy passage round the Cape, much exposed to damp and cold, and I believe much kept below in an orlop badly ventilated. Although lime juice, fresh meat, and other proper means were used, they landed during the monsoon in a bad state, and suffered much, particularly from dysentery of a really scorbutic character. That cold and damp, and the atmosphere in which these young recruits lived below, were the main causes of the disease, seemed to be proved by the very healthy state in which a detachment of the Buffs, composed of recruits of greater age, better stamina, and better commanded and cared for, made the voyage to Bombay at the same period and in the same kind of weather. Scurvy is frequently seen in the European General Hospital, in the men of crews which make long voyages in badly found, badly provisioned, uncomfortable vessels, such as colliers, and ships chiefly from the northern ports of Great Britain and Europe. Exposure to wet and cold, bad sleeping places, and long voyages in badly found ships, are evidently the causes, since the disease is never seen in vessels in which these circumstances have not obtained. On the first occupation of Aden and Sind, scurvy prevailed at times to a certain degree, both among European and native troops, but was easily put down by the adoption of the usual means; though in the former station, for a considerable period, there was a great proclivity to it, only checked by liberal rations and anti-scorbutics, and by improvement in the water supply, much of the water there being saline or brackish, but better being procurable at cost from a distance. A slight scorbutic taint among natives is in my opinion by no means rare, attributable, as I think, to low fare, unhealthy abodes, and imperfect protection from the weather, and in consequence, in jails, antiscorbutic diet to numbers of prisoners is very frequently required to meet this cachectic state. At Nusseerabad, cases of scurvy occur among native troops attributable to defects in diet, and particularly

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to want of vegetables, coupled probably with climatic influences, arising out of its arid barren soil; particularly after a succession of droughts. I have heard of its occurrence there even among European officers. Prevention by the ordinary generally received means seems to be all that is necessary. In regard to the causes of Guinea worm, obscurity and uncertainty still prevail; but it seems probable that it arises in consequence of the introduction of the worm from without in bathing, or in walking in marshy ground. If so, it would tend to the diminution of its frequency, to enjoin caution and care in exposure to such causes.

1226. Taking together all the causes which may be supposed to influence the life and health of the soldier while in India, such as climate, local position of stations, and adjoining marshy ground; want of surface-cleansing, irrigation, defects in drainage, and in the construction and ventilation of barrack-rooms, intemperance, errors in diet, clothing, and exposure while on duty; to what class of causes would you attribute the largest amount of injurious effect on the health of the soldier?—To climatic influences, intemperance, and sexual disease.

1227. You consider that those are the three principal causes of disease in India?—I think that they are the three great causes, for in many of the Bombay stations a full fifth of the sick in hospital are there from sexual disease, and there is a lamentable amount in many places from intemperance, not among the troops so much as among the civil population; but still even among the troops.

1228. With regard to the effects of intemperance, I presume that they cannot be directly traced, because intemperate habits act in making persons more liable to ordinary diseases?—Yes; and they very much increase the difficulty of treatment when disease occurs.

1229. But the number of persons whose illness you could distinctly trace to intemperance would be no measure at all of the number of those who had injured their constitutions by it?—Certainly not; yet the amount of sickness from such intemperance in one hospital in Bombay is something appalling; the European general hospital is a hospital for all classes of Europeans, both men and women. Into it, during 10 years, from 1846 to 1856, out of 12,325 admissions with all diseases, not less than 1,146 were from delirium tremens and ebrietas, being a per-centage of 9·297, or nearly one-tenth. With the sole exception of fever, the number of admissions was larger than from any other disease; and as to deaths, alcohol had there destroyed more than either fever, hepatitis, or diarrhoea, and nearly as many as cholera. There were deaths from—

Fever	-	-	-	48
Hepatitis	-	-	-	61
Diarrhoea	-	-	-	39
Cholera	-	-	-	74
Alcohol	-	-	-	68
Dysentery	-	-	-	186

Of the 1,146 cases of delirium tremens and ebrietas,—352 were soldiers, but a half of those were pensioners. 170 were sailors.

291 were paupers.

118 were women, of whom the great majority had led a barrack life.

66 were warrant officers.

Vide a Paper on the Statistics of the European General Hospital, Bombay, by Dr. Matthew Stovell, then surgeon, now deputy-inspector general, P.D.A., Bombay army, in the Transactions of the Medical and Physical Society of Bombay for the years 1855 and 1856.

1230. Do you think that the life of a soldier, with the comparative absence of occupation in quiet times, predisposes to intemperance?—I think that very much depends upon the man. There has been a great improvement in the soldier lately, and he is a very different character now from what he was 20 or 30 years ago. I think that there is less intem-

perance, and far more correct conduct, than when I first went to India in 1821.

1231. On the other hand, I suppose there is no doubt that military rules and discipline prevent intemperance from being carried to the same length as in the case of a person not placed under the same restraints?—Very much so. Delirium tremens can only be rarely seen, although there are instances even in disciplined bodies.

1232. Among the stations at which you have served, have you been at any of the hill stations, or sanatoria?—I have not served there.

1233. Have you studied the effects of climate in some of the dry situations upon the health of the men?—In the course of duty I have had to consider the effects of sanatoria in high situations in the Bombay presidency; but I do not know that from either that or my reading I have been able to appreciate any difference as to the healthiness dependent on the mere extent of the position, or its continuity with or separation from the country beyond its precincts. The healthy or unhealthy nature of the approaches, of neighbouring ravines, and of the neighbourhood generally, and particularly to windward during prevailing winds, would require to be taken into account in deciding on individual fitness. Isolated hills, if affording greater facilities for police surveillance, would for that reason be preferable for sanatoria; but it is most extraordinary how even the sick soldier in India is followed to such places, after a time, by parties who would procure him forbidden articles, but particularly liquor. Much therefore depends on the good management of the military and medical officers in charge.

1234. You do not think that any general rule can be laid down as to the comparative healthiness of the mountain ranges, the isolated hills, or table land?—I think not.

1235. (*Sir R. Martin.*) You would, I presume, consider that the comparative coolness and purity of the air on the mountain ranges would make them preferable to the heated plains?—Decidedly; though I think that some diseases might prevail to a greater extent on the heights than on the plains. By ascending you escape much fever, and perhaps cerebral affections, but you may occasionally have more pulmonary attacks and bowel complaints.

1236. But more especially of the character of diarrhoea?—Yes.

1237. The mountain ranges are comparatively exempt from a great prevalence of the endemic diseases of the plains, such as fever, remittent and intermittent, and dysentery?—Yes; and yet upon that point, even in previously favoured stations, I suppose one must now talk qualifiedly, for we have lately heard in Jamaica, at Newcastle, which is 4,000 feet high, and in Maroon town, 2,500 feet high, where they had been long free from fever, that it has lately prevailed in both.

1238. But that was yellow fever, not remittent fever; and even there it is supposed that the yellow fever was not generated in those stations, but that it was carried there?—Yes, I read that; yet thereon opinions were divided, and medical testimony seemed to be quite as much in favour of its local origin as of its having been imported.

1239. Fever, remittent and intermittent, dysentery, diarrhoea, epidemic cholera, and syphilis are the six diseases which together produce by far the greater proportion of the mortality, and the invaliding of European soldiers serving in the East Indies?—Yes.

1240. By how much do you consider that sickness and mortality, and the invaliding of European soldiers, might be diminished, referring to the six diseases I have mentioned, by removal to table lands or mountain stations?—To that I must answer, that in the presidency which I know, I really do not think that much benefit would arise from going above 1,800 to 2,300 feet, the heights of the principal stations now long occupied. In them a diminished prevalence of, and diminished mortality from, fevers, dysentery,

diarrhœa, and epidemic cholera is undoubted; but as to syphilis, it is most prevalent in the Deccan (the table land in question), where the greatest portion of the European troops of the Bombay presidency is quartered. For its check police regulations are essential, and climate has little or nothing to do with it.

1241. Except that a high elevation would make it more difficult of access?—I do not think so, but am of opinion that the soldiers would be followed by women everywhere, and I should expect much more from the introduction of some system of inspection, registration, and control, such as that which is generally adopted in the case of public women in many of the cities of Continental Europe. I do not know why diseases of contact should not be kept from soldiers; but authorities do not listen, in fact they have checked medical men who have suggested that these diseases should be stopped by means of prevention, which have been quite successful in the case of plague, treated preventively as a disease of contact.

1242. With regard to the table lands, it is already ascertained, at Poona and Bangalore, that the mortality among the European regiments, when we take into account the diseases which they have taken into those stations, has been reduced to little more than 30 in 1,000 per annum?—I know that in one year in Poona there was even a more favourable rate of mortality than in the population of these parts of Great Britain of the same age.

1243. It was only for one year?—Yes; in that year there were no epidemics.

1244. (*Dr. Farr.*) We have here a series of returns showing that the mortality in Bombay has been as high as 83 in a thousand?—Yes.

1245. And at Poona only 18 in a thousand?—Yes. Bombay is, so to speak, the outlet port from which all invalids embark for Europe. All men and officers who are sent down from the interior find their way to Bombay.

1246. Would that observation apply as well to Company's troops as to Queen's troops?—Yes, to all. The unfits of the different regiments are quartered in Bombay, which of course adds to the apparent mortality, but it is a bad quarter without doubt.

1247. But the difference which I have pointed out is enormous. You do not, I presume, suppose that it would be accounted for entirely by the sick being imported from other stations into Bombay?—Certainly not.

1248. I believe that they were eliminated entirely from the regimental returns?—It is a very bad quarter, so bad that for many years back there has never been more than a weak wing of European troops in Bombay.

1249. At one of the stations that you mentioned, which I believe was Matoongha, the mortality was enormous?—Yes.

1250. To what was that mortality ascribed?—To the unhealthiness of the low land, to bad drainage, to indifferent barracks, and to the great prevalence of guinea worm, which unfitted a very large number of men.

1251. I will assume that the mortality in Bombay is 80 in a thousand, although it varies from 63 to 103, and that the mortality in Poona is 20 in a thousand. I wish then to ask you to what you ascribe that difference in the mortality; what is the nature of the Poona station as to its soil?—Poona is on a high table land, and is well drained; it is 1,800 or 2,000 feet above the sea; it is cool, and there is not there that little-varying, long-continued wasting heat; while there is little variation of temperature in Bombay; it is a warm and wasting climate; children, for instance, are more healthy, and look far more healthy in Poona than in Bombay, where sanitary improvements too, are much demanded, as I have already stated, and where also there is great intemperance.

1252. That sort of climate would be found, I suppose, everywhere under the same conditions on the coast of Bombay?—Very much so.

1253. Then with regard to the water at Bombay, what is the quality of that?—The water hitherto has been indifferent and brackish. Now, I believe, it is brought from a distance, and is good.

1254. How is it at Poona?—There is a river there, and the water is good from the wells.

1255. Can they obtain at Poona with facility vegetables and other articles of necessary food?—Yes; but I should not be disposed to attribute much to that. I think that Bombay is tolerably well supplied.

1256. But Poona is well supplied?—Yes, it is. In Bombay there is probably more rice consumed by the native population, which is a less nutritive food, than there is on the high land; in the Deccan they use a different description of grain, and much rice is used in Bombay.

1257. And in Poona?—Not so much.

1258. What is your opinion of Poona with regard to the consumption of spirits and the prevalence of debauchery?—Poona is a military camp, and its bazaar is well regulated; no bad spirits can be, or ought to be, sold; and the men are kept in check. The population of Poona consists of disciplined men, who are well looked after, and tended like children; but in Bombay, if a man gets out of barracks, he is pounced upon instantly by the abandoned. In one place there are good regulations, and in the other there can be none.

1259. That, I suppose, is in consequence of one station being a large town with a large population, and the other station being on the hills?—Poona is a camp subject to camp police, while in Bombay there is only the general police and no camp restrictions.

1260. These stations are not very distant from each other, in one of which the mortality is at the rate of 80 in a thousand, and in the other only 20 in a thousand; and the great distinction between them is that the one station is on high ground, and the other low down on the coast?—Yes; but I should not be disposed to put the difference altogether upon that; it has a good deal to do with it doubtless; but the question is whether, if there were a town similar to Bombay at Poona, and that a regiment were there, or a wing of a regiment exposed to just the same temptations as in Bombay, whether you would not then have a very different account of mortality?

1261. At the time the return was made to which I have referred, I see that there were in Bombay 1,240 British troops, in December 1859?—That is the season when the unfits go home; and I do not doubt but that, in consequence of the immense additional number of European troops in the presidency, arising out of the mutiny, possibly also in consequence of a presumed necessity for a stronger garrison for the same reason, as also it may be that because there was always much unoccupied barrack accommodation there, the number of European troops then quartered was larger than for many years back, and far larger than it is to be desired (excepting for some dire necessity) that it should ever be. In 1858 the strength of the European force of the presidency was much more than double what it had ever been during any period of my service.

1262. In Poona there were 3,420 British troops, and is it not a great advantage to the authorities to be able to station 3,000 troops up at Poona rather than down at Bombay?—Most certainly. By an Act of Parliament the Government is constrained to keep 500 European troops in Bombay; but for that I question whether they would keep 100 there; they keep the lowest number that they can, solely because it is a bad quarter.

1263. According to your opinion, the policy of removing the troops from low stations to high mountain stations, within a moderate distance of the points where their services might be required, is an advantageous one?—Yes; and it has always been acted upon; in Bombay it was quite recognized.

1264. On the whole the advantages are enormous?—They are, without doubt.

1265. What are the disadvantages, if any, of

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keeping troops up at Poona rather than down at Bombay?—I know of none. As I said before, if there were not a law constraining the Government to keep 500 men in Bombay, up to the time when I quitted India I do not think they would have kept 100 there; in fact, they kept the lowest number there that they could, so bad is the climate, and so great was the intemperance.

1266. These are the two stations at which you were principally during your residence in India?—Yes.

1267. (*Chairman.*) Is not the expense of procuring supplies greater at Poona than at Bombay?—Of some it must be; for instance, liquor, beer, and all European articles of supply; but I do not know as to the great commissariat supplies of beef, mutton, vegetables, and bread, &c.; on that point I cannot speak confidently; but I should think that even of the most expensive the expense must be lessening, for now, by means of a railway, that difficulty is much diminished.

1268. (*Dr. Farr.*) What is the distance from Bombay to Poona?—I think 70 miles, and it will be connected by a railway.

1269. Judging from your past experience in Bombay, you would be decidedly in favour of stationing the troops at such elevated stations as that of Poona?—Most certainly.

1270. (*Sir R. Martin.*) The chief comparative advantage with regard to climate being that in the one case the station is upon a table land, where they are very much exempted from the malarious influences which everywhere prevail on the low grounds?—I should not like to say that altogether, for you may have a great deal of malaria on the table land of the Deccan.

1271. Is it so at Poona?—Yes, a good deal.

1272. Is there much fever there?—A good deal.

1273. But not, I presume, to be compared with Bombay?—No; but I do not know that I should like to state anything very strongly upon that point. Bombay is a paradox. I have heard officers, pointing to the ditch and to the paddy fields, express their astonishment that the troops were not decimated immediately.

1274. (*Col. Greathed.*) Is there not a bad fever called the Deccan fever?—There are and have been very deadly fevers formerly at Ahmednuggur, Sholapore, in Candeish, and near Aurungabad. Poona is a very good station; but decidedly there even there is both fever and cholera.

1275. (*Dr. Farr.*) Jaulnah is a comparatively healthy station, is it not?—Yes; that is a Madras station.

1276. Have you been at Mhow?—No; most of those stations have not been greatly tried by the residence of considerable bodies of European troops; the information has been mostly obtained from detached companies of artillery.

1277. (*Dr. Gibson.*) At Aboo, is there not a sanitarium there for invalid soldiers?—Yes.

1278. I believe they cannot be kept there long?—No, the monsoon is heavy; and that is the evil at most of those very high stations, and in Bombay.

1279. The building, I believe, is very slight, and the men do not recover so well?—No; if the buildings were made permanent, there is still so much fog, damp, and rain, that I doubt whether the station would be very desirable in the monsoon. The hill stations in Bombay are generally used for six or eight months only of dry weather. At Mahableshwur, in four months, there are about 200 inches of rain fall, and 40 miles inland from it there are not 20.

1280. (*Sir R. Martin.*) So that, in fact, we chose the front stations which bear the brunt of the south-west monsoon?—I think you chose the greatest height; for as you go inland you descend.

1281. But that is inland from the south-west?—It is inland from the Ghauts; in short, the Ghauts have a prodigious influence upon the quantity of rain which falls. As you depart from the Ghauts you come to drier and drier soil. At Paunehgunnee, 12 miles from

Mahableshwur, the fall is 50 inches, and at Wye, four miles further eastward, the fall is 25 inches, while at Phultun, 24 miles further in the same direction, it is only eight or ten inches.

1282. (*Chairman.*) Can you describe generally the construction of the hospitals at the stations where you have served, and the materials of which they are built?—They are built of brick, wood, and tiles; they vary much in their construction and arrangements, but probably plans of all can be got at the India House. The town barracks in Bombay have no hospital; that of Fort George, and the European General hospital, are two-storied buildings, the upper stories only of which are used for the sick, the ground floors being appropriated to officers' store rooms, and accommodation for servants. The upper stories of both are raised above the ground from 10 or 12 to 16 feet; the wards are of good height, and have wooden floors, with verandahs on their fronts and rear, the end wards having, if I remember rightly, verandahs on their outer sides. They are tolerable buildings, and so far they are better than some of the hospitals at the out-stations.

1283. What is the amount of cubic space per man that is allowed in hospitals?—One thousand eight hundred cubic feet, and I think that that is sufficient.

1284. Can you describe the provision that is made for medical attendance and for nursing the sick in those hospitals with which you are acquainted?—Besides the medical officers there are the members of the subordinate medical establishment, consisting of warrant officers, hospital assistants, and apprentices; a meritorious, trustworthy, and, medically speaking, well-educated and well qualified class of public servants, reared in hospitals from the age of 15 years, and after two or three years service in them sent to college for not less than three years more for instruction in medicine and surgery; having in college and hospitals many advantages of education. At the conclusion of their college course they undergo a strict examination in all branches of the profession, as detailed in a notification of the General Department, dated the 2nd of April 1851, which I can put in. If approved of they are held qualified for a warrant, and are immediately promoted to the grade of first hospital assistant, and after that, according to their standing in the list of merit at the examination, as vacancies occur, they are promoted to the post of assistant-apothecary, and again return to hospitals for duty in that capacity, acting under the superiors of their own class, and the commissioned medical officers of both services. In each regimental hospital there was an apothecary, a steward, and an assistant-apothecary, and from three to five apprentices; but I am told that, in consequence of the very great addition to the European force, the establishments are now very incomplete. This defect should be remedied as soon as possible. Besides the medical warrant officers and apprentices, there is an hospital-serjeant to every hospital, but no European orderlies, the duties of ward attendants being performed by natives provided by the commissariat in such proportions as may be required, one being allowed to each bed-ridden or seriously sick patient; but for the ordinary run of sick of all kinds, one ward boy is allowed to six patients. The medical officer may have as many as is deemed necessary by preferring a requisition to the superintending surgeon or deputy inspector general. Besides the ward attendants there are what are called sweepers, at the rate of one to every 12 patients. There are also barbers and dooly bearers; these latter are ten in number, and there are two doolies to each European hospital. In addition to these there are cooks, washermen, watermen, store and shop servants, tailors, leech-men, compounders, dressers, and native writers, altogether a very full and efficient establishment. As improvements in this service, I would most strongly recommend that, in point of pay and allowances of all kinds, the medical warrant officers should be put on a perfectly equal footing with the warrant officers of the ordnance and com-

missariat departments, which at present they are not. For instance, while the commissariat conductor on the line of march has an allowance for a pony granted to him to enable him to be up in time to measure and distribute the ration of liquor, the medical warrant officer has no such aid to enable him to keep up with the sick and wounded in order to be able to dispense their medicines or adjust their dressings. The grant of such assistance, I think, would keep up and add to the efficiency and stimulate the zeal of this very important and meritorious department. The only improvement that I could suggest with regard to the second-class servants, meaning the ward attendants, and so on, is one which has at times been thought of, and has not been entertained solely on the score of expense; it is, that ward attendants, dooly-bearers, and watermen should form a body to be constantly retained; in fact, to be enlisted for their services, and having claims to small pensions on becoming unfit for duty. By such means a better class of servants would, doubtless, be had than those who are now to be found in European hospitals, and who are provided by the commissariat department.

1285. What provision is made in the way of baths and ablution rooms for the sick, and can you suggest any improvements?—There is provision made in these matters in hospitals; but at the time I left India there was room for improvement in them which may have been carried out.

1286. Have you been in charge of troops going to India by the Cape of Good Hope, or by Suez, and of the two routes which do you consider the best?—I have not been in charge of any; but the Cape of Good Hope route, I think, is the preferable one, ordinarily; but I believe, if arrangements on both sides were made, that the route by Suez might also be had recourse to without detriment in the months of October and November, and the first half of December; for troops proceeding up the Indus in the months of December and January; and from October to January for troops to Bombay. I think at other times the heat in the Red Sea would be too great.

1287. You would not think it advisable to send troops down the Red Sea in the summer time?—Not in the monsoon; and moreover there is a season at which troops should arrive in India, namely in the cold months, because then the fever season has passed away, and they can go up the Indus in December and January, and arrive at their stations before the heats of March. Arrangements such as that would confine the period of transit to a comparatively favourable period in the Red Sea.

1288. Do you think it is possible to dispense with the Cape route altogether in favour of that by Egypt, if the transit of troops were carried on in the ordinary winter season?—I suppose so, having reference to the comparative expense, and so forth.

1289. Would it in your opinion be an improvement, as to the health of the men, to place them in dépôt at some intermediate station; for example, the Cape of Good Hope, where they might perfect their drill before proceeding to India?—I think it would be well that they should be drilled before arriving, but I am not aware that this might not be as well completed in England as at any intermediate place.

1290. I believe the idea with which the Cape route was suggested, as a drilling station, was this, that it afforded a climate intermediate between that of India and of England; do you attach any value to that?—I do not much.

1291. Have you formed any opinion upon the question of acclimatization?—Yes. If apart from the gradual adaptation of his body and its various functions to increased heat and other differences between the tropics and the native country of the soldier, acclimatization be held to be a knowledge of the causes of injury and of the benefits resulting from the avoidance of such causes in the new climate, acquired by attention to the sanitary rules of the service, and communication with and imitation of initiated or seasoned comrades, and

thereto in progress of time being superadded a constant and careful practice of such habits, possibly occasionally enforced by personal experience of the evils of neglect, or by illustration of such evils in others, then a trained soldier landed in India at 22 years of age, thus instructed by precept and example during the first year or two, and particularly if in that interval he should have led a camp life under canvas, and made some marches, might be considered acclimatized, and would for several years, perhaps for ten or even more, possibly be in his prime, and be less liable to suffer from Indian diseases or climate than one who had not had such training. There is no doubt, however, that as years increase the elasticity of the constitution or its tendency to return to health from disease diminishes, and a happy or perfect recovery is a very different matter in the man of 25 and in the man of 40 or 45 years of age.

1292. As I understand you, you believe in a moral but not in a physical acclimatization?—There is a gradual adaptation; no doubt the functions of the body are somewhat changed. There is a gradual fitting of those functions, for example of perspiration and the force of the circulation, &c., and the quickness with which these changes occur is great. If a person were suddenly transported from this climate into one that was very hot, there would be a certain amount of training requisite, or evil results would follow.

1293. Assuming that an equal amount of caution and prudence was exercised, and assuming that the new comers were taught by those who had been longer in the country what to do and what not to do, which do you think would be the best able to endure fatigue and exposure, the man who had been one year out, or the man who had been ten years out?—The fresh man, decidedly.

1294. (*Dr. Farr.*) Have you observed any difference that is produced by the age at which soldiers may go out to India?—Yes. It is bad to send out boys as recruits. A young man of the age of 21 or 22 is better than one of 16 or 18. I think it is injurious to send them out too young as soldiers. A boy in hospital is a helpless creature, and his constitution is often irreparably injured by disease, and by the remedies employed for its relief, *e.g.*, mercury, &c.

1295. It appears, referring to those who go out at the early age of 15, that the subsequent mortality among them is less than among those who go out at greater ages; have you had any experience in that matter?—I suppose that after a certain number have died off in the first year or two, the remainder may be held in some measure as selected lives, and may, at the age at which a comparison might then be made, contrast favourably with a number equal to theirs then who have arrived at an age then attained by the first arrivals, but who (the last arrivals, to wit,) yet have the subtraction of their delicate to undergo. If it be meant, for example, that of 100 going out at the age of 15 or 16, if 90 remain after two years, and are then compared with 90 of the same age (17 or 18) who have just arrived, then it may be so; I cannot say; but this would be a comparison of "seasoned" with "unseasoned." The testimony of the late Sir George Ballingall, drawn from a knowledge of some boy regiments who were sent out to India in the early part of this century, was, if I recollect rightly, condemnatory of the experiment.

1296. They do not appear to die off so quickly, and the immunity from diseases appears to remain during the career of a considerable number of them. Has it occurred to you that young men may be better able to adapt their systems to the extraordinary climate of India than older men?—In the case of officers, I think that the boy cadets perhaps assimilate themselves to the climate and to its usages and necessities better than those who come out at a much greater age; but there may be other matters to take into account. I think that the age of 15 is too young; 17 is the age for cadets, and it seems to me better.

1297. The mortality is lowest in England at the

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Dr. J. M. Lennan, F.R.C.P. age of 15, and gradually increases as it does in India?—Yes.

1298. (*Chairman.*) For what forms of disease are furloughs usually granted?—Fever and their consequences, dysentery, diarrhoea, and dyspepsia, or other affections of the alimentary canal, cerebral affections, hepatic affections, affections of the lungs and air passages, constitution injured by venereal and other excesses, anæmia and other cachectic states.

1299. What is the usual length of furloughs?—There are the old and new regulations, and in the former furlough is given for from three to five years; in the latter it is from 15 months to three years.

1300. Can you state what proportion of commissioned officers are usually absent from service on account of ill-health?—I cannot state the proportion of commissioned officers, but that could be easily obtained from the India House. Of warrant officers the proportion was small, and of the non-commissioned officers and privates in my day there were scarcely any, or none. The local troops were not sent home on sick certificate; or if they were, it was very exceptional.

1301. What was done with them; were they sent to the hills?—Yes; and they were only sent home when they were unfit for service.

1302. Could you suggest any improvement on the present practice as regards furloughs?—In India, for a very long period, extraordinary regulations, by which I mean the old Furlough Rules obtained, by which furloughs for two years, on sick certificate, to all places within the limits of the Company's Charter, viz., to St. Helena, the Cape of Good Hope, and countries to the east of the Cape of Good Hope, excluding Europe, and I believe America—had peculiar privileges conceded to them, namely, retention of right on recovery or return to India to revert to staff or other appointments; retention of a considerable amount, generally half, of staff pay, and the right to reckon time spent on such furlough as Indian service, while all these privileges were withheld from the officer who went to Europe for the recovery of his health; to whom, however, were given three years leave, with regimental pay, and, if it were necessary, two years more leave, but without any pay. The consequence was, that in those days officers often did not, or could not choose that which merely, medically viewed, was really best, or most needed on account of their health, but rather looked to that which best accorded with their pecuniary, or, so to speak, their service interests, namely, their retention of appointment and half staff pay, and right to reckon as Indian service time spent in absence from duty on sick leave. This has since been changed for the better, by the introduction of the new Furlough Rules, which only are those in force for officers, who, at the period of their introduction, and, since then, have entered the service, while officers of older standing may take either the "old" or the "new." In the new Furlough Rules, the great improvement is, that officers may, with certain privileges, namely, the retention of half staff pay for six months, of right to return to staff appointment for 15 or 18 months, and of reckoning as service a certain portion of time passed anywhere, obtain leave to that place deemed best suited for their recovery, and return to their appointments in India. But it seems to me that the duration of furlough might be advantageously extended to two years, with right of retention of appointment; and I much question the advisability of paying the first six months of the furlough so highly; it tends, I fear, to drive officers back too soon, that is, before their health is in some instances thoroughly re-established. If the same amount were equally divided over the whole period deemed necessary, the objection I state, if it have any force, would be removed. I think it might be of some moment that the time should be extended; for I believe 15 months is in many instances far too short.

(*Sir R. Martin.*) I may mention that I have found, when officers have arrived upon sick furlough

for short periods, that one of two results has not unfrequently followed, either that an officer has fallen sick soon after he has returned from India, or that a recurrence of his malady has proved fatal, both owing, as I conceive, to the insufficiency of the duration of the furlough.

1303. (*Chairman.*) At what age do you consider that men should retire from the army in India?—This must vary in individuals, as it is dependent on many circumstances. I should say for the private perhaps 40 years, for the warrant officer 50, and for the commissioned officer 60 years of age might be considered periods at which they might be deemed "worn out," and beyond which, except under certain circumstances of their services being necessary, they should not be required to serve in India. 30 years of Indian service should, I think, entitle the military officer, and 25 years should also entitle the medical officer to the maximum pension.

1304. Would you extend any rule of that kind to commissioned officers?—There is such a rule in the civil service, and I suppose what may be found necessary in one branch of the service may be also necessary in another.

1305. I presume you would give a dispensing power?—Yes; I mention the matter simply because the question is put to me.

1306. You think that 60 is the average age at which service ought to terminate?—Yes; I think that that is the average age at which men are generally worn out.

1307. Can you describe generally the current medical sanitary duties of medical officers in barracks, on the march, and in the field?—They embrace all matters that strictly lie in their own department, both for the cure and prevention of disease, together with the duty of urging the adoption of all measures conducive to such ends on others with whom may rest their performance, the commanding officers.

1308. How often are reports made by medical officers of the sanitary state of their regiment?—Daily, and at other times to commanding officers, according to regimental standing orders, or to the commands of commanding officers. They are made weekly, monthly, and yearly to medical superiors, and daily to them during the prevalence of violent epidemics. Special reports, rendered necessary by occasional circumstances, are at all times sent, as necessity may arise.

1309. What are the powers and duties of medical boards of presidencies, directors-general of presidencies, and inspectors and inspectors-general of Queen's troops?—The board and directors-general have the general direction and control of the medical department. The deputy-inspector-general of Her Majesty's troops confined himself to a control of the medical practice only in Queen's troops, and was, I believe, solely under the local commander-in-chief.

1310. (*Dr. Sutherland.*) According to the new medical regulations at present in operation in the British service, the medical officer can recommend, either verbally or in writing to his commanding officer, anything which he thinks necessary for preserving the health of the troops. If he make a representation in writing, the commanding officer must either do the best he can to comply, or, if he object, he must state the grounds of his objection in writing. Would there be any objection to a similar course being taken with the Indian service?—I think that that has always been the rule in the Indian service.

1311. (*Chairman.*) Is there anything which you wish to add to the evidence you have already given?—With regard to medical officers not being made presidents of committees, it appears to me that that is an indignity put upon them that is most impolitic, and not at all necessary, inasmuch as if the authorities do not desire that medical officers should be presidents, they have such a superabundance of military over medical officers of all grades, that they have only to select the senior military officer of the requisite rank, and the thing is done with; but it seems an

indignity to state that a medical officer is not fit for the duty. I think that he is always quite as fit as the other. I have been on committees as president, appointed by Government, and in a service of 31 years in India I have never seen an opportunity for the exercise of military command, and I scarcely know how it could arise.

1312. You complain, not that a medical officer is not always president, but that he is expressly excluded by regulation?—Quite so; and he may have to serve under one who is much his junior.

1313. You wish that he should be put on the same

The witness withdrew.

Saturday, 2nd March 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir RANALD MARTIN, C.B., F.R.S.
J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.
Colonel GREATHED, C.B.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

Captain WILLIAM SCARTH MOORSOM, C.E., late 52nd regiment, and Deputy Quartermaster-General, examined.

1314. (*Chairman.*) I believe you have not served in India?—No, I have only been in Ceylon as Queen's Commissioner.

1315. You have had considerable experience, have you not, as Chief Commissioner and Engineer of Government in parts of Ceylon?—Yes, I have, and I have been a civil engineer as well as military for above 33 years.

1316. You have been in India, I believe, also as a traveller?—No, in Ceylon only, I have not been on the continent of India.

1317. The Commissioners understand that you have some suggestions to offer as to a means of improving the ventilation of barracks and hospitals in India?—Yes.

1318. Are you aware whether in Ceylon any complaint has been made upon that head?—No, I am not, further than that the troops generally are a little more numerous in the hospital returns with regard to disorders, that is to say, the per-centage of the disorders is rather greater than in the non-tropical climates, but I have not heard of any specific complaints in Ceylon, nor was my mission to Ceylon to that end at all.

1319. Is it within your own knowledge that any complaints exist on that head in India?—Yes, it is, and upon that which arises out of that complaint I come before this Commission. In order clearly to show this, I beg to read the following extracts from letters written to me by officers of the 52nd Light Infantry, showing the effects of badly ventilated barracks upon that regiment.

From Lieut. Moorsom, 52nd Light Infantry.

“Subathoo, 15th August 1854.

“OUR first march of 12 miles 7 furlongs from Umballa towards this place was the most dreadful I ever saw; the men were so weak that strong men who had marched the whole way from Allahabad to Umballa without a sign of fatigue, now fell out by threes and fours at a time. We had carriage on two elephants and 11 doolies for 23 men who might fall out, and before we got in not only was all this conveyance taken up, but the whole of the officers' horses were ridden; the doctor's buggy was full of firelocks, and many men crawled in after the column with the rear guard. We got into Labroo at half-past one a.m. on the 5th; I got to bed at three, and on rousing at seven a report was handed to me that a corporal had died an hour or two after we came in from the effects of the march.

“On the second day's march another man of his company died from the effects of fatigue on his enervated frame.”

From Lieut. Moorsom, 52nd Light Infantry.

“Lucknow, 21st June 1856.

“I CAN'T say that I don't feel the heat, but certainly I don't care for it. Would that I could say the same for our

footing with the military officer?—I think commanding officers would very often desire to make medical officers presidents, but that they are prevented by the regulation in question. I have not been able to understand the amount of command that could be exercised, because all act under the higher authority, which has directed their assembly for the performance of a special duty, generally of a deliberative nature; and in its performance all are responsible only to that superior authority, and the one cannot be constrained or commanded by the other in the decision at which he may arrive, and which it is his duty to record.

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poor men! They are suffering as badly (if not worse) as they did in '54 at Umballa. Poor fellows! just fancy, six were buried in one day last week, and though this is the largest number that we have lost in one day, I think you will agree with me that those who crowded them into these barracks in the middle of a large native town, have much to answer for. Our hospitals are full to excess.”

From Col. Campbell, Commanding 52nd Light Infantry.

“Lucknow, 12th June 1856.

“MY DEAR CAPT. MOORSOM,

“I HAVE received your note through your son regarding the punkah. If it answers our expectations it will not only prove an inestimable benefit to the soldiers, but as far as I am concerned, will remove a constant anxiety arising from the knowledge that my men are in a state of suffocation every night, to the detriment of their health and vigour.”

In 1854, before leaving Umballa, the 52nd lost many men (I think about 200), owing principally, as was then commonly stated, to disease induced by badly ventilated barracks.

1320. Will you describe to the Commission the nature of the improvements that you have to propose?—I will, with your permission, first describe what led my son (who afterwards fell at Lucknow), when a lieutenant in Her Majesty's 52nd light infantry, to write to me respecting the 52nd at Umballa in the year 1855 or 1854, when they had a very severe period of sickness in the barracks at Umballa. He described it as arising (according to his views as a young officer) mainly from the circumstance of the barracks being very badly ventilated. He had just come into the command of a company, and he proposed to me to devote the proceeds of his contingent allowance, which he said belonged rightly to the men, and not to himself, to the better ventilation of the barracks for his company; and sending me a sketch of the barracks, showing the comparatively small space for India that was allotted to a certain number of men, he observed that as I had been so long engaged in civil engineering he thought I could probably strike out some plan and send it to him, and that upon the basis of such information he should be enabled to supply the defects in the want of air, from which his own men suffered, and which had been so fatal in its effects upon the regiment at that time. He stated the number of the deaths which had occurred and the numbers still on the hospital list. He also described the state of the men and how miserable they were when removed from the barracks at Umballa to the healthy station of Subathoo, and the state of the regiment on its march was most frightful. I need not say it here that

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the 52nd regiment was one of the regiments which used to march with remarkable efficiency in former days; and the colonel of the regiment also wrote to me (quite confirming the facts as to the inefficient state of the regiment), that he attributed it to the want of better air in the barracks, the sickly condition of the men arising much from their having been overcrowded, in consequence of the fall of one of the buildings, and the men who had occupied that building being, in consequence, distributed among the other buildings. Certain it was that the regiment was as quickly as possible removed from that situation to the hills. As I went into this matter of ventilation, believing that it ought not to rest with a young subaltern to do what was needed, in fact, that it could not be carried out by his means, I drew out a plan which was intended to be applicable to the simplest circumstances in which a regiment could be placed, so that any intelligent colonel, such as Colonel Campbell of the 52nd, was, with the assistance of one or two of his officers having some degree of engineering ability (and my son had been brought up in that way), might in this way procure his own means of improved ventilation for a regiment. Before sending it out to my son I took the precaution to show it to General Wetherall, who had been a long time in India, I believe 21 years in the Madras presidency, and after reading it over, and considering it, he said "Yes; this is very feasible and applicable, and "could readily be made by the blackies themselves." I then took it down to Fort Pitt, and showed the same to Dr. Dartnell, and to Dr. Parry, and both of them thought so highly of it, medically speaking, that I felt a little strengthened in my idea; but not satisfied with that, I took it to General Sandham, who was then at the head of the Indian and Royal engineering establishment at Chatham, and he said that he thought it was also very applicable. I then brought it before the Duke of Cambridge, and he sent out orders to General Anson to have it inquired into, and my son, in the year 1856, in a brief note, explained the circumstances that after an examination, the plan was referred to a board at Cawnpore, of which the then Colonel Henry Havelock was president, and that in about April or March 1857 it was recommended to have a trial made of it at Calcutta. I should mention that I took it also to Colonel Sykes, then Chairman of the Board of Directors at the India House, before sending it out to India, and he expressed an idea, which I think was a right one, that before sending it out to India, a sample should be made here, in order to ensure the correct application of all the machinery; and I need not say that if a point depending upon accurate construction is inaccurately constructed at first it will condemn the whole thing, and it is then thought that that which is often a mere error of detail is an error also in principle. Colonel Sykes' idea was, that a trial should be made of it, that is to say, the machinery only, and that that machinery, if successful in the trial, should be sent out to India. That, however, was not the plan that was pursued; the design was sent out in the form of a paper, and a trial was ordered (as I am informed by the Adjutant of the 52nd regiment) at Calcutta, after the Cawnpore Board had reported on it in 1857; but the mutiny broke out, and I believe nothing more was heard of it until about the time of the appointment of this Commission, when some medical officer brought before it the fact that there was such a thing designed, and that he thought it worthy of notice. This will explain the circumstance, that although I have not been on the continent of India, yet I felt it to be rather in the light of a sacred duty to bring forward this matter in the shape in which it had been originally commenced by my late son. I shall now be happy to explain anything, or to answer any questions that the Commission may think proper to put to me.

1321. Will you be so good as to state what the principle of the improvement is that you have to

propose?—I will lay this sketch upon the table. I presume that the members of the Commission sitting here are all aware that the ordinary plan of ventilating a barrack in India is either by a tatty, which embraces a water supply to a certain extent, or by a punkah, which I believe never embraces any water supply; or by a thermantidote, which is very much of the same nature, or is a modification of the punkah in its effect,—and, if I understand it rightly, is not accompanied with water—at all events, not generally. All of these various modes of ventilating the barracks or dwellings in India are moved by means of man power. Natives are employed to pull or to move them, and the cost of man power, I imagine, must be more than the cost of a properly arranged set of implements moved by animal power. It therefore appeared to me that a set of implements of a simple character to be moved by animal power must, as a question of expense, be less costly than the implements at present used, and moved by man power. Then came the question, of course, how to arrange a simple implement of that kind, and it appeared to me, that an implement moved very much as our English farmer moves his chaffing machine, by a bullock, or by a horse moving round an ordinary spindle, just as we see it in many places in Egypt, where the water is so raised, would be the best and simplest means. The next question was, after the moving power, how to apply a system of pulleys or ventilating shafts, and areas in motion which should catch a certain amount of air, and distribute it about the barracks, so as to give a current of air, which every one seeks in India; the problem was to find something simple of that character, and which should be applied simply to the moving power. I came to the conclusion that pulleys placed very much as they are in our English cotton manufactories, or in our iron factories, moving by simple leathern bands, and giving a rotatory motion to canvass fans, would be the best means, and the cheapest of circulating air through a large barrack room, and that one bullock would move the fans necessary to circulate the air thoroughly for about 100 men, that being described to me by my son as the ordinary state of the barrack room in which his men were. The next consideration was, that when the atmosphere is in a dry state, it is necessary or desirable not only to give a circulation of air, but it is very desirable to supply the atmosphere with as much moisture as possible, both in order to refrigerate and to cool it down, and to give a relief in moisture when a very dry state of the air might render such desirable from its effects upon the skin. This seemed to be perfectly available, and capable of being done, by throwing upon each canvass fan, which I have described as being used for the circulation of air, a very small quantity of water, dribbling as it were upon this loose canvass, and in this state of dribble being evaporated before it should come to the end of the canvass by a simple mode of regulation, so that not too large a quantity should come upon the canvas, which would not be carried off by evaporation, and which, if not so carried off, would wet the barrack floor, or the men lying about. This, I believe, has been done by means of that plan before the Committee, which I should simply describe as a series of canvass fans, moved by bullock power, to supply in a dry state of the air both the air and the quantity of water that was necessary only to give a degree of evaporation sufficient to carry off the water into the air, without any running on to the barrack boards.

1322. Except as to the introduction of moisture, your plan appears to have more analogy to the ordinary thermantidote than to the ordinary punkah?—No. I have not seen the thermantidote, but I understand it as described to me, to be very much like our English circular bellows, it is a large circular fan wheel, covered and working in a circle upon an axle, with a muzzle which looks like an enormous horse pistol, but which muzzle throws a stream of air con-

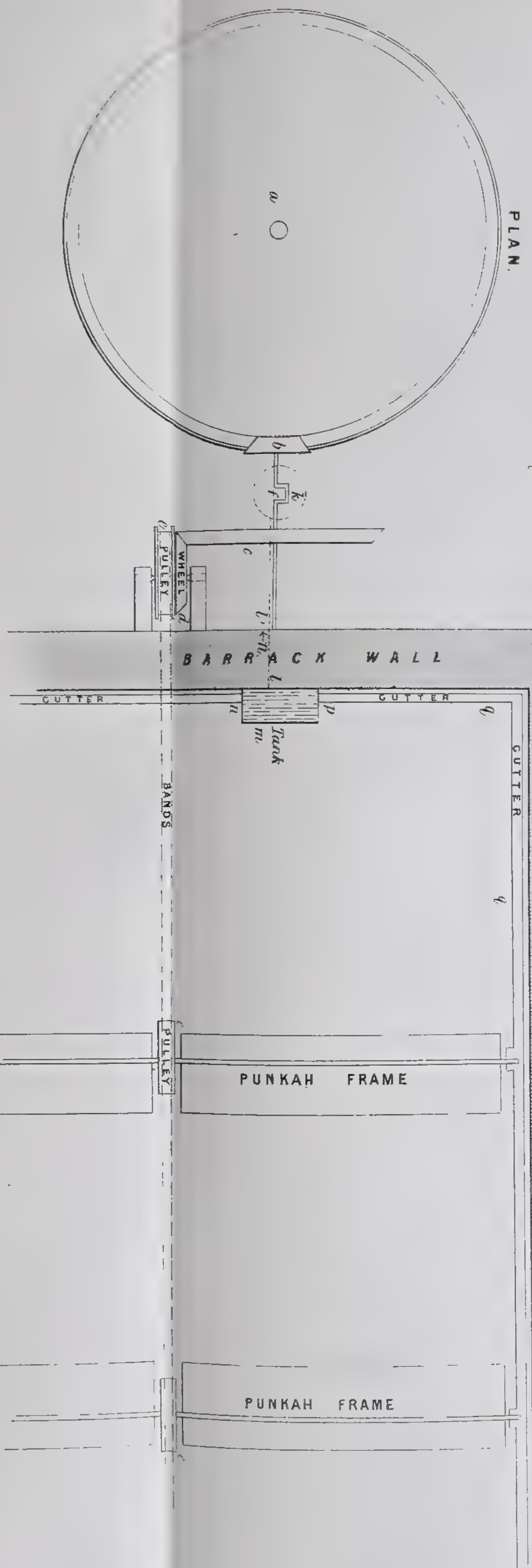
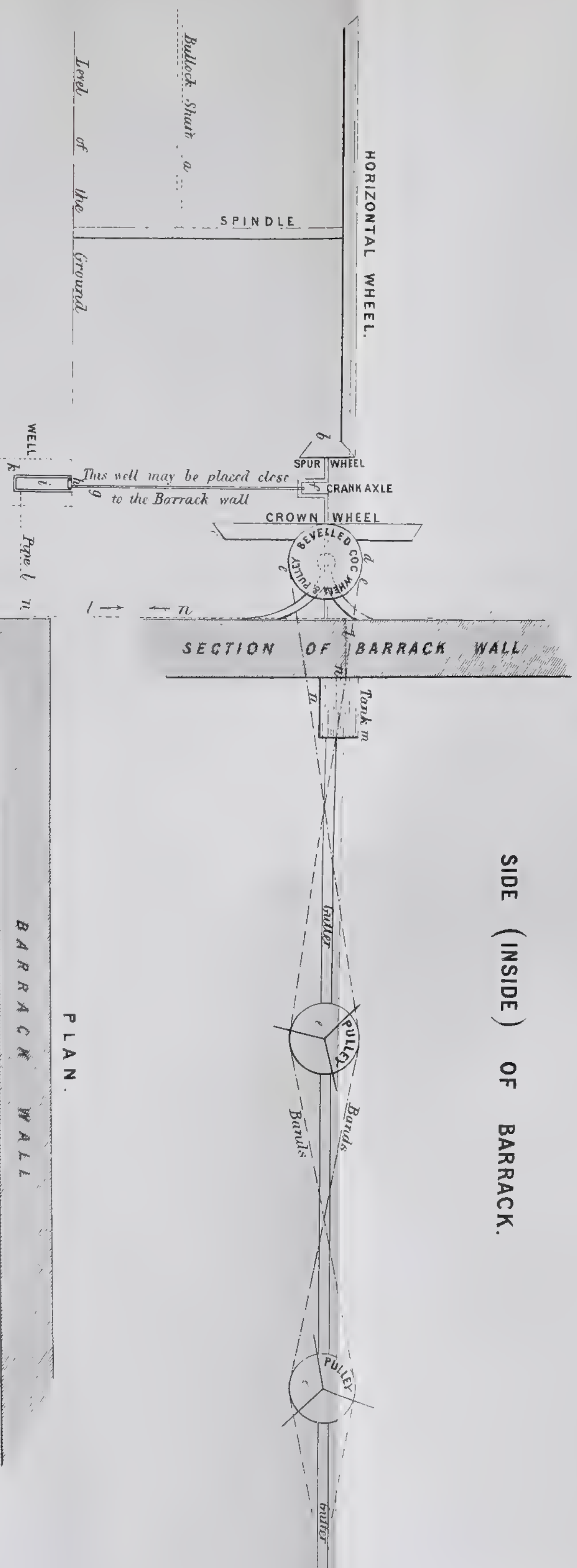
SKETCH PUNJABI Designed by Lieut. W. R. Moorsen 52 E. Infy

IN 1856.

Scale - four feet to an inch

Elevational View.

SIDE (INSIDE) OF BARRACK.



- The common **Bullock-shaft** works the upright *spindle*, on the top of which is a *horizontal wheel* 12 feet in diameter and 5 inches broad, with bevelled cogs.
- Spur-wheel**, 1½ feet diameter and 5 inches broad, with bevelled cogs.
- Crown-wheel**, 6 feet diameter and 4 inches broad, with bevelled cogs.
- Bevelled **Cog-wheel**, 2 feet in diameter.
- Series of **Pulleys** or plain wheels, all of which work with an *endless strap* passed alternately over and under each pulley.
- Crank**, in the axle of the *spur-wheel*.
- Lifting Pump-rod**.

(h) **Pump-piston** and leather **Valve** moving up and down the **Cylinder** (i), in the **Pump-well** (k) (which Well may be a barrel or heightened bed in below the barrack floor). The **Cylinder** has a *water-tight case* at top, fitted so that the pump-rod works through it in *water-tight packing*.

The water lifted by this pump-rod up the **Supply-pipe** (l) (which may be a gas-pipe or hollowed bamboo), flows into the **Reservoir** (m), and the **Waste-pipe** (n) returns any overflow to the **Well**.

The **Gutter-box** (o) of the reservoir may be shut by a sliding door (p), till opened to let the water flow into the gutter (q).

When the door is open, the water flows along the gutter, along the wall of the barrack, over the ends of the *axles* of the pulleys, and a few small holes let the water

dribble from the gutter into a *greased canvas funnel*, which leads the dribble into the end of each hollow axle, opening close to the side of the gutter; a small stopping of putty or india-rubber, or even of moist clay resting on the *bracket support* just under the holes in the gutter, will prevent the dribble from running back out of the hollow axle.

The waste water (if any) at the end of each gutter is led to the floor by a *waste-pipe* of bamboo. By regulating the small holes in the gutter, no waste water need exist; all will be evaporated on the punks.

The *pulleys*, 2 feet in diameter and 6 inches broad, are merely wooden wheels or drums sufficiently strong to resist the press of the *strap* or *belt*, which may be about 4 inches wide, and of light but strong leather; the band has faces and face-holes at each end, so that it may be laced to exactly that degree of tension which enables it to run easily round with the pulleys after having become stretched.

The *axle* for each pulley is hollow. The outside diameter may be rather less than 3 inches next the wall of the barrack, and about 3 inches full where it joins the pulley; the part of the axle on which the pulley is fixed may be solid, turned so as to fit true into the hollow arms. The hollow should be about 3 inch diameter, at the end where the dribble enters through the funnel; and about 1½ inch diameter at the end towards the pulley, so that the water may run freely down to the end, after entering the hollow axle. Small holes are bored all along each of these axles, and the water dribbles through on to the canvas or grass frame.

The **Punkah** frame is made of strong wood. Each pulley axle is fitted on each side of the pulley with three such frames standing inclined towards each other at an angle of 120 degrees.

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together, or to that arrangement of barrack which would render it necessary to have one set of punkahs distributed over another set, for example, for the use of a second story; the extent is limited by that nice adaptation of the machinery, which, when we come to very long bands, is difficult to maintain, for example, a length of band working pulleys of 300 feet in length would be more difficult than a length of band working 100 feet in length. With that exception, the arrangement being different, the plan and principle are applicable to 1,000 or to 10,000 men.

1337. Suppose a barrack of the ordinary form for 1,000 men, how would you proceed to ventilate it on your plan as the barracks are now in India, say upon one floor?—Upon one floor; I presume the width would be so great that there would be something like a party-wall between; if there be not, then I should consider it as one room, as this is, and, in that event, whatever be the extent of the room, I should throw a shaft across from wall to wall, and have an extreme breadth of punkahs from wall to wall, arranged precisely on that plan. If the length of the barrack be so great that you could not get correct machinery for a very long length, I should work the machinery from the two ends, thus dividing the plan as it were into two plans, working one plan at one end, and the other plan at the other end of the barrack. If the barrack, on the contrary, were so arranged as to be comparatively short and high, with two stories, it would then only be necessary to increase the altitude of the vertical shafts which connect the moving power with the same description of punkah, and the power would be the same, merely adding the additional friction involved by the additional shaft.

1338. Can you state whether the expense of ventilating a large barrack would be ten times as great as the expense of ventilating a small one upon your plan?—By no means; but it is not very easy to give you an exact constant or ratio for multiplying the expense for 1,000 men as compared with 100 men, but I may approximate it, I think. The expense of ventilating a barrack arranged for 1,000 men, as compared with the ventilation of a barrack for 100, would probably be from five to six times as much.

1339. Have you any idea of the expense of working your apparatus for 100 men?—Yes; the cost of constructing this machinery in England would be a total of 68*l.* for 100 men. I should say that the punkahs and frames are not included, but they be would best made in India.

1340. And the expense afterwards to be incurred for additional machinery in India?—That would be a few shillings only for the canvas.

1341. And then the bullocks?—I do not know the expense of the bullocks, but there would also be the expense of a person to attend the bullocks.

1342. You are not able to give the comparative cost of ventilating a barrack on your plan with that which is now in actual use?—I am not; but I have stated before (1321) that animal power is less costly than man power.

1343. Upon your system would you displace the air of the room entirely? Suppose the apparatus was working in a large room like this, how would the air be brought in, and how driven out?—I think that there is no barrack in India like this room, but there is a very large accession of air from the open spaces coming in; it is only the air coming in that would be constantly thrown about in currents on the same principle, but to a much greater extent than by the ordinary punkah.

1344. You assume that there would be a current of air into the room, and your apparatus would cause it to be moved?—I do not assume that there would be a current of air into the room, but that there would be an access of air from the outside, and when there is any disturbance momentarily from the punkahs it would throw the air to a different portion of the room, and consequently bring in something fresh. There would, however, in this case be a distinct action of the air as refrigeration is going on; there would be currents to supply the effect of the refrigeration from the outside; but I can hardly say what that effect would be.

1345. You consider this the cheapest way of applying that amount of force in producing motion in the air?—I think it is the cheapest way of applying it in India, under the circumstances of India.

1346. (*Sir Ranald Martin.*) I think you stated that a model machine was sent out to Calcutta?—No; I said that Colonel Sykes in going into the matter at the India House gave me off-hand his view, which was, that a working model of this machine should be made in England, in order to ensure the proper execution of the machinery, and be sent out to India as a sample, from which they might form a correct judgment.

1347. And that plan you would recommend to be followed?—I certainly would.

1348. In that case would you have your machinery, the cog-wheels for instance, made of iron for the sake of durability?—No; but I should have two points to take into consideration; first of all, the making of the most perfect machinery would undoubtedly give us most of these wheels, not all, in iron, but I should also have to consider that I should send to India a machine which might immediately strike an Indian officer as being a thing which his own people could construct and work, and therefore the result would resolve itself, I think, into causing to be made in England machinery of the simplest materials which are available in India.

The witness withdrew.

Dr. C. Smith.

Dr. COLVIN SMITH, Madras Army, examined.

1349. (*Chairman.*) Will you state how long you have served in India?—I arrived in India in December 1851. But I have been twice on sick certificate at home, both times from field service; altogether I have served between six and seven years in India.

1350. Have you served with Queen's troops, local troops, or native troops?—I have served principally with local European troops and with Native troops. I have served with detachments of Queen's troops likewise.

1351. In what presidencies have you been and at what stations?—I have served in the Madras presidency; I also served during the late mutiny in Bengal. I was in Burmah also during the last war.

1352. Which are the principal stations at which you have been posted?—St. Thomas's Mount, Madras, was my first station. I was stationed in Rangoon for six months; in Prome for five months on the Irrawaddy and throughout that campaign. Then at

Secunderabad I was eleven months; at Kurnool I was six months; and I was backwards and forwards in Jubblepore for about eleven months.

1353. Can you give the Commission any information as to the healthiness or unhealthiness of these stations at which you have been with regard to climate, local position, natural means of drainage, and so forth?—St. Thomas's Mount would be a healthy station if it were not for the bad barracks there. Rangoon was very unhealthy, but that was during the war. It has improved in healthiness greatly since that time.

1354. What is your opinion of Prome?—It was very unhealthy, and it was afterwards given up as a station because it was unfit for the men to live in.

1355. The next you mentioned was Secunderabad, what is the nature of that station?—It was healthy when I was there, except as to the native troops in one portion of the lines; but that might be accounted

for by their position. The Europeans in 1856 were remarkably healthy; I allude to the 3rd Madras European regiment.

1356. (*Sir R. Martin.*) That which you have mentioned as to Secunderabad was rather an exception to the rule?—Yes; it was to be accounted for in this way, that they got rid of all the grog shops about the lines, and that improved the health of the regiment immensely, the regiment was remarkably healthy under the superintendence of Dr. Macfarlane. They also established a lock hospital, which greatly reduced the number of the sick.

1357. (*Dr. Farr.*) It appears by the returns before us that the mortality among the British troops of the Company was 25 in 1,000, while the mortality among the Queen's troops was at the rate of 60 in 1,000 at Secunderabad. Was there anything in the barracks that you think would throw any light on that great difference?—I think that must have occurred since I was at Secunderabad.

1358. You saw nothing there that would explain the difference?—No; I have known the troops when they first went into the old barracks to be very unhealthy.

1359. When were the new barracks erected?—They were not finished when I passed through Secunderabad in 1857.

1360. You do not know probably the results of the erection of the new barracks?—I do not; I spoke of the old barracks when I mentioned the 3rd Madras European regiment.

1361. (*Sir R. Martin.*) And that was only for one year?—Only for that year. I think that in three months they only lost about three men. In the unhealthy native lines the men are generally unhealthy the first year, healthy the second, and in the third year they become sickly again; but that is more especially in the native lines, which are in a very low spot.

1362. (*Dr. Farr.*) What is there so objectionable in the old barracks?—They are badly built, and they are huddled together on a low piece of ground; there is a great deal of broken ground in the neighbourhood, and that during the rainy season is very wet. They permit the natives to dig out and build their houses there, and the consequence is that every place where a house has been built is a receptacle for the water during the rainy season. From this I think one of the chief causes of the sickness arises; it is quite undrained beyond the barracks.

1363. During the time that you were there, was your regiment suffering from ill health?—Yes; the 49th Native infantry regiment suffered very much. I was called upon in consequence to report the cause of the sickness; the lines were not in such a position that any native corps could be expected to be healthy in; they were quite close to the tank—a tank about four miles long—in the rainy season, and the whole, with the exception of a made road lying between that and the barracks, was under water, the wind blowing from that quarter during the time of the drying up of the rains, was sufficient to cause fevers.

1364. What did the men chiefly suffer from?—They suffered very much from fever and guinea-worm. We had a few cases of cholera, but they were not to be attributed, I think, to the same cause.

1365. How did they obtain water?—From wells; they were not good wells, but bad, not deep enough.

1366. (*Col. Greathed.*) Was the guinea-worm caused by the water, do you think?—Yes; I am convinced that it was.

1367. (*Chairman.*) What sort of station is Kurnool with regard to healthiness or unhealthiness?—It is a very hot station, and for Europeans I think it is unhealthy; but the natives recruited there wonderfully. There is a great deal of smallpox in that district.

1368. The next station you mentioned was Jubblepore; what kind of station is that?—That is a very malarious station; it is a beautiful station, but very malarious; it is very pleasant for a short time.

1369. (*Sir R. Martin.*) Do you think it is malarious on account of neglect?—There is an immense jeel or marsh there to the east of the station, and in 1858 they built barracks on high ground, but close to this jeel. Since then, I have had charge of about 120 men of the Europeans stationed there for some weeks, and I found that nearly all had the spleen very much enlarged.

1370. (*Dr. Farr.*) The country round is high, and I suppose not generally unhealthy, as I see at Saugor. the mortality is low, and the country seems not very different from the country round Jubblepore; is the whole district unhealthy?—No; what I speak of is quite close to an undrained jeel, and I recollect that an engineer officer told me that it might be very easily drained.

1371. (*Chairman.*) A jeel is a kind of marsh?—Yes; those barracks, I believe, were built in 1858.

1372. (*Dr. Gibson.*) The country generally is not marshy?—No; but there are a great many tanks in that district; it is close to the Nerbudda.

1373. It admits of drainage?—Yes; but the station is very badly drained, and the subsoil there is so wet, that if you dig a foot or two underground you find water; it is a very sandy soil.

1374. Is the water retained by something underneath the sand?—It appears to be so; it is a rocky district; one or two artesian wells have been put down.

1375. (*Chairman.*) You have stated that there is in the neighbourhood of Jubblepore a source of malaria close to the station?—Yes.

1376. Is that the case at any of the other stations you have mentioned; for example, is it so at Kurnool?—No.

1377. Is it so at Secunderabad?—Secunderabad is generally well drained; but it might be much better drained near some of the native lines. I do not think that the same source of malaria occurs.

1378. Is it so at Rangoon?—It was so at Rangoon in 1852.

1379. That is in a marshy situation?—It was so in 1852, of which time I speak, and also at Prome it was very bad.

1380. With regard to the drainage of the stations, is there any systematic drainage in regard to any of the stations you have mentioned?—Round the European barracks at Secunderabad, it was remarkably well drained for a short distance in the neighbourhood of the barracks.

1381. (*Dr. Farr.*) Do you mean round the old barracks?—Yes, around them, but there is broken ground in the neighbourhood.

1382. (*Chairman.*) Are any effective means taken to carry away the impurities of the station itself?—Yes, by the orders of the brigadier there are carts supplied, which go round daily for that purpose.

1383. It has been stated in former evidence that that is the general custom at the Indian stations, that that is the manner in which the ordure is disposed of?—It is under the Police.

1384. Are all impurities removed daily?—Yes, or should be.

1385. Have you ever known any cases in which that was neglected, and where a longer interval than 24 hours have been allowed to elapse?—No, I cannot say that I have.

1386. With regard to the water supply, has there been to your knowledge any cause of complaint in any of the stations you have mentioned?—Yes, in the native lines, referring to my regiment, the 49th Native Infantry, many of the wells were very bad indeed at Secunderabad, they were almost dry, and there was a very bad supply of water there generally in the hot weather.

1387. Was the water that was supplied of good quality or not?—It appeared to be of good quality, but the natives all suffered from guinea-worm, so that I should say it was bad water.

1388. Did you trace the guinea-worm to the water?—Yes, I think I did.

Dr. C. Smith.

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Dr. C. Smith.

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1389. (*Dr. Farr.*) Did you examine the water chemically or microscopically?—I did both, and I once or twice thought that I did distinguish sufficient to cause the guinea-worm.

1390. The ova, I suppose, were very small?—Yes, and there are a great many animalcules in every description of water that is exposed in India.

1391. They seldom take water from the rivers in India, I believe?—Yes, they do occasionally, and I know that at Kurnool the men who took water from the river seldom suffered from guinea-worm; but there is a disinclination to take water from the rivers.

1392. (*Chairman.*) With regard to the construction of barracks and the materials with which they are built, do you consider that they were appropriate for the purpose?—I do not think so, I think that they were very bad in many instances, the barracks at St. Thomas's Mount were very insufficient, and I think also the hospital when I was there, but it is improved since, I believe, it has been enlarged.

1393. In what respect are the barracks at St. Thomas's Mount defective?—In their situation, there is a hill there and they are placed immediately under this hill, and in hot weather it is something fearful, the attraction of the heat is so great.

1394. They get no breeze there?—Very little; the sea is only four miles off, and they might have got the sea breeze daily.

1395. Are there any other barracks at the stations you have named which are defective?—I think that the old barracks at Secunderabad are very bad, but the new barracks at Trimulgherry are certainly the finest I have ever seen.

1396. Are the floors raised above the ground in any case?—They are raised a few feet.

1397. But not, I believe, with a free circulation of air below?—No; I think that is improper for India. it would only be a receptacle for filth.

1398. With regard to exercise, is there sufficient shade or protection from the sun in the stations to enable European soldiers to take exercise in the heat of the day?—There is no such shade. I think the planting of trees in the stations would be a great advantage, and that that should be done in every station.

1399. (*Col. Greathed.*) Are there any sheds under which the men can take exercise?—No; none that I have seen.

1400. There are no sheds attached to the barracks for the purpose of enabling the men to take exercise?—At none of the stations at which I have been do I recollect any, but in some stations I believe there are.

1401. (*Chairman.*) As a matter of fact, do the men take much exercise either in the morning or in the evening?—A few of them do; but I do not think that they take sufficient exercise.

1402. (*Dr. Gibson.*) Do not the natives take exercise?—Yes; the natives take more exercise than the Europeans.

1403. (*Col. Greathed.*) Do you think that there is any advantage gained in allowing the soldiers to go out shooting?—I think there is; and that they should always be permitted to go and enjoy themselves morning and evening, when not on duty.

1404. Have you never found the men suffer from that?—They do suffer occasionally; but I do not know that the officers who go out shooting suffer more than others who do not.

1405. (*Chairman.*) You would not apply that, I presume, to all the stations, and allow the men to go out shooting in a damp and marshy country at all hours?—Certainly not, at all hours. It is very bad to be out in the heat of the sun, and up to the middle in water.

1406. Do you consider that the ventilation of the barracks by means of punkahs is sufficient?—No, I do not think it is; and I think that each barrack should be well supplied with tatties, in order to reduce the temperature in the hot weather.

1407. What are the ordinary means of ventilation

used at the stations?—The barracks are generally ventilated from the top.

1408. Punkahs are in use during the hot weather, I presume?—Yes, in some barracks.

1409. But tatties are not so much in use?—They are not now, generally.

1410. Thermantidotes, I believe, are not in common use?—No, they are not.

1411. At Madras, where they say the objection to a station was its excessive heat, were the punkahs in use?—I never was stationed with troops at Madras; but at St. Thomas's Mount, eight miles from Madras, there were no punkahs in the barracks in 1852.

1412. (*Dr. Farr.*) The mortality at Palaveram is 26 in a thousand, at Madras 31, and at St. Thomas's Mount, 41 in a thousand. Do you think that that is partly to be accounted for by the site of the barracks?—Yes, I think it is partly accounted for by that.

1413. (*Dr. Gibson.*) Do you mean the site or the construction of the barracks?—The site, and also the construction of the Mount barracks; they are close.

1414. (*Sir R. Martin.*) And very old?—They are, and then the hospital was just close to them, within a few yards; the station is very confined.

1415. (*Dr. Farr.*) You meant at St. Thomas's Mount?—Yes, there is a beautiful plain about half a mile further on, where they might have good barracks.

1416. (*Chairman.*) Have you any suggestions to offer as to any improvements in the materials, or form of construction, or ventilation of the barracks and hospitals?—I think that the barracks at Trimulgherry are, without exception, the finest I have ever seen; certainly they have no fault, except the expense; but I think that on the same principle good barracks could be built at much less cost.

1417. To what do you refer, to the height or the size of them?—They are very broad, and that increases the expense enormously; the height is very good indeed, and also the verandahs; but I would have them a little narrower, I think, and you could by that means build a very good barrack for much less.

1418. (*Col. Greathed.*) Have you any reason for wishing to have the barracks narrower?—No.

1419. Have you not observed that when they are wider, and there is a press of men, an additional row of beds is put in?—I believe that has happened, but there should only be two rows of beds.

1420. (*Chairman.*) Do you think that sufficient provision is made for personal cleanliness in the way of ablution rooms, and bath rooms?—Yes, I think that sufficient provision is made; but I do not think that the soldiers take sufficient advantage of it.

1421. Is there, in a climate like that of India, an unwillingness to make use of the means supplied?—The English privates in India are the most dirty of men, I suppose, in existence; the common soldier generally washes his face and hands once a day!

1422. Are there any means employed to see that he does more than that, for example is he not required to bathe and wash himself in a proper manner?—I am afraid not, by the present regulations, although I have known many of the cleaner men go to the tank, and also wash themselves in their ablution rooms from head to foot; but as a general rule, when they come to me in hospital, I find that they have not been well washed for a long time.

1423. (*Dr. Gibson.*) Are all the stations well supplied with baths and ablution rooms?—Not exactly with baths, but with ablution rooms they are.

1424. The men have the means of washing the whole body?—Yes; the means generally used in India are little chatties, or tubs, and the habit is to throw half a dozen of these tubs full of water over their heads in the bath room, and then they wash the body; but there are very few plunge baths, that I have seen, for the men—there are some. If what I have mentioned is done every morning I think it keeps the skin clean.

1425. Are there basins in all the ablution rooms?
—Yes, there are basins.

1426. And a sufficient number of other necessary vessels?—Yes, I think so; if the men would only take the trouble, or were ordered by their officers to do so, there are quite sufficient means.

1427. (*Col. Greathed.*) Have you found that the means provided for washing in the hospitals are sufficient?—Yes, in all the hospitals that I have been in.

1428. I mean are they convenient for the patients?
—No, they are not convenient.

1429. For example, is it not the case that a sick man has often to sit on the ground in order to wash his face?—Yes; the means are not well arranged.

1430. There are no basin stands, I believe?—There are no basin stands in the hospitals.

1431. (*Dr. Gibson.*) Are there not benches in the ablution-rooms on which the basins might be placed?—There are benches; just one row with the washing basin on it. I never saw any other arrangement.

1432. (*Chairman.*) With regard to barrack cooking, and the rations of the men, have you any suggestion to make?—I think that the rations are very good indeed. The contractors often try to cheat as much as they can, but generally the rations are very good indeed, and they are, I think, wonderfully well cooked.

1433. Do you think there is a sufficient variety of food?—There might be more variety introduced in the way of vegetables, but I think as a general rule the rations are very good indeed.

1434. (*Col. Greathed.*) Speaking from your experience, are you aware that it is the fault of the regimental authorities if the rations are not good?—Yes, I am.

1435. Is it not in the power of the commanding officer to convene a committee, whose decision is final?—Yes.

1436. And who can reject the meat, or the bread, or the vegetables, or the tea, whichever may happen to be objectionable?—Yes; they can reject anything.

1437. (*Chairman.*) Are spirits served out as part of the daily ration of the soldier?—They were in the beginning of last year.

1438. (*Col. Greathed.*) Do you mean in barracks?—No, in the field I mean. I have not been in barracks for three years.

1439. (*Chairman.*) What is the quantity of spirits allowed in the field?—It is a dram twice or thrice a day.

1440. Do you think that that quantity is too much with regard to the health of the troops?—Yes; and I think that that might be done away with altogether.

1441. What would you substitute in its place?—Beer.

1442. Would not any difficulty arise on account of the beer being less portable on the march?—That is one difficulty, no doubt, if there is not good carriage; but it would be a great saving in the long run.

1443. Have you known cases where the health of the men has been injured by consuming merely the amount of spirits issued to them?—Yes, I am sure that I have; and especially when served in the morning, as many of the commanding officers have it served in the field.

1444. (*Col. Greathed.*) Is not that contrary to orders?—I believe it is; but it is done, as I know.

1445. (*Chairman.*) Do you mean in the morning, after breakfast?—No; I mean the first thing in the morning.

1446. Then it is given on an empty stomach?—Yes; I have known this often done in the field.

1447. Would the medical officer have no right to interfere, or to remonstrate in such a case?—He might be listened to; the commanding officer in such a case is all-powerful.

1448. (*Col. Greathed.*) It would probably be when a man came in from a long march?—No, not exactly that; if he did so come in, it would revive him, and

not do the same harm. I have known the men go to the tap for grog before starting on a march.

1449. That is entirely contrary to orders, is it not?
—I believe so.

1450. (*Chairman.*) The result of that practice, I suppose, is, that the men come in additionally heated and feverish from the march?—Not exactly that; but after giving it to them for a short time they cannot do without it.

1451. (*Sir R. Martin.*) It becomes then a morbid habit with them?—Yes, I think it does; I think the old soldiers would grumble if they did not get their grog.

1452. For the old soldiers, perhaps, you think you could not do away with it?—Not at once.

1453. But in the case of a young man, you think it might be done away with with great advantage to his health and efficiency?—Certainly.

1454. (*Dr. Gibson.*) Are the recommendations of the medical officers usually attended to?—I am sorry to say, that they are not always attended to; they are in some cases, of course; but in a case of that sort the commanding officer generally consults the men's tastes.

1455. (*Chairman.*) Besides beer, are there any other drinks that could be supplied advantageously to the soldier, so as to diminish his inclination to drink spirits?—I think that a good cup of coffee should be given regularly the first thing in the morning.

1456. That would not cost more, I presume, than the spirit ration?—No, I do not think it would.

1457. (*Col. Greathed.*) Have you not known it very commonly the case that the men do get a cup of coffee in the morning?—I mean in the barracks, not in the field?—Yes; I have known it.

1458. Not as a rule?—It is the rule to give them their coffee in the morning, and that, I think, should always be substituted for the dram in the field likewise.

1459. (*Chairman.*) At the stations at which you have served what means of amusement or occupation are there for the men?—They have a game of cricket occasionally in the cool weather.

1460. That would only be, I suppose, in the morning and evening in the cold season?—They used to play in the middle of the day during the cold weather generally.

1461. Have they any other amusements?—"Fives courts," "quoits," &c.

1462. (*Col. Greathed.*) What is the great amusement of the soldier in India; is it not long bowls?—Yes, generally.

1463. Do you know whether they gamble at that game?—They always like to have a little gambling at all these games, and I dare say they gamble at it.

1464. In short, are not the amusements of the men almost always connected with drink, more or less?—Yes, they are. The amusement for the men is not enough, either mentally or physically.

1465. (*Chairman.*) Do you think the men suffer in consequence from ennui?—I think they do often.

1466. Should you say, speaking professionally, that that state of things was unfavourable to their health?—Yes, it is very unfavourable to their health.

1467. Do you think it predisposes the men to disease?—I do.

1468. In the course of the daily duties, referring to the drill and the guards, are the men subject to much exposure from the weather?—They often are, but they might not be in cantonments.

1469. I am not speaking of service in the field, but of the ordinary duties in a time of peace at a station?—Some commanding officers will drill the men morning and night; in the morning for hours, much too long for any constitution to bear, and they are exposed to the morning sun often; and in the evening they are often drilled before the sun has gone down sufficiently.

1470. Is there any general order limiting the hours at which drills should take place?—I do not know it, but I believe there is.

Dr. C. Smith.

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Dr. C. Smith.

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1471. Do you think that there ought to be any limitation as to the length of time that troops should be drilled during the day?—I think so; I think that the soldier, if he is sent out to India a good soldier, might be drilled for a hour and a half in the morning, and for an hour in the evening during the cold season; that, I think, would keep him in good training.

1472. Do you mean that that should take place every day?—I think that should be done four or five times a week in the cold season; in each station there is a holiday upon one day.

1473. Will you fix the hour in the morning after which, and the hour in the evening before which, the men should not be taken out of barracks for the purpose of being drilled?—In cold weather you must fix one period, and then another period in the hot weather, in which season there should be little drilling. In wet weather they should not be drilled at all.

1474. (*Dr. Farr.*) But as this is the only work that soldiers do in India in a time of peace; are you of opinion that the soldier should not work more than during the time you have mentioned daily?—The hour and a half that I speak of would be only part of his duty, he goes upon guard, and I have known them to be on guard every third day or oftener.

1475. You would say two hours and a half of drill, and the time occupied in mounting guard?—Yes, I think that two hours and a half of drill per day would be almost sufficient. When the soldier is in the field, you require a much longer period of duty. For young recruits, if they are to be sent out to India, you would, of course, require longer time, but I speak of men who have been made soldiers.

1476. What amount of work do you think that men of the class to which soldiers usually belong should perform in a climate like that of India?—This is difficult to estimate; but a good deal of indoor work might be done during the day.

1477. In addition to the other duties which the soldier has to perform?—Yes.

1478. Can you suggest any other improvement for the benefit of the soldier in India than that?—Yes, there are many.

1479. I mean improvements which would be conducive to his health?—There should be, I think, workshops attached to the barracks where the different accoutrements might be made, or the clothing that is necessary for the regiment, &c. I think that workshops should be established.

1480. And would you recommend gardening?—Yes, I would.

1481. Those occupations would perhaps diminish the ennui, if the soldier had such work to do?—They would in a great measure. The want of occupation for the men is greatly felt. In India, there is nothing for a man to do except his duty.

1482. (*Col. Greathed.*) Do you know whether the men are in the habit of reading much?—No, they do not; it would be a great advantage if they were to establish a good reading room, and a library to be attached to every regiment.

1483. You think that there is a deficiency in that respect?—A very great deficiency.

1484. What means have the men of obtaining coffee or ginger beer?—They have a coffee shop.

1485. But I meant rather a reading room where they could obtain coffee?—I think it would be a good thing to have such a reading room attached to the coffee shop.

1486. Where the men could also smoke?—Yes, you must allow them to smoke.

1487. (*Chairman.*) Have you at all considered the question of the soldiers' dress and accoutrements?—Yes, I think the present dress in India is a very good one indeed. The dust-coloured dress without a stock, a good helmet made of wicker-work, well covered.

1488. That is new within the last two or three years, is it not?—It is, within the last four years.

1489. Has that generally been introduced or not at the present time?—There was an order for its introduction in 1858, I think. I do not know whether

it has been regularly introduced yet; it was not introduced into all the line regiments when I left India, I think.

1490. The stock, I believe, is disused altogether?—I think so, and it should never be used.

1491. (*Col. Greathed.*) Have you seen the new dust-coloured dress, which was sent out from England?—I have seen the cloth of which it is made, but not the dress.

1492. Did you form any opinion as to whether it was too heavy or not?—No.

1493. You did not see the material made up?—No, I did not.

1494. (*Dr. Gibson.*) Do the troops wear flannel in India?—They generally have a little flannel, but they take very little care of it. I do not think that they are well supplied with flannel.

1495. If they were supplied with that kind of flannel which they would be enabled to purchase, do you think they could wear it?—No; I think that it is a great deal too hot for the skin. It increases the irritability of the skin, and it induces perspiration, it is, therefore, very weakening; it is very hard flannel, and should not be worn in the hot season.

1496. (*Sir R. Martin.*) But you would approve of it, I suppose, for service?—I would have a lighter kind of flannel for service always.

1497. (*Dr. Gibson.*) The soldier, I believe, has a great indisposition to wear flannel?—Yes, he has.

1498. (*Col. Greathed.*) You find it very difficult, do you not, to make them wear their cholera belts?—Yes.

1499. Would you recommend the wearing of a cummerbund?—Yes; I think it is of great use, even more so than the cholera belt.

1500. (*Dr. Farr.*) With reference to the selection of sites, you have mentioned three sites which you condemn on general sanitary grounds; first, the site on which St. Thomas's hospital is built; next, that on which the old hospital at Secunderabad is built; and then, Jubblepore?—No; it was the site of the barracks at St. Thomas Mount that I condemned, also the old barracks at Secunderabad and the Jubblepore barracks.

1501. You have mentioned, at the several stations you have been at, instances in which the troops have been placed on bad sites, and where, nevertheless, better sanitary sites were almost in the immediate neighbourhood?—In my opinion these were much better sites.

1502. (*Dr. Sutherland.*) Have you ever witnessed the effects of an epidemic on the march?—Yes; of cholera.

1503. Where did you witness that?—It attacked my corps, the Madras Rifles, on the march to Mirzapore.

1504. What were the circumstances which struck you on the march as likely to predispose the men to the attack of that disease?—We marched at a most unhealthy season of the year, in May and June, when the wells were nearly dry, and the tanks in a like condition, and the heat as high as 119°.

1505. Then they had no good water to drink?—No; what they had was very bad.

1506. Bad to the taste and bad to the smell?—Yes.

1507. Did you attribute that epidemic to that circumstance, along with the fatigue of the march and the temperature?—Yes; their food was very good.

1508. What was the length of the march upon that occasion?—I think it was 150 miles before we were attacked by cholera.

1509. How long did it continue with you afterwards, and for what distance?—It continued with us for about three weeks, but disappeared on the first rain.

1510. (*Dr. Farr.*) Was that in Burmah?—No, we were on the Ganges river in Bengal.

1511. (*Sir R. Martin.*) Had you been making forced marches previously to the invasion of the cholera?—No; but my regiment had been exposed

throughout the whole campaign; and this was when we were marching to Jubblepore after the campaign.

1512. (*Dr. Sutherland.*) What precautionary measures did you recommend on that occasion?—The breaking up of the regiment into two detachments as I only had one assistant.

1513. What effect had that, if any, in staying the progress of the disease?—It seemed to lessen the virulence of the disease.

1514. Did you pass through any towns or villages on the march?—Yes, and we left the disease in every village that we passed through.

1515. Have you ever witnessed an attack of cholera amongst the native population, independently of the case you have mentioned?—Yes.

1516. Will you state to the Commission the sanitary condition of those places where you have seen cholera, with regard to drainage, cleansing, and the water supply?—The place I am referring to was Promé in Burmah, and there everything was against the health of the natives, for it was surrounded by swamps, which, in the rains were filled with water, and in the dry weather, they were dried up.

1517. Was the town of Promé itself clean?—No, it was very filthy.

1518. From whence did the people derive their supply of water?—They had wells.

1519. What was the state of the dwellings, were they clean or filthy, or were they crowded?—They were generally crowded.

1520. (*Chairman.*) Taking into consideration all the causes which influence health or disease among soldiers in India, such as climate, position of stations, want of drainage, defective construction of barracks, diet, clothing, intemperance, and the like, to what class of causes do you attribute the largest amount of injurious effect upon the health of the soldier?—To a malarious climate, together with intemperance, and syphilis. These are the three things which generally break up the constitution of a man I think in India.

1521. Intemperance, syphilis, and malaria?—Yes.

1522. With regard to malaria, do you think that the effects of that can be diminished to a considerable degree by a more careful choice of sites for stations?—I think it could be diminished in a great measure.

1523. As to intemperance, you have stated that that has been to some extent encouraged by the habit of serving out a spirit ration?—I am sure that that has encouraged it.

1524. You also, I presume, think that intemperance may be diminished?—Yes, by substituting for the spirits an allowance of beer.

1525. With regard to the third cause that you have mentioned, have you any suggestion to offer to the Commission as to a possible diminution in the causes of that disease?—Yes; I should suggest the re-establishment of female lock hospitals wherever Europeans are in India, and a good set of peons or police to be attached to each hospital.

1526. Is there no special provision made for the treatment of such cases in India?—A number of years ago in every station there were lock hospitals, but those were done away with, and only at a very few stations have they again got lock hospitals.

1527. Do you know why they were done away with?—It was false modesty, I think, on our part. I had charge of one at Hyderabad, and the commanding officer of the 3rd Europeans made this observation to me, "Your hospital has diminished mine by at least one-third since its establishment." Since being examined on this head I have heard that there was abuse of police authority, and that the report of Her Majesty's Inspector-General of Bengal was quoted by the Indian Government as influencing them powerfully in abolishing lock hospitals.

1528. (*Dr. Gibson.*) Are the women placed under police regulations?—Not nearly to a sufficient degree. I think that they should be placed under police regulations, as I believe that would reduce the sickness in regiments. I think that there should be a regular police system established for that purpose.

1529. At Secunderabad you said that the sick were greatly diminished in numbers, in consequence of the establishment of a lock hospital; was that accompanied with police regulations?—Yes; I could not have done anything unless the police had managed it.

1530. (*Dr. Farr.*) How did they interfere?—They found out the women who were generally attached to the soldiers and brought them to the hospital; there were a couple of very good nurses attached to the ward, and they generally examined a suspected woman, and if there was anything the matter with her she was of course detained.

1531. Were the women inspected weekly by the medical men?—Yes.

1532. Had they then a certificate given to them?—No, but they should have had.

1533. Those who were infected were placed in hospital?—Yes, they were.

1534. There was no inspection made of others who were unsuspected of being afflicted with the disease?—No.

1535. (*Dr. Gibson.*) Were the men obliged to attend at the lock hospital?—No.

1536. When they contracted syphilis, were they obliged to state from whom they obtained it?—No; but that might be managed, I think; it is not the practice at present.

1537. (*Col. Greathed.*) There was no inspection by the doctor of native soldiers?—No, not as a general rule as there is in the European regiments; but there should be, I think.

1538. (*Dr. Farr.*) Do you attach much importance to the water as a cause of disease in India?—In some districts I do; but generally speaking, I think the water is good.

1539. You mean the water of the wells?—Yes; you generally find some well in a station that is good. I have often known bad wells; but I have never been in a station where there has not been a good water.

1540. You think that there would be no difficulty in procuring good water at all the stations which have come within your knowledge?—I think not.

1541. Would you recommend filtration or any other means for purifying the water from impure wells?—Certainly.

1542. You think that that would be quite practicable?—I think so.

1543. (*Chairman.*) You have not, I think, been on duty at any hill station?—No; I have not been on duty, but I took up wounded and sick from Lord Clyde's force to Darjeeling in 1858, and I remained at that station for some months.

1544. Have you considered professionally the effects of the climate of those hill stations on the health of the men?—To a certain extent I have.

1545. As a general rule, what degree of elevation would you recommend? I understand that it is possible to go to an elevation greater than is desirable for the purposes of health, and that a moderate elevation is to be preferred?—In the three presidencies I should think the elevation is very different; the elevation is about 6,500 feet above the level of the sea; on the Neilgherries, and also on the Himalayas, where you could get very healthy stations at this elevation; then in Mysore you could get them at lower elevations; there is a very healthy station in Madras Presidency only 3,100 feet above the level of the sea (Ramandroog).

1546. (*Sir R. Martin.*) There are medium ranges which are very available, are there not?—Yes.

1547. (*Dr. Farr.*) Both in Madras and in Bombay?—Yes.

1548. And in Bengal?—I think that the Himalayas are the only elevations, and there is nothing under 5,000 feet I should think; some of the stations are much too high in Bengal; there is a new station, Sinchul, which is many hundred feet above the present sanitarium at Darjeeling, and it either rains or snows the greater part of the year; it is just placed on the top of a range of hills.

1549. (*Sir R. Martin.*) On a spur?—Yes; there is an immense quantity of rain there.

Dr. C. Smith.

2 March 1861.

Dr. C. Smith.

2 March 1861.

1550. (*Dr. Farr.*) How long were you at Darjeeling, and during what months?—I was there in the months of June, July, August, September, and October.

1551. In charge of the wounded men?—I went there with wounded men, and I was myself invalided there.

1552. (*Sir R. Martin.*) Those were the most unhealthy months to be upon the plains?—Yes.

1553. (*Dr. Farr.*) What did you observe at Darjeeling?—The men I took up were badly selected; but the men that should have gone up to the hills, I observed, soon became robust and strong, and by the month of October they were almost able to return to the plains again. I may mention that I took the invalids that year down to Calcutta from Darjeeling.

1554. From what diseases did the men suffer who you thought should not have been sent to a hill station?—Chronic diseases of the different organs of the body, men who were very far gone with phthisis, and dysenteric patients.

1555. Those cases, I suppose, were aggravated at Darjeeling?—Very much so.

1556. Was that due to the climate, or to the uncomfortable circumstances in which the men were placed?—They had everything very comfortable; and I think it was wholly due to the climate.

1557. Wet, and damp, and cold?—It is damp and cold; but it is not an unhealthy dampness for healthy men.

1558. (*Dr. Gibson.*) Would not those men have suffered more in the plains than upon the heights?—We arrived at the foot of the hill about the 27th of May, and we had not lost a man on the way up to the hills; I think three men died within a week or two after our arrival at the sanitarium, and those men, I think, should have been sent to the sea coast, and not have been sent up to the hills at all. I do not think they could ever have recovered completely in the plains.

1559. (*Sir R. Martin.*) General experience of the mountain ranges throughout India shews that they are adverse to the condition of men suffering from bowel complaints?—Yes; I think so, certainly.

1560. (*Chairman.*) Have you considered the question, whether mountain ranges, isolated hills, or high table lands, are, upon the whole, the most healthy situations?—The mountain ranges are the most healthy.

1561. With regard to men who are not invalids, to troops in ordinary health, do you think it is desirable to station them at a considerable elevation above the plains rather than upon the plains?—Yes, and on that account hill stations should be greatly increased in number.

1562. Do you conceive that a considerable additional expense would be created by the greater labour of carrying up provisions and supplies of all sorts to mountain stations?—It would be an additional expense, but a great saving in the long run; for you would save your men's lives.

1563. There would be a saving of life?—Yes.

1564. (*Sir R. Martin.*) And of sickness?—Yes.

1565. (*Chairman.*) Which of two men would be the most fit for service during the hot seasons in the plains; the man who had been recently residing in a hot climate, or the man who had been living in a cooler climate at one of the hill stations?—I think the man who had been living previously in the plains, for he does not come directly into the hot weather of that year, it comes gradually upon him.

1566. (*Dr. Farr.*) That is, if he is alive at the end of the six months; but he is less likely, is he not, to live on the plains than on the high land?—He is. Coming down from a very cold station to the hot season is, I think, very bad for the men.

1567. (*Sir R. Martin.*) Are you aware that the brigade which descended from Simla and marched upon Delhi in the hot weather was remarkably healthy, with the exception of cholera?—Yes; I believe they were.

1568. That is rather at variance with the opinion that you have just expressed?—But then, did you follow those men afterwards, for I should think that they would be very much broken down.

1569. But that applies to general service on the plains everywhere?—I think that no corps should be kept on the hills during the very cold season.

1570. (*Col. Greathed.*) Have you also heard that the men who came from the stations on the plain and marched down to Delhi were also healthy with the exception of cholera?—I cannot answer that question; but they were wonderfully healthy for a long time. I know that the excitement kept up the men, and it is after the excitement is over that disease broke out, as it does in every campaign.

1571. (*Sir R. Martin.*) You have stated that heat and malaria are amongst the principal causes of disease on the plains?—Yes.

1572. You are, in a great measure, if not entirely, relieved from both on the elevated ranges?—Yes; by occasionally sending the men up to the hills for the hot seasons you can keep up their stamina; but if you keep them in the plains they lose that in a very few years; for this reason hill stations should be greatly increased.

1573. You would bring them down in the cold seasons for exercise on the plains?—Yes; you cannot exercise the troops on the hill stations, as there is little drill ground.

1574. (*Chairman.*) There is generally a want of space in the hill stations?—Yes.

1575. (*Dr. Farr.*) You mean at the present hill stations?—I only speak of one that I know, and that is Darjeeling.

1576. (*Sir R. Martin.*) Are there not extensive spaces on the Neilgherries for exercise?—Yes, there are. The Neilgherries are much flatter altogether than the Himalayas. In the Mysore district, the table-land of Mysore, there might be a number of fine stations. I think we are not at all in want of positions in India for stations.

1577. There are great ranges in the country of Travencore, which are as yet unexplored?—Yes. The Resident has a very nice residence on one of these.

1578. (*Chairman.*) There has been, I believe, no systematic inquiry in India as to the stations that might be found for troops at elevations of about 2,000 feet?—Every now and then there is something said about it; but it has never been done in any systematic way. I think, that besides hill stations, coast stations are required for the men.

1579. (*Sir R. Martin.*) For certain classes of diseases?—Yes.

1580. But you are, I presume, of opinion that the mountain ranges would be the most available for the preservation of health, though not for the cure of disease?—I do not think that any very serious organic disease would be improved by residence on mountain ranges.

1581. (*Dr. Gibson.*) Is a sanitarium out of India, in your opinion, wanted?—No, I think that the men should be sent home, if they are not fit cases for the hills or sea coast.

1582. Could not men be sent conveniently to a place like Australia; I mean men suffering from acute and severe disease, who cannot be sent to England, and who are eventually invalided, but who might recover if they were sent at an earlier stage of the disease to Australia?—They might be so; but I think that a soldier, if he would neither recover on the sea coast or hills, should be sent to England, and if he were brought back to his own country it would be a saving in the long run; Australia has no doubt a fine climate.

1583. (*Chairman.*) With regard to the construction and the arrangement of hospitals at the stations at which you have served do you consider that they are generally satisfactory?—No, I do not think that they are for European troops, the native hospitals are generally very good indeed.

1584. Do you think they are too crowded?—I have seen them very much crowded. The hospital at St. Thomas's Mount was very much crowded, in fact we had the men always in the closed verandahs, besides being in the centre ward; but since I was there in 1851 I believe the hospital has been improved.

1585. As a general rule is there sufficient ventilation?—I think that the old hospitals for Europeans were very badly ventilated, the new ones are very good indeed—the Trimulgherry Secunderabad hospital is a very beautiful building, but rather too extravagant, I think.

1586. In what way are the wards protected from the direct action of the sun?—They have outer verandahs.

1587. Have they also double roofs?—No, not that I have ever seen.

1588. The verandahs are sometimes occupied by invalids are they not?—Yes, in that hospital I mentioned to you where there was no outer verandah.

1589. In what state is the atmosphere generally found in the wards towards morning?—I have found it very bad indeed—very impure often.

1590. From want of means of opening the windows, or from carelessness, or unwillingness to use the means provided?—I think it was more from overcrowding in the old hospitals.

1591. I suppose that punkahs are universally used for cooling the air?—They should be, and they are generally.

1592. Are thermitidotes ever required?—I believe they are, but I never saw them used for hospitals.

1593. And tatties?—They should be always in the hot weather.

1594. But are they used?—They are sometimes.

1595. I understand you to say that punkahs are generally used?—Yes, for European troops, of course.

1596. Is there a sufficient provision for the sick, in the way of baths and ablution rooms?—In the old hospitals I do not think there was.

1597. Are the same means which you have described as being employed in the stations for removing impurities, employed also in the hospitals?—There is generally a number of natives attached to a hospital for the purpose of cleaning it, and they are always ready to clean it out.

1598. In regard to the manner in which that service is performed, are you satisfied with its sufficiency or not?—Yes, I think so; they are under the medical men, and if the medical officer attends to cleanliness, it is very well done.

1599. (*Dr. Farr.*) Have you observed gangrene or erysipelas in the hospitals in India?—I have observed erysipelas, but not gangrene.

1600. Or erysipelas occurring after operations have been performed?—In the field hospitals I have observed that.

1601. But not in the hospitals?—No, not in station hospitals.

1602. Upon the whole, do you think that the hospitals are as good in India as they are in England, considering the circumstances of the climate?—I have no experience of the latter. In Madras, the dresser establishment is remarkably good; the finest in the world, I think.

1603. (*Col. Greathed.*) In Madras have you female hospitals in connexion with the European regiments?—I was with the artillery, and we had then; it was in the same compound, but in a separate building.

1604. Was there a matron allowed?—Yes; we had a very good matron.

1605. (*Dr. Gibson.*) Were the lying-in cases admitted into hospital?—Every severe case that came under the charge of the surgeon was admitted; but there were generally many midwives in the regiment.

1606. And such cases were not required to go into that hospital?—No; except they were bad cases.

1607. (*Chairman.*) From your experience should you say that men are more or less liable to suffer from Indian diseases or from climate in proportion to their years of service?—For the first few years of service a

man is very apt to suffer from fever and inflammatory diseases, and after that he suffers from chronic diseases.

1608. Does that arise from a greater constitutional liability to them, or merely from the inexperience of a man, and not knowing how to take care of himself?—I think from the two together, and especially from the latter, in the case of young soldiers arriving in India, who take no care of themselves at all.

1609. Do you think that there is such a thing as acclimatization, and that the men do get accustomed to the climate, and are able to bear it with less injury to their constitution than they did at first?—No, my experience leads me not to think so.

1610. At what age do you consider the soldier's service in India should begin and end in order to obtain the largest amount of efficiency?—I should think about 21 years of age.

1611. You think that he is as well fitted to bear fatigue and exposure in a tropical climate at the age of 21 as he ever will be?—Yes, or at 22.

1612. At what time do you think the service should end?—I think he should be good for about 15 years in that climate, or between 12 and 15.

1613. Is it your opinion that there are many soldiers who are not fit to serve longer in a tropical climate, but who are still capable of doing good service in Canada, or the Cape of Good Hope, or in Europe?—Yes, I believe there are.

1614. Fifteen years' service in India you consider to be about the maximum service for a soldier?—Yes.

1615. (*Sir R. Martin.*) Is it not the fact that you seldom see a soldier 40 years of age in India?—It is very seldom, except in the artillery; there you occasionally see them older.

1616. And that is principally among the non-commissioned officers?—Yes; of course they are better taken care of; but it is the drilling of the young soldiers of the age of 17 or 18 in India which kills them.

1617. Referring to the drill; if there were tablelands on mountain elevations the drilling of young soldiers, I presume, could be carried on there with comparative immunity from the consequences of which you have spoken?—Yes; but I do not see any advantage to be gained by that, as the men should be drilled and made soldiers before sending them out to India.

1618. I was merely comparing the drill on the plains with the drill on the Neilgherries?—Yes, in that case the hills have a great advantage over the plains.

1619. (*Col. Greathed.*) Have you had any opportunity of seeing anything of the cavalry?—Yes. I served with the 6th Madras Cavalry.

1620. But not with European Dragoons?—No.

1621. (*Chairman.*) You have been examined on a variety of subjects; is there any remark or suggestion that you would like to make upon any one of them, or upon any of the questions contained in the printed paper?—No, except this, that I think the medical officer should have a great deal more to say with regard to the sanitary improvement of a regiment than he has now, and I think that sanitary committees should be appointed in all stations with a medical sanitary officer at the head.

1622. At present, if I understand the case rightly, a medical officer has the power of reporting or of advising, whether he be asked to do so or not, the commanding officer, but he has not the power of putting any protest on record, and the decision of the commanding officer is final on all points?—Not upon all points, for, with regard to cholera, the commanding officer is under the medical officer, that is, the commanding officer must obey the medical officer, but on all other points the commanding officer may do as he pleases, I believe, at present, but the medical officer can put his protest on record.

1623. Take an imaginary case. Suppose that a commanding officer not sufficiently acquainted with

Dr. C. Smith.

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Dr. C. Smith. the climate, and not believing in its dangers, was to insist on keeping the men out till a comparatively late hour in the morning, so that they suffered much from the sun; or suppose again that the practice which you have described to exist of issuing the spirit ration prevailed largely, and it was seen by the medical officer that that was producing injurious effects upon the men, what would be the limit in each of those cases of the medical officer's power?—He would have no power but to report to the deputy inspector of hospitals.

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1624. What would become of it then?—The deputy inspector may do as he pleases with it.

1625. If he chooses to take the matter up, to whom does he refer?—He reports to the Brigadier, to the principal Inspector-General of Hospitals, who may report to the Adjutant-General of the Army, who brings it before the Commander-in-Chief.

1626. (*Sir R. Martin.*) Might not the Superintending Surgeon report to the General officer commanding a division?—He might do so.

1627. That would be, would it not, the more immediate course?—Yes, it would; but a General officer in India takes often the view of the Commanding officer.

1628. (*Dr. Gibson.*) I believe that the recommendations of the medical officers do not receive much attention?—It just depends upon the commanding officers. I have had two or three commanding officers who delighted to do anything they could for the benefit of the men's health.

1629. I think you stated that the Superintending

Surgeon, or the deputy inspector does not pay much attention to the recommendations which he receives?—In some cases I have seen that, but I have also seen the very reverse. The principal Inspector-General in Madras was a most careful superintending surgeon, and he took every precaution against letting any reports fall to the ground.

1630. (*Chairman.*) With regard to the appointment of sanitary committees,—for what purposes should such committees be appointed, and how, in your opinion, should they be constituted?—I think that a medical officer should be appointed as a sanitary officer (or officer of health) in each station.

1631. (*Col. Greathed.*) Was not that done before you left India?—No, not to my knowledge.

1632. (*Dr. Farr.*) What power would you give to the sanitary officer?—He must have a good working committee under him, in order to see that a station is kept in a proper condition; he should have the power to carry out his orders.

1633. You would have inspectors under him to carry out his directions in all minor sanitary matters?—Yes, he must have them, for by himself he can do nothing.

1634. (*Sir R. Martin.*) Have you heard that the Royal Commission of 1857, who considered the sanitary condition of the British army, recommended the appointment of a medical officer of health?—Yes.

1635. That is the kind of officer that you have referred to?—Yes, a sanitary or medical officer of health.

The witness withdrew.

Saturday, 16th March 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.
Sir RANALD MARTIN, C.B., F.R.S.
J. B. GIBSON, Esq., M.D., C.B., D.G.A.M.D.
Colonel GREATHED, C.B.

Colonel DURAND, C.B.
WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

*Major-Gen.
H. Goodwyn.*

Major-Gen. HENRY GOODWYN, Bengal Engineers, examined.

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1636. (*Chairman.*) Will you state at what stations you have served in India?—At Kurnool, Neemuch, Jhansi, Cawnpore, Calcutta, Berhampore, and Bareilly.

1637. To take Kurnool in the first place; what is the character of the country about it?—It is generally flat.

1638. Are there any marshes or works of irrigation in the neighbourhood?—The canal ran close alongside, on the east side of the cantonments.

1639. Were there any natural facilities for drainage?—With the exception of the drainage into the canal itself there were none; there was an attempt made to drain the cantonments at one time by means of connecting a series of tanks, which were in the rear of the cantonments, and eventually passing them off into the canal.

1640. (*Sir P. Cautley.*) The canal ran through an old hollow, did it not?—Yes.

1641. (*Col. Durand.*) Was not the cantonment originally upon the high land which bordered on the low land of the river?—The position of the cantonments was rather upon a slope, not upon the highest part of the parade ground. The part eventually occupied by the European infantry was higher than the original position of the cantonments. A trench was cut in front of the whole line to pass off the drainage round by the horse artillery barracks.

1642. (*Chairman.*) Are there any hills or elevated table land within a reasonable distance of Kurnool?—No.

1643. Will you take next Neemuch, and state whether there are any peculiarities in that station?

—The peculiarity in Neemuch was, that it was excessively well adapted for drainage; it was an undulating country.

1644. Were there any marshes in the neighbourhood?—There were a few lakes, I think, in the vicinity, but at some little distance; and there was a nullah that ran at the foot of the parades.

1645. Is it upon a high elevation, or upon the low ground?—The cantonments there were rather upon a high level, and very favourably situated for drainage, and they were always dry.

1646. Now take Jhansi; can you give us any account of that station?—That was a small station, and merely for a regiment of native infantry.

1647. Were there no Europeans quartered there?—None.

1648. In the case of Cawnpore, is there any inundation or irrigated land in the neighbourhood such as is likely to produce malaria?—No; none that I ever saw.

1649. (*Sir P. Cautley.*) It had the character of being badly drained when I was there?—The position of the European barracks at Cawnpore is about the worst that they could have occupied, and they are positively, with the exception of the civil lines, upon the lowest spot of the whole ground. The horse artillery are in the best position, and the native cavalry; but the European infantry are placed in about the worst possible position that they could be.

1650. (*Sir R. Martin.*) So as to make it very difficult to carry out effectual drainage?—Yes; the

drainage from the bazaar, which is in rear, passes through the lines of barracks.

1651. It is in a saucer, as it were?—Yes.

1652. (*Sir P. Cautley.*) And yet the river is close to it?—Yes; but a high bank intervenes, and very little attempt has been made to carry out the drainage from the barracks, which consequently was very inefficient.

1653. (*Chairman.*) Would it be possible, without much expense or labour, to drain the barracks into the river, and also to prevent the drainage of the town, which you say passes through, from passing through?—I think not; it is in such a very crowded position, and so confined, that there is very little space; the houses are close all round.

1654. (*Sir R. Martin.*) Is the hospital placed under similar disadvantages with regard to its position?—It is; it is rather nearer the river, upon a little higher ground, but still they are all in the line of the drainage, and the drainage there is very offensive. I would condemn the infantry barracks at Cawnpore altogether, both on account of site and material.

1655. (*Chairman.*) Is the barrack an old one or a new one?—Very old.

1656. Was it not destroyed in the late disturbances?—I am not aware.

1657. Your impression of the place is derived from your experience of it previously to 1857?—Yes, I left it in the early part of 1857. I believe there were some new barracks being built in 1855 or 1856; but the position I do not know. I was in Calcutta at that time. I should think that Cawnpore can be drained, and very well drained; and what has done harm at Cawnpore, and to the greater part of the cantonment, is that it is on a kunkur (limestone) soil, and from that they get lime for building purposes as well as metal for roads; and the little natural ravines that run through a part of the place have been excavated in various localities, and the hard substance of the soil has been taken away; the consequence is, that the place is now in hollows and pits, and the loose soil only remains and holds the water.

1658. (*Sir R. Martin.*) So that they become receptacles for the refuse matter?—Yes, the kunkur has not been dug so near the river, but from the very cantonment itself, and of course it is in the line of the drainage.

1659. (*Chairman.*) I believe there is no high ground in the neighbourhood of Cawnpore?—Not what may be called high ground; there is a higher level than the European barracks, namely, where the barracks are which are occupied by the horse artillery and dragoons.

1660. But not in the nature of a hill station?—Nothing of that kind.

1661. And there is not, I believe, within a very considerable distance?—Nothing, I believe, nearer than the Himalayas that I know of.

1662. Where are the troops quartered at Calcutta?—They are quartered in Fort William itself.

1663. The whole of the troops?—The whole of those who are on duty in Calcutta; they are quartered in the Fort. I may say that I was building a new range of barracks before I left, in Fort William; the old ones, I am happy to say, were just about that time condemned, and they were being pulled down. They had been for a long time before the Government as being unhealthy.

1664. From what reason were they unhealthy, from being overcrowded, or want of drainage?—Partly from their position, being close under very high ramparts, and the absence of ventilation; partly also from the crowding, for they were very much crowded in those barracks, especially in the triangular ones.

1665. (*Col. Durand.*) Was it not found very difficult to drain Fort William properly?—Yes; very difficult; it could only be drained by means of the operation of the tide, and that not effectually.

1666. (*Chairman.*) I suppose that a barrack which

is situate within a fort is always disadvantageously placed with regard to ventilation?—Yes; and these were; they were situate close to the ramparts, but a better site was fixed upon latterly, and by having them well raised. I cannot speak as to the result, but it was the general opinion that they would be far more comfortable and healthy for the men.

1667. (*Sir R. Martin.*) They are very lofty, rising above the ramparts, are they not?—Not altogether, the upper story is, but from their position, away from immediate proximity to rampart, will be better ventilated.

1668. (*Col. Durand.*) Were you able to give any attention while there to the usual set of the winds, and the disposition of the new barracks in Fort William?—The wind in Bengal is not so prevalent from one particular quarter, for a long time together, as it is in other parts of the country. The location of the barracks there has been principally guided and arranged with reference to the present buildings, and the lines of road, and other circumstances to be considered there, and not with reference to any wind.

1669. But the monsoon is pretty regular in its usual set, is it not?—I do not think that the westerly wind prevails with that regularity that it does in the upper provinces; where such is the case, it is desirable that the barracks be placed accordingly.

1670. (*Chairman.*) The last station that you said you served at was Berhampore?—Not the last station that I served at, but Berhampore was in my circle at the time I left India.

1671. (*Col. Durand.*) You were, as I understand you, Chief Engineer?—Yes; and also the barracks at Chinsurah; they were included in my circle and they were very bad ones.

1672. (*Chairman.*) Will you be good enough to state to the Committee what you know about Berhampore?—At the time when I was there, there were no Europeans there, but latterly there have been some. At the time I was Chief Engineer there were none, and attempts have been made to drain the place more thoroughly than it had been, and a proposition was before the Government for a more effectual drainage of the place by means of machinery. The square in which the barracks were was pretty well drained, but the marshy state of the native lines and their parade ground was that which seemed to cause the unhealthiness of the place; it was in a very low position.

1673. (*Sir P. Cautley.*) What was the defect at Chinsurah barracks?—I was talking of the Dutch barracks.

1674. I mean the immense buildings which I recollect seeing in 1845?—As far as they went they were pretty good, with the exception of their not being sufficiently raised, especially for the soil and climate of Bengal; they were too near the ground and the urinaries and cookrooms were defective and badly placed.

1675. They had an upper story, I think?—Yes.

1676. (*Chairman.*) Can you tell us what is the usual practice that is followed in selecting sites for stations, when a new one is to be established?—I have never been at a new station where a site has been selected, but I believe that it has principally rested with the civil authorities in regard to the selection of the site originally.

1677. (*Col. Durand.*) Will you explain what you mean by the civil authorities?—With reference, I believe, to the nature of the ground, and its value probably for agricultural purposes; at least I recollect something of the kind as to the station at Julundur, through which I was merely passing at the time the question was being settled as to what position it should be in, and I think that was done under the authority of the Commissioner.

1678. Was there not a committee of medical officers, and engineer officers, and some other field officers?—That I do not know.

1679. (*Col. Greathed.*) Do you remember that Sir Hugh Wheeler fixed upon one site, and it was put

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aside by the Commissioner afterwards?—That is what I am alluding to.

1680. (*Chairman.*) The decision, I presume, ultimately rests with the Commander-in-Chief and Governor-General?—I can hardly answer that question.

1681. At all the stations at which you have served has there been, in your judgment, sufficient care taken to clear away the impurities and remove the ordinary drainage of the stations?—Yes; it has been attended to by the establishment of the regiment as far as I have observed, that is, as regards the buildings.

1682. The system throughout India is the same, is it not?—Yes.

1683. All refuse and impurities are removed by hand labour?—Yes.

1684. Is that done daily?—Yes.

1685. Have you ever heard complaints that that service has not been sufficiently attended to, and that nuisances have arisen in consequence?—Not, I think, from the want or rather from any carelessness in the establishment, but more from the system itself; for instance, the system of allowing large urine tubs to remain in the barracks the whole night, and not to be taken away in the morning until the sweepers were allowed to come in. In using large bamboos to remove a heavy tub, they would splash it over, and the offensive smell of the urine tubs would remain in the barrack for some hours afterwards. That was the case at Cawnpore also, and with the temporary barracks at Kurnool.

1686. Are the tubs left in the barrack room all night poisoning the air?—A barrel sawn in halves, as it may be, is left in the barrack all night, and it is carried away by the sweepers in the morning.

1687. Whatever it might be during the day, during the greater part of the night, while the men are there, there would be continually a bad smell?—Yes; that remained some time after they were removed.

1688. (*Dr. Farr.*) And these tubs are particularly offensive in India, where the temperature is high?—Yes.

1689. Decomposition of the urine would take place?—Yes.

1690. (*Sir P. Cautley.*) Where was the urine taken to?—I think it was thrown into a drain at some short distance, or perhaps nullah.

1691. Near to the barracks?—Not very far off.

1692. (*Chairman.*) Was there any care taken that very offensive substances should be removed to a sufficient distance?—I do not know whether there was.

1693. (*Col. Durand.*) With whom did that rest?—I fancied that it was a regimental matter; there was an establishment of bheesties and sweepers attached to the regiment, I believe, for that express purpose.

1694. (*Chairman.*) It would be the duty of the colonel of the regiment, would it not, to see that any complaints made on that score by the medical officer were attended to?—Yes.

1695. It would rest absolutely with him, would it not, to decide whether they required to be attended to or not?—Yes.

1696. (*Col. Greathed.*) Are you not aware that there is a quartermaster of the week whose business it is to see that everything of an offensive nature is removed from the barracks at all the stations in India?—I do not know whether there is or not; I do not remember any such official.

1697. (*Col. Durand.*) Was there any systematic periodical flushing of the drains about the barracks at any cantonment where you have been, or which has been under your charge?—No; I think it was left for the periodical rains more than anything else; the native establishment used to wash them out, but this cannot be called flushing, nor was its efficacy extended beyond immediate area of buildings.

1698. That was during the hot weather?—During the cold weather there was none; but the system has

been generally, I think, to take as much care as possible in the formation of drains immediately around the barracks, and for a short distance from them; and then the matter has been left to take its natural course. I do not think that an eventual outfall has been provided.

1699. That would, in fact, account for what is called the difficulty of draining cantonments like those which you have mentioned, Kurnool and Cawnpore, which are on flat ground?—Yes; but at Berhampore it was because the barracks lie close to the river, and there was not only a possible, but an effectual method of draining the whole square of the barracks into the river.

1700. But it is very difficult from the nature of the level?—Yes; the difficulty of Berhampore was that the interior of the square was lower than the highest point of the flood-rise, and an embankment alone kept it out.

1701. (*Chairman.*) Does the same arrangement which you have described as to the urine tubs prevail in hospitals as well as in barracks?—I am not quite sure upon that point.

1702. With regard to the water supply, in what manner is that generally provided in barracks?—By hand labour and water-carriers.

1703. (*Dr. Farr.*) From what source do they procure the water? from wells?—Principally.

1704. Not from the river?—Wells, I believe, are the principle sources.

1705. Are they shallow or deep wells?—They vary.

1706. To refer to the well at Cawnpore, what was the depth of that?—I do not know, but I believe that the wells at Cawnpore are what might be termed shallow.

1707. That, I suppose, is naturally the case at the lowest stations in the valley of the Ganges; the water is near the surface?—Yes.

1708. Have you examined the water as to its purity, or have you tested it in any way?—No. At Berhampore the supply was, I believe, principally from the river, except when it was in a turbid state.

1709. (*Chairman.*) Are you aware whether it was the habit of the medical officers or other competent persons to regularly examine the water in order to ascertain whether it was free from all admixture of deleterious matter?—I do not know.

1710. How is the water stored and distributed for use?—There is no storing of it that I am aware of; it is supplied daily at the time it is required, with the exception of those places where there have been baths built for the soldiers.

1711. Is not that the case at every station at which you have been?—No, I do not think so; not at every station.

1712. (*Dr. Farr.*) In the new barracks that were built at Fort William were there any baths provided?—There was one plunging bath in Fort William, but only one.

1713. Had you no arrangement for providing baths in the new barracks you have constructed?—No; but they were only half finished when I left.

1714. But it was no part of the plan?—No.

1715. That was in 1856 or 1857?—Yes.

1716. (*Chairman.*) At the stations which you have described, are the barracks generally of one or two stories in height?—Those at Cawnpore were of one story; those in Calcutta were of two stories; and at Chinsurah two. At Berhampore they were of three stories.

1717. (*Sir P. Cautley.*) And at Dumdum, of what character were the barracks?—I think there were both kinds, with and without upper stories.

1718. (*Chairman.*) The materials used, I suppose, vary in different parts of the country?—Yes, they do; that is to say, brick is almost all they use, with the exception of those in Central India; and I believe that they are built there of rough stone, but brick is the principal material. The material for the barracks is a point which I wish particularly to bring

to the notice of the Committee; for I think it is a point which deserves the most serious attention, both as regards the health and the comfort of the soldier, and also economy to the Government. When I was in England in 1842, I designed a complete set of fire-proof barracks for India, and I submitted them to the Court, and they were pleased with them, and had a large number of them lithographed, and they were distributed over the different Presidencies in India. It was a substitution of a permanent material for that which is so apt to decay, and to cause inconvenience and expense in India, namely, to substitute iron for wood, and asphalté floors for the present lime and brick, thereby gaining an increase of width and space, an increase of height, and a more permanent flooring, which I think is a most necessary thing in a barrack, for it is impossible to keep a lime floor free from dust, and constantly breaking up, and it is also damp.

1719. Are the floors always limed at the present time?—Almost all that I know of. I am not sure about the Berhampore barracks, but I believe that all I know are limed, Chinsurah I think has stone.

1720. (*Sir P. Cautley.*) I have some indistinct recollection of your trying an experiment with asphalté floors in Calcutta, and of your finding that the weights placed upon them sunk into them. I mean the cots?—No, not those that were covered in; there was a large slab of asphalté laid down in front of the main guard in Fort William, exposed to the sun, and when a weight was placed upon it, in the months of May or June, it indented it; but the moment the sun set it became all level again; and there was no stickiness at all on it; it remained like a large slab of granite.

1721. You think that there is nothing to affect the value of its application?—No, it was laid down in the medical college hospital with perfect success, and in one of the store-rooms in Fort William, which I inspected from time to time, and reported upon, and timber was laid down upon this, and paper, and clothes, and many things, and they were kept free from the white ants, which destroyed similar materials when lying in other parts of the store-room that was not laid down with asphalté. I consider it an exceedingly valuable material, especially for barracks and hospitals.

1722. (*Col. Durand.*) Of what are the floors in the hospitals in India usually made?—Generally the same as the barracks.

1723. Have you had any complaints with regard to that kind of flooring as being unsuited for a hospital?—Yes.

1724. What means were taken for its purification in the hospitals?—Simply a renewal again of the lime floors.

1725. Is that frequently done?—Frequently; certainly annually.

1726. Did that at all answer the purpose of keeping the place sweet and clean?—I do not think so; for, with regard to a lime floor, when you have the smallest hole in it, you cannot repair it. The moisture of the new material invariably gets in, and that is very inconvenient.

1730. (*Chairman.*) Have you considered the question of the comparative expense as between an asphalté floor and a lime floor?—It is, I think, a question of original expense, and that no doubt is greater; but I think that one would be found to be less costly in the end. There are repairs which are done in the department of public works, which have been styled quadrennial; and I have always remarked that when the second quadrennial period comes round, almost all the woodwork that is required in the barracks has to be renewed. There was scarcely a bit of timber that lasted for eight years in Bengal. Certainly there was an immense amount of woodwork, and it was an immense expense in Calcutta. I entered into a calculation at one time, which showed that the difference in the eventual expense in the course of 20 years would be nothing.

1728. (*Sir P. Cautley.*) Was that calculation made

with reference to a particular spot, or generally all over India, or over a large tract of country?—I think it was with reference to Bengal. It would not be so great in Upper India, but certainly in Bengal the ultimate saving, and indeed in Upper India, would be very considerable—perhaps not in the hills; and independently of that, light wrought-iron roofs and asphalté flooring are materials that can be taken away and removed, and they can also be kept lying in store in the magazines ready for the erection of barracks when required.

1729. (*Sir R. Martin.*) Have such buildings as these been tried?—The barracks that I built in Calcutta were to be on that principle. I may add, that there is an admirable system of ventilation connected with this plan from the roof.

1730. To carry off the heated air?—Yes; and these light iron trusses are capable of an immense amount of ventilation, and can be applied with the greatest ease and simplicity.

1731. I have heard that a number of these roofs have been constructed at Roorkee in the last four years, in the Punjab?—I have not heard of those; but I am sure that from the nature of the materials, and the facility with which they can be put together, they could be kept lying in store, capable of being removed; and the extreme inconvenience to which soldiers are put when the roofs of the barracks are being repaired, and the constant changing of the timber, which is necessary from its liability to decay, would be prevented; for I should mention that there is never a store of timber in the engineer's yard in India. It is not allowed to accumulate on account of the destructive nature of the material itself; and, as to the wood, you are entirely dependent upon the contractors to bring what wood they choose into the market. It is, therefore, never properly seasoned, and the consequence is, that it all goes actually into the buildings with the seeds of decay in it. With reference also to bricks, and the materials of which they are made, I think, too, that that is a matter which very little attention is paid to by the department in India, and nothing is more destructive to health than an imperfect brick building. The moisture which it imbibes is very great, and wherever the plaster decays and peels off, which it will, the brick absorbs the moisture, and therefore not only is the permanence of the barrack destroyed, but the men's health and accoutrements suffer.

1732. (*Sir R. Martin.*) I suppose it crumbles and powders both in the hot and in the cold seasons?—Yes, (*i.e.* the plaster.)

1733. (*Sir P. Cautley.*) What should you substitute for the brick?—I would not substitute anything for the brick, but I would inculcate a better system of manufacturing it; I mean that the soil should be more particularly looked to. I think that an engineer generally endeavours to make his bricks as cheap as he can in order to keep his rates low; and I think that he is therefore not so careful in regard to the preparation of the material as he might be. I think that this is a matter which ought to be taken up entirely by the department.

1734. Have you seen Mr. Digby Wyatt's design for iron walls, and so getting rid of brick entirely?—No.

1735. It is a double casing of iron?—It was something upon that principle that I designed the roofs of the barracks. The section of the iron was like an H, on the lower flange of which a ceiling of corrugated iron was proposed, to be painted white, between which and the upper flange, on which rested the tiles, there was a hollow space of six or seven inches, which might either remain hollow, or be filled in with a non-conducting material such as charcoal.

1735. (*Chairman.*) You would not, I presume, expose the iron to the direct heat of the sun?—It would not be exposed to it at all. Not only would I advocate iron roofs, but I would advocate iron doors. I would have a double iron door, for I look upon that as almost a necessary thing to be attached to that

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system, for just as anything else of wood, the doors are tumbling to pieces everywhere, and their frames too.

1737. (*Dr. Farr.*) Are the barracks in India generally built of bad materials?—I think so, that is, inferior, and susceptible of improvement if scientific men, who have been brought up to brick making and lime preparing, were sprinkled through the department.

1738. (*Chairman.*) You object, as I understand you, altogether to the use of timber; you think it is liable to perpetual decay?—Yes, timber and grass. I have seen a whole regiment obliged to turn out into tents, just when the rainy season is setting in, and suffer considerably from the barracks having been burnt down.

1739. I suppose you have no means of laying before the Committee an approximate estimate of the comparative expense of the barrack built as you propose, and of a barrack built under the present system?—I had the whole matter drawn out, and I have been asking Col. Baker if there was a copy of my drawings and report at the India House, and it appears that there is not, that they all went out to India.

1740. (*Col. Durand.*) Can you in general terms state what the proportionate cost was?—I can hardly state just now.

1741. (*Dr. Farr.*) You will be able to supply it subsequently, perhaps?—I doubt whether I shall be able to find the requisite data, but will do so if possible.

1742. What the Committee would desire to see would be the cost of a barrack constructed according to your plan for 1,000 men, and the cost of a barrack built under the old system?—Yes.

1743. (*Chairman.*) Are the barracks which are now constructed raised above the ground with arched basements and a free passage for the air beneath?—I only know one instance of the kind, and that is in Calcutta, the absence of such arcaded basements is a great fault.

1744. (*Dr. Farr.*) Were the barracks which you erected at Fort William on a plan which you submitted to the Company?—No, not upon the ground plan; the roofs were being made with light wrought-iron trusswork.

1745. Why were they not built according to the plan that you thought the best?—Because there would not have been space for them; it was only for one single company the barrack that was being built on that principle, and not for a regiment; and it was in lieu of a barrack which had been pulled down that was rotten and unserviceable; the old artillery barracks stood upon that site, and therefore we were confined for space, and my original plan would never have got in there; my plan involved an increase of width, which could not have been given upon that spot.

1746. (*Col. Durand.*) In fact your plan had reference to having the amount of area that was requisite, whereas in Fort William you were necessarily confined to the area that was available?—Yes.

1747. (*Dr. Farr.*) With regard to the materials, could you not have got asphalte floors and iron roofs?—The iron was being adopted in the roofs.

1748. But you did not get the asphalte?—No.

1749. Then did they use brick?—The floors were not finished when I left, nor was the roof on.

1750. Therefore the suggestion that you made in 1842 was not carried out?—Only in the roof.

1751. (*Col. Durand.*) Where would you get the asphalte from? Could you get it in India?—No; it must come from England, and care must be used in selecting the pure Seyssel asphalte, for there is much spurious material of a defective kind, such as "Parisian bitumen," &c.

1752. (*Sir R. Martin.*) Will you describe the composition of the roofing of that barrack in Fort William? was it of iron?—Yes; it was composed of wrought-iron trusses, and a double-tiled roof over it, with every now and then a moveable portion of the framework capable of ventilation to be worked by a lever below.

1753. (*Chairman.*) With regard to temperature, can you suggest any improvement in the present means of keeping the interior of barracks and hospitals cool?—I think that an increase of width, such as I originally recommended, is one great thing, and also that there should be attention paid to the doors to see that they shut closely and properly.

1754. So as to shut out the hot winds?—Yes, and also the hot air at all seasons of the year.

1755. What is the average width at present?—The average central width of a barrack now is 24 feet.

1756. Do you consider that insufficient?—Yes, I do, however, many verandahs you may build outside; there are the incumbrances, brick walls, in the intervening space, which take up a great deal of room, and are inconvenient, although the verandahs are exceedingly necessary.

1757. There are verandahs everywhere, are there not? and no barrack is constructed without them?—I do not think that the Berhampore barracks had verandahs, but I am not quite sure.

1758. (*Dr. Gibson.*) Does your plan exclude verandahs?—No.

1759. (*Chairman.*) Are double roofs ever used at present?—I have not known of any.

1760. Do you consider that the provision made for ventilation by punkahs at present is satisfactory?—No, I do not indeed; roof ventilation, which I believe to be the best, is very spare and scanty, and must be so, particularly in those pent-roof barracks.

1761. You think that there are not sufficient means employed to remove the impure air?—I do not think that there are.

1762. Have you any specific plan to propose on that subject?—Nothing beyond that, which was part of the construction of the new roof which I proposed, and in which there was great freedom of ventilation.

1763. The means adopted for cooling the air in barrack rooms are almost invariably, I believe, the same, namely, by punkahs and tatties?—I have not seen any punkahs up myself, tatties are the general means used by day. There was an attempt made to introduce punkahs into Fort William, upon some new principle which had been sent out from the Court of Directors at home, which had not been tried, but I cannot speak to the value of it.

1764. When did you leave India?—In the beginning of 1857. I believe that what I have referred to was the invention of a naval officer.

1765. (*Sir P. Cautley.*) Was it worked by machinery?—Yes; it was worked at one end by a circular cog wheel, moved by a bullock.

1766. (*Col. Greathed.*) Do you mean Captain Moorsom's invention?—I cannot remember the name, but I would advocate the system of thermantidotes in preference to anything else.

1767. (*Chairman.*) That is forcing a current of air through a barrack room, is it not?—Yes; it is on the principle of the fan blast, which is attached to iron foundries.

1768. Has that an effect in removing the foul air, or only of lowering the temperature?—I think it effects both, and I think it would be very useful to serve both purposes.

1769. (*Dr. Farr.*) Have you seen it in operation?—Not in barracks, but I have in private houses, and in large houses too.

1770. How has it worked?—Very well indeed, so much so that in the month of May there was no occasion for a punkah.

1771. Is it worked by hand?—Yes; it might be very easily worked by simple machinery, and half a dozen of them might be connected together.

1772. Is that in your opinion the most economical way of applying an amount of force for removing the air?—I do not know of any better at present that could be so simply and effectually introduced there.

1773. (*Col. Durand.*) Does not its action depend

a good deal upon the hydrometric state of the air, or would it apply equally in Bengal as in the north-west provinces?—Yes, it does depend upon that, but it is only required at those particular seasons when the air is in a heated state, in the intervals between the rains; for instance, sometimes you have a week or 10 days of excessive heat in the rainy season; but in Bengal you are sometimes without a drop of rain for many days, and the air is then very hot.

1774. Have you tried it in Bengal?—Yes.

1775. (*Sir P. Cautley.*) Do you remember to what extent the thermometer was reduced by the use of a thermantidote in extremely hot weather?—No, I never kept a register of that.

1776. (*Dr. Farr.*) Is water evaporated in the apparatus, or how is the temperature depressed?—The air comes in through the sides of the machine which are filled in with tatty-work or grass.

1777. It is wet?—Yes, and kept constantly moist, but there is no occasion to have it constantly supplied by manual labour; a trough erected, or a tub erected above, pierced with holes, would supply it all day long.

1778. (*Chairman.*) What is the regulation as to the cubical space allowed per man in barracks and hospitals?—That has varied, I think, from 800 to 1,000 cubical feet; but I think in Calcutta it was less in the triangular barracks when they were full.

1779. (*Col. Durand.*) In some of the casemates occupied by the men, do you think, they got a full allowance of cubical space there?—I do not remember the casemates being occupied by troops.

1780. I thought they were by warrant officers?—Yes, they were, and I do not think that they had their full allowance. I think there is not a question as to the advisability of having the barracks raised some 10 or 12 feet from the ground, and for two reasons, first on account of keeping the barrack dry, and also of place for providing the soldiers in rainy weather when they can go nowhere else. I am sure that if in rainy weather, they had an arcaded place, under the barracks, for amusements, or to walk about in, they would be more comfortable and healthy, than if they were either shut up in a barrack room, or that which they have, as the only alternative, namely, going to the bazaar for amusement.

1781. (*Col. Greathed.*) What height would you wish the arcades to be?—Not less than 12 feet.

1782. (*Chairman.*) Can you give the Committee any account of the cooking arrangements which are generally in use in barracks, hospitals, and cantonments?—There have been separate cook-houses built for the purpose with common brick and mortar, and places for boiling and roasting adapted to the area of the barracks generally; I mean separate buildings, as near the barracks as it was considered advisable to build them. They are very simple in their arrangements as to cooking matters in India; they are nothing but a series of brick and mortar receptacles for little iron gratings to boil and roast on; there are no stoves or anything of that kind, or grates.

1783. Can you suggest any improvement as to the cooking arrangements?—I think that the introduction of asphalte flooring would be a material improvement in the cook-rooms, for they are always dirty, and always broken, and nothing is so simple and effectual or so easily cleaned as an asphalte floor.

1784. In the event of the floor getting damaged, is it easy to repair it?—As easy as possible; nothing can be easier, for it amalgamates so beautifully; there is no shrinking of the material; you sear the edges of the hot material, and it never shrinks away from it in drying.

1785. When a barrack requires repair, can you tell the Committee what is the course of proceeding?—It is always executed through the instrumentality of the department of public works, the executive engineer of the district or the station; his establishment is always employed. Petty repairs are done at the request of the commanding officer of the regiment; but there are periodical repairs for which he sends in a regular estimate to the Government.

1786. And the same rule, I suppose, applies to hospitals?—Yes.

1787. (*Col. Durand.*) Is there any delay in effecting repairs to hospitals?—I think not; they are generally allowed to be proceeded with at once.

1788. Is there any discretion left?—Yes, I think so; but the superintending engineer generally permits it if an urgent request is made.

1789. (*Chairman.*) Is there, generally speaking, any other information or suggestion which you can make to the Committee?—I would recommend a reduction in the location of troops in the plains, in the immediate vicinity of the hill stations. I think that if there was an increase of barrack accommodation in the hill stations, and railways leading from the foot of the hill stations to the principal military posts in Upper India, great benefit would be derived in a sanitary point of view to Europeans. I think that a small force in the plains themselves, and a larger force in the immediate vicinity of the hills, would be an advantageous arrangement.

1790. Do you think that the moral or political effect would be the same if it were known that the troops were within reach, although not actually visible, as they are at present, when they are seen at most of the important stations?—I think that if there were a rapid means of communication, that would be so well known that there would be no difference at all in the political aspect.

1791. Can you name any considerable stations which are so near to the hills that they might be removed from the present sites into the hills without inconvenience?—There is one or two stations in the Punjab, I believe; Jullundur is one, I think, and Umballa, and as far down as Delhi it might be extended, and to Meerut.

1792. If you diminish the number of troops at Delhi and Meerut, where would you propose to send those that you removed?—To the neighbourhood of Mussourie and Subathoo.

1793. (*Sir P. Cautley.*) Do you think there is ground for barracks near Mussourie for additional troops?—I cannot say.

1794. (*Chairman.*) Have you considered the question of expense in reference to this removal, or do you consider that the expense of maintaining troops would be very much increased if they were removed to the hills?—I have not entered into the question of expense at all; but it is a matter that an officer of engineers, who is now dead, (Major Abercrombie,) and I used to talk over a good deal, and it was his opinion as well as mine,—he had been a good deal in Jullundur and at the posts in the Punjab, near the foot of the hills, and it struck him also that it would be an advisable thing to do.

1795. (*Dr. Farr.*) Do you consider Jullundur a very unhealthy station?—I do not know.

1796. Do you think that it is too low in the plains?—I do not know anything about it; I was never there, except for a few days.

1797. You would have no difficulty in erecting the barracks you have mentioned at any station at which it might be thought advisable to place troops?—None whatever.

1798. I mean among the hills on the high ground, you think you would have the same facilities?—I think on the hills it would be more advisable still; the material for roofing is so light that it would be more easily carried. Timber, I believe, is a great difficulty in the hills, it being always green. Other materials are available there; in fact the greater part of the material being iron and asphalte, they ought to be in store.

1799. The buildings would last longer, would they not, on the high ground?—Yes; the one may be called permanent, and the other I would call temporary.

1800. The expense would be less on the hill stations than it is now on the plains?—Very likely.

1801. Do you think the expense would not be greater for erecting barracks and the necessary

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buildings?—The difference would be in the hill carriage, nothing more.

1802. Upon the whole, are you of opinion that the expense of that part of the works which has fallen under your observation would be greater on the hill stations than on the plains?—I cannot answer that question, because I do not know the expense of labour there. I have never had any experience in engineering in the hills.

The witness withdrew.

JOHN SEPTIMUS ROE, Esq., examined.

1805. (*Chairman.*) You are Surveyor General of Western Australia?—I am.

1806. Is it long since you returned to England from that country?—It is about 11 months. I arrived in May last.

1807. During what length of time did you reside there?—About 31 years. I went out with the first ship, and have been in the colony from its commencement.

1808. Therefore you are thoroughly acquainted with its climate and its capabilities?—I think I know as much of them as any one; and am acquainted with the country generally, its salubrity, the health of the people, its productions, and its fitness as a residence for Europeans.

1809. I believe a suggestion was made some time ago that Western Australia might be used as a sanitarium for European troops who had been serving in India?—Attention has long since and frequently been called to the subject, and the colonists have always been of opinion that it would be a very favourable situation for a sanitarium, the climate being beneficial to the health of Europeans.

1810. What is the average length of the voyage from Calcutta?—By sailing vessel or steam boat?

1811. Take a sailing ship. At present I presume that there is no line of steamers established?—Steamers go from Calcutta to Galle, and from Galle to Australia. These steamers make much quicker passages than sailing vessels.

1812. Then supposing that a person in Calcutta wishes to proceed to Western Australia, what is the average time in which he would expect to be able to arrive?—I am not prepared to say what the distance is, but I have a map here by which the distance can be seen. The time of the voyage would of course depend upon the distance.

1813. Will you have the goodness to hand in the map (*the same was handed in*)?—It would be, I think, about 21 days by a sailing ship from Galle, which is at the south end of Ceylon, to the colony of Swan River. I should think it would be about a week more from Calcutta to Galle, if so much.

1814. Do steamers run at present from Galle to Western Australia?—They do, monthly, with the mails, and back.

1815. At what point do they touch?—They touch at King George's Sound, which is on the south coast.

1816. (*Sir R. Martin.*) What is their average run?—The steamers, I think, make it from Point de Galle to Swan River in about 20 days, but they are not regular in their running; they ought to make it in about 14 or 15 days.

1817. (*Dr. Gibson.*) You stated that sailing vessels would do it in about 21 days?—Yes; that is reckoning it at about 150 miles a day. By steam you must reckon a greater distance per day.

1818. (*Chairman.*) We may take it, I presume, generally in this way, that the distance measured in time from Calcutta to Western Australia would vary from three weeks to a month?—Three weeks by a steamer and a month probably by a sailing vessel, but I am not prepared to answer that question from my own personal knowledge; I have not gone into it, and have never made the voyage, but I would beg leave to hand in a table of the distances and length of

1803. Perhaps you will be good enough to think over the subject, and supply any information that may occur to you?—I think if you could obtain any information from any officers who could give you the details of the expense of carriage and labour in the hills, and of workmen, it would be simplified at once.

1804. (*Chairman.*) Is there anything further that you wish to add?—I think not.

voyage by steam between the several ports in India and Australia, as published in a "Hand-book of Information," by the Peninsular and Oriental Company for the guidance of the public, and which I believe to be correct. (*See Addenda, No. 4, p. 119.*)

1819. Has it happened that Indian officers on sick leave have made the voyage to Western Australia?—Yes, some officers did so several years ago, before steam communication was established between the two countries; but they were deterred from repeating their visits by finding that there was no regular means by which they could return, and it was of great importance to them that they should return at the expiration of their leave. I had a brother on the western side who lost his staff appointment in consequence of not returning to his time to Bombay. He had no opportunity of doing so, and being thus compelled to go round by a circuitous route, he was too late. I think the alarm was taken, as officers have not since gone there, but those who did go derived benefit from it, and praised the climate much.

1820. Therefore before any plan could be entertained for using Western Australia as a sanitarium for Indian troops, it would be necessary to establish a regular communication which does not exist now?—I should think that absolutely necessary; indeed a communication would be required of a more extensive character, perhaps, than is now established by the mail steamers going backwards and forwards. If it were adopted as a sanitarium, probably the Government would see the propriety of laying on vessels of their own to go to and fro between Galle and the Swan River, or wherever the sanitarium might be established. The steamers now only call in at King George's Sound, which I do not think is the fittest place for a sanitarium to be established at.

1821. Where should you propose that it should be established, if anywhere?—I think that the Swan River itself would be the most favourable part; it is situated on that part of the west coast where Rotnest island is marked; that is a central part of the colony, and supplies would be procurable there in abundance; that is the place to which all who have visited the colony from India resorted.

1822. Can you give the Committee any general idea of the extent of the colony, and the parts of it which are at present occupied?—The occupied part is about 560 miles north and south, and perhaps 250 east and west, in round numbers.

1823. There are great heats in summer, are there not, or is the climate equable throughout the year?—The heat in summer does not approach generally 100°; sometimes, however, when bush fires and land winds prevail, and the sea breeze does not set in at its usual time, the land winds will blow over a large extent of country that is on fire; then the air is heated so much that for six or eight days in the course of a year the thermometer will range very nearly to, and sometimes above, 100°, but in the summer I should say the greatest heat under ordinary circumstances would not be more than about 92° or 94°.

1824. (*Dr. Farr.*) Is that the temperature of the air in the shade?—Yes; but that is the extreme; that is not the general heat throughout the day.

1825. Have you any returns of the temperature?—I have with me a return of the temperature for fifteen consecutive months; it was published in a book

entitled "Western Australia, by N. Ogle, 1839," and might be perhaps of some use to the Committee (*handing in the same.*) That return shows that the temperature never reached 100° in that year.

1826. At what station was this register kept?—In the Survey Office at Perth.

1827. (*Chairman.*) The lowest temperature reached appears to have been 45°?—Yes.

1828. And the highest 97°?—Yes; but we have frosts there occasionally, and it is below the freezing point at times. That seems to have been a very mild winter.

1829. (*Dr. Farr.*) Was this register taken from a maximum and minimum thermometer?—Yes; a self-registering one. It registered the maximum and minimum.

1830. From this it would appear that the lowest temperature was 45° in June?—Yes; the lowest in that year.

1831. Do you think that the instrument can be depended upon?—Yes; we had three or four instruments, and we took the most approved.

1832. Is this an average year?—No; I do not think it is; the temperature here given is above the average in winter, and below the average in summer.

1833. Higher than any temperature marked here?—Yes; that extreme shows 96°, and sometimes, under extraordinary circumstances, the thermometer has ranged up to or above 100°.

1834. (*Chairman.*) In the hot weather the sea breezes generally prevail, do they not?—Yes; during the summer the sea breezes are very regular; they set in in the forenoon, and the temperature decreases soon after noon. The sea breeze will last sometimes till 9 o'clock at night, then it dies away, and is succeeded by a cool pleasant land wind; but whatever the day may be, the night is always redeeming, for it is cool, and pleasant, and people may always enjoy their sleep.

1835. (*Dr. Farr.*) At what distance is the range of mountains from Perth?—From 10 to 20 miles from the coast generally; from Perth it would be about 15 miles.

1836. What is their elevation?—From 1,500 to 2,000 feet.

1837. The temperature of those hills would of course be much lower than the temperature given by your register?—Very much lower.

1838. Have you had any register of the temperature on the high grounds?—I do not think that there has been any register kept there.

1839. (*Col. Durand.*) Have you had any survey stations established on the high land?—No; we have not had a trigonometrical survey of the country made yet, and the nature of the country on those hills is not of the best description, so as to induce settlers to take up lands there to any great extent; they have availed themselves of the best spots first, and when all those are gone, they must put up with the secondary ones, and then stations will be established for surveying them.

1840. (*Dr. Farr.*) Higher up the river there is a good deal of land, is there not?—Yes.

1841. In the immediate vicinity of those hills?—Yes, on their east side, and among their slopes. About 60 miles inland from the coast the country becomes lower, and falls towards the interior, to the bed of the Avon river, which is an upper branch of the river Swan. Along the Avon river, and to the east of it, there is a large extent of occupied country.

1842. (*Chairman.*) There is less inconvenience felt, I believe, from drought in Western Australia than in any other part of the Australian continent?—Far less; we have a western and a southern aspect, and a very large share of sea winds that bring moisture; we have also a more equable temperature by far.

1843. With regard to the cost of maintaining troops, and the ordinary price of provisions, and articles of consumption, would they be high or low relatively to

other countries?—From recent accounts that I have heard since I came home, I understand that the cost now of keeping a man is considered to be about 22*l.*; that he may be found with the necessaries of life for that; the cost of maintaining a convict there is said to be 22*l.*, and in England it is 28*l.*, I have heard, but I cannot speak upon that with any authority. Provisions are getting much more abundantly produced, and in consequence they will be cheaper. The produce of the last harvest was considered more than sufficient for the consumption of the people in the colony, as I find by the official returns.

1844. Labour, I presume, would be very costly, except convict labour?—It is costly. The colonists were in hopes, when they petitioned the home authorities to have the colony converted into a penal settlement, that they would have a large amount of cheap labour. They have had a large amount of labour, but it is no cheaper than it was before, for now a labourer receives 4*s.* or 5*s.* a day, which is a large sum.

1845. Therefore, comparatively, the cost of making a road or building a barrack in Western Australia, as compared with what it would be in India, would be very great indeed?—It would be, but not by means of convict labour; when I speak of convict labour I do not mean the ticket-of-leave labour; that is available for the settlers to hire. The Government have convicts not on ticket-of-leave, who are put on the public works, and those are the men who make the roads. They must be, and they are, employed in some way or other; but whether employed or not, they must be fed; and cost the Government nothing more by being employed on the roads or public buildings.

1846. I presume that they are employed on public roads which are useful to the colony, and that if they were taken off from those works, for instance, to build barracks, to that extent the colony would lose?—They have up to the present time been almost invariably employed upon Imperial works; there have been a few detached parties scattered about repairing the roads, and doing what may be necessary to keep them in passable order; but as to public buildings, they have erected next to nothing for the colony, having been employed principally in erecting their own prisons, and buildings connected with their own residence and the residences of their officers, guard-rooms, pensioners' barracks, engineers' barracks, and officers' quarters. But there are very few buildings which have been erected there for the colony; they are all for Imperial purposes, and therefore this would only be a continuation of the same kind of work. The colonists have petitioned to have transportation carried on to a larger extent, in order that now the Imperial buildings are finished, and the colonists have incurred all the odium of having their colony converted into a penal settlement, they might derive some benefit from the labour of the persons sent out. No doubt, if it were required to carry on any additional buildings for a sanitarium, there would be a sufficient number of men disposable to carry them out, and the colonists would not object to the convicts being so employed.

1847. It would be possible to send out a much larger number of convicts; but there has been an apprehension that there might be an overdoing in the matter, causing a prejudice in the minds of the colonists against their reception?—There is no fear of that at the present time; they have room now, and could accommodate a couple of thousand convicts well. I do not think that there are 400 convicts in the colony, on the hands of the Government at the present time.

1848. You said that the danger of drought was less felt there than in any part of Australia. How is the colony generally speaking with regard to the water supply; or would there be any difficulty in finding a site for a sanitarium, where the water supply would be ample?—I apprehend there would be no difficulty whatever. There is an abundant supply of water

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for all domestic purposes; the only difficulty that has been experienced has been in finding water occasionally on the interior runs for stock, the interior country being drier than the coast line; but these difficulties are very fast disappearing; and it is found that as the vegetation and trees are cleared away, the water which those trees formerly absorbed by their roots, has broken out in places where springs were not known before, so that by clearing the land you get an available supply of water; there are many more springs known on places that have been taken up by settlers than were known to exist when they took up their locations. As cultivation and clearing have extended, the water has burst out.

1849. Or it has been discovered?—It has actually burst out; there is no question about it. Water has appeared at the surface where it was not known before; where water was known, in fact, not to exist before, it has burst out in springs on the surface, or by drainage.

1850. (*Chairman.*) What building materials are there in the colony; is there any good stone?—They make bricks in the colony to a large extent. There is an abundance of stone and good lime.

1851. (*Sir P. Cautley.*) Is there a good supply of timber in the colony?—Yes, timber of the first quality which is impervious to the dry rot, or the white ant, or the sea worm, or anything destructive. I think, without exaggeration, it is the finest timber in the world; it is what is called the "jarrah," and resembles mahogany.

1852. The jarrah timber has been sent down for sleepers to Bombay?—Yes, it has been employed as railway sleepers, and is now in great request. There are orders now for the timber to a larger amount than the colonists feel at present able to comply with. Labour is rather scarce at the present time in consequence of the convict supplies not having been kept up, and the colonists are a little put to it to find labour; but the timber is unexceptionably good.

1853. (*Chairman.*) Is there ever any difficulty in obtaining access to the anchorages at any time of the year?—None whatever; the access is always open and clear round the island of Rotnest, which lies in front of the mouth of the Swan River. Gage road, immediately off the river's mouth, is the general resort of ships that frequent the place. In winter they prefer going through that anchorage, and into another called Owen anchorage, which is still more protected than the Gage roads. The latter is open to the north-west, but the holding ground is good; and if it were intended to use it in the way now under consideration, it would be advisable perhaps to lay down moorings for the use of ships resorting thither for this particular purpose.

1854. There is no difficulty in vessels of any size coming in?—None whatever; there are pilots, and ships are always boarded before they get into any difficulty.

1855. (*Col. Durand.*) Are there any troops there?—Besides some Royal Engineers who superintend the public works, there is only one company of the line stationed there, which company, it has occurred to me, might be dispensed with if a sanitarium were established there; for their place might be supplied by the convalescents, who could do the duty and take the place of those troops, and thereby effect a considerable saving to the country.

1856. Are there any desertions or any inducements to men in the colony to desert?—I do not call to mind any desertions that have taken place; it is of no use for a man to desert, for, unless he can find his way on board a whaler going away, he is sure to be apprehended. Every convict who attempts to get away into the bush is speedily discovered, the natives have such a facility for tracking them.

1857. They have no opportunity of getting to the other coast?—No; there is no communication to the other colonies except by sea.

1858. (*Chairman.*) The colony is entirely detached, is it not, and there is a great extent of unoccupied

land between?—Yes; it is quite isolated by tracts of country which have not yet been explored, but which, there is reason to believe, are of an impassable character.

1859. (*Col. Greathed.*) Is there any time at which it is unsafe to go out in the sun in the colony?—You may go out in the sun with greater impunity in that country than in any other, but for the sake of comfort umbrellas are sometimes used.

1860. It is not dangerous to go out?—No.

1861. The heat would not stop men in their work?—No; I have made explorations there in the very height of summer.

1862. (*Chairman.*) Are there many days in the year, and if so, can you state how many, on which a man could not labour in the open air, or play at any game requiring strong exercise, or go through much fatigue?—There are about 10 or 12 days in the course of the summer during part of which a man would not work in the sun if he could avoid it; but the settlers have the labourers called in at such times in order to escape any serious effect that might otherwise be produced; but it is not because they could not work in the sun, for they do so constantly, and with impunity.

1863. (*Col. Durand.*) Have you known cases of *coups-de-soleil* there, and are they at all frequent?—I think I have heard of two or three, but none have come under my own observation; I have heard of them.

1864. (*Chairman.*) Can you tell us generally what are the prevailing diseases in that country?—It would, perhaps, inform you better if I were to hand in the Registrar General's return up to the end of 1859, as that will give the Committee much more authentic information than I can. He gives a very satisfactory synopsis of the whole of the diseases, the number of deaths, their proportions to the population, and so on (*the same was handed in*). That is the only one that I have seen; it was sent to me from the colony and is the Official Return made up to the end of the year 1859.

1865. (*Dr. Farr.*) The climate of the colony is not a tropical climate?—No.

1866. It corresponds, does it not, more nearly with the climate of the north coast of Africa?—The occupied part of the colony is between about 27 degrees and 35 degrees.

1867. Is there much rain in the colony?—In winter we have an abundance of rain, but not tropical rains.

1868. Is the rain-fall given in any of the tables?—No.

1869. There is no register of the amount of rain that falls in the year?—No; it has been kept in the colony, and there may be such an account deposited at the Colonial Office.

1870. Are there rainy seasons in the colony, or is the rain distributed over the whole of the year?—We have rain in summer showers occasionally, but dews supply the place of rain during the summer. In the winter time, which corresponds with the summer season in this country, the rain falls and commences towards the end of June, but sometimes June is dry. If June is a dry month, we have rain in May, July, and August, clearing up towards the end of August, and then merging into showers.

1871. Is the rain almost uninterrupted during that season?—No; rainy weather will be ushered in by a gale of wind from seaward, which will usually last three to five days, and be succeeded by eight or ten days of most delightful weather; similar westerly gales will then follow at intervals, bringing abundant moisture from the sea, and filling all the pools and rivers. Refreshing rains are also experienced in the month of March.

1872. (*Col. Durand.*) Do you consider that you come within the scope of the regular south-westerly monsoon?—No, we do not; we have the south-east trade wind, which always blows on some part of our coast. As the summer advances the southern

limits of the trade wind advance also further to the south, until towards the middle of the summer it extends as far as our south coast, for a few days, including King George's Sound, and sometimes blows a gale. As the summer takes off, the trade wind has its southern limit further and further north, until it is forced within the tropic of Capricorn by the prevailing westerly winds of the winter; after which it again returns to the south.

1873. (*Dr. Farr.*) Do you think that any, and what part of the year, would be more suitable for invalids?—I should say that the winter would be more invigorating and refreshing, the summer heat being to be avoided if possible, although in some seasons the heat is by no means oppressive.

1874. As being oppressive to Europeans, if exposed to the heat of the sun?—Yes; those extreme heats when they do occur are, of course, oppressive, and are not courted by any one; but they last a very short time.

1875. Do the people remain indoors during the whole of the day?—As much as circumstances will permit, during the oppressive part of it, when the bush fires are extensive, and there is no sea breeze.

1876. Under shelter of some kind or other?—Yes.

1877. Do you believe that the system of registration in Australia is completely perfect, and that all the deaths, for example, are registered?—I have every reason to think that that which I have handed in is as correct a return as could be procured in the country—of course a few may have escaped the register.

1878. How do they obtain a return of the deaths?—Branches of the registry office are scattered over the country, under sub-registrars, who are compelled by law to keep a register of all deaths, marriages, or births, and to report the same periodically to the head registrar. It is made a penal offence in the colony if parties interested in making such returns do not make them.

1879. Where are the people buried, in churchyards?—There are cemeteries appointed to every district, and no clergyman is warranted in interring a body, except under the registrar's certificate, or in the appointed cemetery of a town.

1880. Do you think that under that system very few deaths escape registration?—Very few, if any; and I think that that must be a very close return indeed, which I have now handed in. Perhaps a small percentage might be allowed, for some people, as we all know, will not make returns; they think that the Government have some object in it, and they will not make returns.

1881. (*Col. Durand.*) They dislike the trouble perhaps?—Yes.

1882. (*Dr. Farr.*) The population consists chiefly of adults, does it not? There are very few old people and very few children?—There is a large number of children.

1883. But I mean in comparison with the population of England?—Yes, the women are very few in number as compared with the male population. 2,871 adult women to 7,112 adult males.

1884. Consequently the number of children is below the average?—Yes, as compared with the total population; and that has been aggravated since the place has been made a penal settlement, for all the convicts who are sent there are men, and of course the proportion of children would be comparatively small. They number 4,855 below the age of 15, at the end of 1859.

1885. (*Chairman.*) What is nearly the amount of the population at the present time?—It is very nearly 15,000, but I will hand in a paper which I have made up from the Registrar General's official returns, showing what the per-centage of deaths has been every year for the 12 years up to the end of 1859.

1886. In this paper which you have handed in, I observe that out of 209 deaths in 1859, 101, or nearly

half, are deaths of children under three years of age, and the number who had died at the age of 60 and upwards is only 9?—Yes, 9 out of 242.

1887. It would therefore appear from these official figures that there is a very large comparative infantile mortality, and a very small number of persons who have reached the age of 60 years and upwards?—That is quite true.

1888. (*Dr. Gibson.*) Is the small number of deaths at the age of 60 in consequence of the greater ages which the people have attained?—I do not know that there are any very great number of old people in the colony. It has been established 31 years only, and the oldest people would probably be those who went out in the first instance; there were 233 above the age of 60 at the end of 1859.

1889. (*Dr. Farr.*) The mortality appears to be low in Western Australia, and not to exceed one per cent.?—The average has been below one per cent. for the last 12 years.

1890. That is very remarkable?—It is very low, and it has sometimes amounted to only the half of one per cent.

1891. It is so low that one can scarcely believe it to be correct?—Were it not that it comes from the Official returns. I have here the Official return itself for the years 1848 to 1854, and that return which you hold in your hand gives the average since that time to the end of 1859.

1892. The mortality appears to be so great among young children?—Yes, it seems to be greater among them than amongst the adults.

1893. Bowel complaints seem to prevail; I suppose that the drainage of the town and so on is imperfect?—The drainage of Perth, the head-quarters, has been very much improved within the last few years.

1894. Upon what plan is the drainage carried out?—By trunks and culverts to carry off the water. There were some lakes at the back of the town which contributed considerably towards supplying it with well water, but they are now for the most part drained in this way, and have been converted into rich gardens.

1895. Do you mean the Melville water?—No, that is salt during summer; but there were some lakes at the back of the town, about three to twenty times the size of the ground on which this house stands, and these are now drained into Melville water; the rain water percolates through the sand, and furnishes to the inhabitants an abundant supply of water in the town. They sink wells from 18 to about 36 feet deep, and come to the water.

1896. Is the water at Perth good water?—Very excellent; it is the best.

1897. And it is obtained from wells?—Yes; but there are some small running streams of excellent water also.

1898. I suppose there are cesspools in the houses, or are there drains?—There is no system of sewerage; there are cesspools convenient to each house, but not under the same roof.

1899. Is the ground favourable for draining?—There are facilities for it, but it is a very expensive undertaking, and would cost a great deal of money. Estimates have been made, and the subject has been agitated, but it is rather beyond the means of the residents to accomplish at present, and no attempts have yet been made to drain.

1900. Which place do you think it would be advisable to select for the purpose of establishing a sanitarium for troops in that colony?—I think that either Perth or Fremantle would be the most desirable.

1901. Not on the high ground above Perth?—There is plenty of high ground near Freemantle, which is exposed to the sea breezes, and that I think is a very desirable point; the low hills overlook the sea at Fremantle; it is the seaport of the place.

1902. You think that there are sites in the neighbourhood of Fremantle which would be very suitable for a sanitarium?—Yes, I think so.

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1903. Are the grounds extensive there, and could troops be removed about, and exercised?—Any amount of ground might be obtained there for those purposes.

1904. Vegetables and other necessities are, I suppose, procurable?—Yes; what the immediate neighbourhood could not furnish might be brought down the river in boats; and contracts might readily be obtained for all the necessities of life for any number of men.

1905. Is the water supply good at Fremantle?—Yes, and that is procured from wells; but the Perth water is better than the Fremantle water. The Fremantle water, being amongst limestone, is hard; it partakes in some measure of the nature of the rocks among which it is found, and is hard. In washing with it, it will not lather with soap so readily as other water will, or as Perth water does. The Perth water lathers well, and you wash with it as freely as with rain water. I may mention that the convict establishment is at Fremantle. I do not know whether that would be considered as any objection to having a sanitarium at the same place; that is for the Committee to think of. I mention it merely that you may be aware of the fact. It may also be known to you that there is a Committee of the House of Commons now sitting, to report upon transportation generally, and that the result of that report may be that transportation to Western Australia will cease. In that case if the convict establishment there were broken up, there would be a very extensive mass of buildings at the disposal of the Imperial Government, which, with the aid of convict labour, might be converted, and so save many thousand pounds in erecting buildings specially for a sanitarium. The site was chosen by the Comptroller-General, in the first instance, for its healthy position, overlooking and above the level of the town, with the sea breezes passing freely to it. The buildings now there will be comparatively useless if transportation to the colony ceases, but by alterations and additions with convict labour, might without much expense be turned into an excellent sanitarium.

1906. (*Dr. Gibson.*) Is not King George's Sound cooler in the summer than Fremantle?—It is cooler, but in my opinion it is not so well adapted. I do not think the climate so good.

1907. For what reason?—There always appears to be dust blowing about there or wet, boisterous, bleak weather. There is very much dust there at times, and it is also at times very hot. I think that there are as great extremes of heat at King George's Sound as in many other places.

1908. Are not the winds as prevalent in King George's Sound?—They have sea breezes in summer, but not so regularly as at Fremantle.

1909. Are not the hot winds less prevalent in King George's Sound?—In the summer the natives burn the country very extensively throughout the colony, in order to procure their customary food, and the fires range over many miles of land; the winds passing over those fires become in consequence much heated.

1910. But not, I suppose, to affect King George's Sound?—Yes, and the whole of the coast more or less. King George's Sound is cool at times; when the sea breeze does blow in there, uninterrupted by warm land winds, the temperature then is cool and pleasant; but King George's Sound is not so conveniently situated with reference to India. On referring to the map, you will observe that there is a large extent of the south coast to get over, before a ship can reach the sound from India; the weather on that coast is usually boisterous, except in the summer time; and the postal steamers between Ceylon and Melbourne find the south coast of Australia the most boisterous and difficult part of their voyage to make. Now from India to the Swan River there is no part

of that south coast to pass; and it may be considered a fine weather voyage the whole way, to and fro.

1911. Are there not return steamers from Swan River to Ceylon?—The postal steamers return monthly from King George's Sound.

1912. Back each way?—Yes, they touch at King George's Sound for the benefit of coaling, and there are facilities for entering the port. There are light-houses, and all the necessary conveniences; but the neighbourhood of King George's Sound does not afford supplies that the other parts of the colony do near Swan River. I do not think that the soil possesses the requisite capability about King George's Sound, and there is not much produced there.

1913. (*Sir R. Martin.*) You mean that it does not possess capabilities for colonization?—Yes, it is a more hilly country, and not so good a soil, while supplies are abundant at the Swan River.

1914. Your favourable estimate of the climate applies generally to the coast line, excepting King George's Sound?—When I speak of the climate of Swan River, I include all the colony thereabout, and all the interior for 50 miles inland. It is warmer, of course in the summer, the further you remove from the sea coast; for when the sea breeze reaches inland 40 or 50 miles, it becomes somewhat heated; at 70 or 80 miles it becomes warm, and the elevated lands intercept it altogether at times, when the sea breeze is not strong.

1915. What is the physical character of the children who are born and bred in the colony?—They are not so stout as children reared in England; they grow tall, but they are slighter, although they are fine figures; there are very fine children born in the colony.

1916. Are they well complexioned?—They get very much bronzed by running about in the sun, and when they get older they become sallow in consequence.

1917. How do they bear removal to other colonies, or to England?—They bear it very well, I think, generally. Sometimes young families when removed to England have felt that they had come from a warmer climate. It is something like transporting a hothouse plant to a cold region; but this is not a peculiarity confined to Western Australia.

1918. Have you heard that such people become consumptive here in such a proportion as to attract attention?—Yes; and that they are more liable to chest complaints.

1919. (*Chairman.*) That is the general case, is it not, throughout Australia?—They are not liable to chest complaints there. I understood the question to be when they were removed into a colder climate.

1920. (*Dr. Gibson.*) To what do you attribute the large mortality among the children, there being no epidemic diseases, such as measles, scarlet fever, and other diseases to which children are liable?—I should think it is from a species of neglect among a certain class not remarkable for temperate habits, and from the remoteness of many of the settlers from medical advice.

1921. (*Sir R. Martin.*) Are the mothers of the working classes careless of their children?—I think they are among the certain class referred to, and that they are often left too much to themselves; they do not seem to attend to them sufficiently, and many are unable to do so from having to work hard themselves to maintain their families.

1922. (*Chairman.*) Have you any further remarks to offer?—Considering that the Commission would be desirous of having all the information that could be collected in so short a time relative to the climate of the colony, I have made a few extracts from a work on Western Australia, published in 1839 by Nathaniel Ogle, and from other published documents, which I beg to hand them in.

The witness withdrew.

ADDENDA.

No. 1.

MEMORANDA CONNECTED WITH WESTERN AUSTRALIA.

1. Western Australia includes all that portion of New Holland situated to the westward of 129° E. longitude; its greatest length is therefore 1,280 miles N. and S., and 800 miles E. and W.

2. With a coast of 2,000 miles on the Indian ocean, and with a westerly aspect, from which the prevailing winds blow, there are abundant rains during the tillage season, and the farmer is relieved from that anxiety about his crops which is felt in other parts of Australia on account of drought. There is also abundance of edible fish on the coasts and in the numerous estuaries. The heat of summer is moderated by alternate land and sea breezes.

3. All sorts of vegetables and fruit trees flourish luxuriantly, especially the vine; and the land bears good crops of grain of all kinds, particularly on the low alluvial flats which line most of the rivers.

4. The Darling and the Roe ranges of hills, rising to the height of 1,500 to 2,000 feet above sea level, lie parallel to the western coast, at 10 to 25 miles from it, and are dotted with numerous thriving farms amongst its hills and valleys. These ranges are 20 to 50 miles across, and on their eastern side the undulating grassy lands are situated, which constitute the principal sheep and cattle runs.

5. The number of sheep in the colony is about 235,000, of cattle 31,000, pigs 11,000, and horses 8,400. Consumed in 1859, sheep 39,000, cattle 6,300.

6. Quantity of land under lease as stock runs, 5,250,000 acres.

Quantity of land in fee simple, 1,600,000 acres.

The above scattered over 18 districts, which occupy an area of 560 miles N. and S., and 200 miles E. and W.

7. Extent of country explored is 800 miles in a northerly direction to the tropic of Capricorn, and 250 miles wide from the coast; and 500 miles of the southern part of the colony, extending 100 miles inland.

8. Land in cultivation, 36,430 acres.

Yield of wheat in harvest of 1859-60, at low average of only 12 bushels per acre, 163,320 bushels.

Surplus for exportation, 20,624 bushels, equal to 459 tons of flour.

Wine made in 1859, 20,833 gallons.

Fruits dried „ 18,952 lbs.

All productions of the soil greatly on the increase, as also live stock.

9. Population at end of 1859, 14,837.

Deaths in 1859, 209, or 1·41 per cent.

Average per-centage of deaths to popu- lation	in 12 years, 1848-59	Per cent.
Maximum	do.	1·47
Minimum	do.	0·55

Total deaths in 1859, 209, namely,—

Under 3 years of age	-	-	101
3 to 5	„	-	0
5 to 20	„	-	12
20 to 40	„	-	56
40 to 60	„	-	31
60 and upwards	-	-	9
Total above 5	-	-	108

During the last 30 years the deaths of colonial-born, 5 to 30 years old, only 20, namely,—

From disease of the brain	-	-	3
„ „ bowels	-	-	4
Accident	-	-	8
Hooping-cough	-	-	1
Decline	-	-	4
Total in 30 years	-	-	20

10. Only three seasons. Spring, April to June; winter, June to September; summer, September to April.

11. No endemic diseases. An epidemic catarrh, called “influenza,” twice a year, *i.e.*, at the changes from summer to spring, and winter to summer. It is mild, but very general when it appears.

12. Arguments in favour of Western Australia as a J. S. Roc, Esq.
sanitarium for invalids from Her Majesty's forces in India.

1st. The great salubrity of its climate, healthiness of the colonists, and very small mortality in proportion to the population; the latter averaging only 0·91 per cent. during 12 years, from 1848 to 1859 inclusive. 16 March 1861.

2d. Freedom from nearly all the serious diseases which are so destructive of human life in other countries.

3d. Very mild form in which those diseases appear.

4th. The above showing conditions of climate, &c., very favourable to the rapid and effectual recovery of Indian invalids.

5th. Although there may be many salubrious parts of India to which invalids might be beneficially sent, there is reason to fear their cure would not be of a permanent nature.

6th. The unrivalled geographical position of Swan River, and its easy access in a few days from Point de Galle or Trincomalee in Ceylon, where invalids might be assembled monthly for embarkation; or,

7th. A steamer leaving Galle with invalids at the end of February (during the cold season of India), would reach Swan River after the Australian summer had passed, and might return at once with convalescents if urgently required; otherwise,

8th. Convalescents removed from the Swan in October or November, might arrive in India during the cold season of that country.

9th. Supposing some thousand of invalid troops to be sent annually from India to England or elsewhere, and their places to be supplied by an equal number, a saving to the country of several hundred thousand pounds a year would be effected by having a sanitarium so near as Swan River.

10th. A further saving might be effected by dispensing with the regular troops now stationed at the Swan, and by those troops thus becoming disposable elsewhere.

11th. The great military and political importance of having always at disposal (at so healthy and convenient a station as Swan River) a large body of regular troops, available at once for service in any part of the eastern seas, on an emergency, seems very evident.

12th. The capability of Western Australia to furnish food for any number of men likely to be congregated there, is beyond doubt.

13th. The present convict establishment at Fremantle, the principal seaport town of Swan River, might, without great expense, be converted and enlarged by convict labour into an excellent sanitarium, should transportation to Western Australia be discontinued.

14th. If a pecuniary value could be attached to the life of every soldier in India, many hundred thousand pounds would be annually saved to the country by a largely decreased mortality amongst troops, worth to it at least 100*l.* each.

15th. If two or more auxiliary screw ships of 1,000 tons or less, were properly and permanently fitted out for this special service, it would not only contribute greatly to the comfort and recovery of invalids on the voyage, and afford them the salutary advantages of roomy accommodation, but it would benefit the service by inducing many officers in India to take short sick furlough to Swan River, instead of proceeding on a long voyage to England.

13. Monthly average of thermometer in Survey Office, Perth, West Australia:—

1842	-	January	-	-	66 to 97 Fahr.
„	-	February	-	-	61 „ 95
„	-	March	-	-	66 „ 90
„	-	April	-	-	63 „ 90
„	-	May	-	-	55 „ 77
„	-	June	-	-	45 „ 76
„	-	July	-	-	54 „ 76
„	-	August	-	-	50 „ 71
„	-	September	-	-	54 „ 73
„	-	October	-	-	55 „ 73
„	-	November	-	-	55 „ 88
„	-	December	-	-	57 „ 96
1843	-	January	-	-	60 „ 95
„	-	February	-	-	67 „ 95
„	-	March	-	-	66 „ 96

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No. 2.
WESTERN AUSTRALIA.

RETURN of the POPULATION and DEATHS Registered in the Colony between the Years 1848 and 1859 inclusive, compiled from Official Records.

At end of Year.	Population.			Deaths.			Per-centage of Deaths to Population.
	Males.	Females.	Total.	Males.	Females.	Total.	
1848	2,818	1,804	4,622	41	27	68	1.47
1849	2,685	1,960	4,645	19	10	29	0.62
1850	3,491	2,395	5,886	31	23	54	0.91
1851	4,062	2,599	6,661	25	12	37	0.55
1852	5,645	3,066	8,711	41	24	65	0.74
1853	5,727	3,607	9,334	46	46	92	0.98
*1854	7,973	4,071	12,008	51	19	70	0.58
†1855	8,506	4,332	12,838	—	—	87	0.67
†1856	8,946	4,445	13,391	75	21	96	0.71
†1857	9,028	4,573	13,001	113	51	164	1.20
†1858	9,930	4,846	14,776	101	63	164	1.11
*1859	9,522	5,315	14,837	143	66	209	1.41

Average Per-centage of Deaths to Population during 12 years - 0.91

* Population by actual Census.
† Approximate Population.
J. S. ROE,
Surveyor-General of Western Australia.

No. 3.
EXTRACT from "COLONY OF WESTERN AUSTRALIA," by N. OGLE, 1839.
Pa. 18.

"This colony of Western Australia is in a position highly advantageous, whether considered in relation to Europe or to Asia. It is nearer by one month's voyage to the former than Sydney, and only 25 days sail from Madras; and when steam communication has been established, less than half that time will be necessary to convey the exhausted European from the enervating climate of Hindostan to the invigorating and healthful air of Western Australia; also those productions of the east which may be in demand. So healthful a clime will constitute a home for the wives and children of those whose avocations require their attendance in Hindostan, and who will become profitable consumers in the colony."

Pa. 23.

	Distance.	Sailing time.
	Miles.	Days.
From Swan River to Cape of Good Hope	5,000	31
" Ceylon -	3,100	21
" VanDiemen's Land	2,200	12
" Sydney -	2,600	16

Pa. 26, &c.

"By the unanimous testimony of every writer and every traveller, the climate of Western Australia is equal, if not superior, to any on the habitable globe. The English language has been taxed to the utmost for epithets of admiration to convey the opinions of various writers. The medical reports coincide in stating that the diseases incident to childhood seem for the most part eradicated; and those few which remain are modified so as to give no cause for alarm. Dyspepsia, and other affections of the digestive organs, give way to the genial effects of the climate. Asthma, bronchial affections, tendency to consumption; and all the insidious pulmonary diseases, seem to vanish as by an enchanter's wand, and change the delicate convalescent into the robust and healthful creature. No woman, at the date of Mr. Milligan's valuable report, had died of childbirth in the colony; and the general health of women is improved by the dry and elastic air. All rheumatic affections are mitigated and cured; while the "cold and melancholy damp," which weighs the spirits down as age steals on, seems to have attained no footing in that land of warmth and breezy freshness. Even the troops, being few in number, were harassed by perpetual duty, and brought, by the fatigue of marching throughout the day under a powerful sun, into that physical state which is most susceptible of disease; they were exposed to the rainy season and the influences of the night air, and yet none were invalided. During three years that Her Majesty's ship "Sulphur" "was employed on that station, "not a single death, and very few important cases of disease "occurred; notwithstanding the great exposure of her men, "not only to wet, but also night air, in consequence of her "boats having been a great deal employed at a distance

"from the anchorage. When exploring the country, for "several days, and sometimes weeks, people have been ex- "posed to the sun, and, fatigued in the evening after a "day's excursion, have slept in the open air, and repeatedly "in wet weather, without suffering in the slightest degree." "The men who bore such trials had been fed on salt pro- "visions for three years and 10 months, with the excep- "tion of 256 days. A life of this description, adds Dr. "Johnston, I have no hesitation in asserting, would have "been productive in any other climate of the most serious "disease." The three hottest months in the year are December, January, and February, when the medium heat is about 76° of Fahrenheit; the three coldest months, June, July, and August, have an average temperature of 58°. During the summer months the regular land and sea breezes blow, the former early in the morning from east and north-east; the latter comes in about noon from the south and south-west: about two in the afternoon the thermometer begins to fall, until the temperature of the evening is delightful, and of the mornings fresh and invigorating. The sky in summer (i.e. during our winter) is of a clear and beautiful azure; occasional showers fertilize and render fragrant the earth: the dew is light; the nights are transcendant in beauty. As autumn approaches, the weather becomes less serene, the sky is occasionally darkened with clouds, and lightning and thunder, with heavy showers, occur; these rains are sudden and heavy, with intervals of fair weather and sunshine. In winter it rains for two or three days together, then an interval of eight or ten days fine weather takes place. Hail of large dimensions some- times falls with the rain; snow has been seen once; ice is very rare, and soon melts away. In winter and wet weather a fire is a luxury in the evening, but not indispensable."

Pa. 85.

"Man to be physically contented, needs only warmth, clothing, and sufficiency of food. The climate is perhaps the healthiest and most genial on the earth; no bitter frosts, chilling winds, perpetual damps, or sudden changes of temperature, subject the human frame to disease. The effect on the mind is equally great; the spirits are cheerful and light, so that mere existence is pleasurable: the *percep- tions become more acute* and active; and it is the opinion of that accurate observer, Sir James Stirling, that the mental powers of future generations will be materially improved; but that all excitement and stimuli should be avoided, as unnecessary and injurious. The changes of the seasons are gradual; and never is the heat so oppressive as to create languor, or the cold so great as to create discomfort. The earth is fertile, yielding her increase; the seas teem with fish; and by industry (labour is, by the Almighty fiat, the lot of man,) every one can provide enough for himself and family, and the more numerous they are the better for him. Such being the case, the great incentives to crime and vice are removed; simplicity of mind and thankfulness of heart must follow as truly as effects their causes."

Pa. 141.

EXTRACT from REPORT of a COMMITTEE of the AGRI- CULTURAL SOCIETY of WESTERN AUSTRALIA, in August 1838.

"The salubrity of the climate of Western Australia is abundantly testified, both by the colonial surgeon and the military surgeon, and this under all the circumstances of exposure and privation to which many are necessarily subject in a new settlement. The only ailments mentioned as in any degree incidental to the climate are a slight inflam- matory affection of the eyelids, especially on the part of those who sleep exposed to the night air; and a slight attack of bowel complaint by those who neglect warm clothing in the change of the year, or who are addicted to intemperance. This salubrity is attributed to the peculiar dryness of the atmosphere, and its freedom from damp exhalations, noxious vapours, or unwholesome fogs. If this state of things were generally known, and the low per- centage of deaths were duly considered, it would appear but reasonable that they should operate strongly in favour of those who desire to effect insurances upon their lives, either whilst residing in, or coming out to, this colony. It may be very important to state that, since the date of the com- munications of the medical gentlemen, the application of vaccine matter has, after many previous failures, been at- tended with complete success; and vaccination may now be considered as established in Western Australia."

No. 4.

LENGTH and DURATION of VOYAGES between INDIA and AUSTRALIA, and *inter se*.

From.	To.	Miles.	Steam Voyage.	Sailing Voyage.
Calcutta	Madras	770	Days. 3	Vary according to the time of year and the monsoons.
Ditto	Point de Galle	1,315	7	
Bombay	Ditto	911	5	
Point de Galle	K. Geo. Sound	3,330	14	
Ditto	Melbourne	4,580	19	
Ditto	Sydney	4,786	23	
Sydney	Melbourne	590	3	
Ditto	K. Geo. Sound	1,970	9	
Ditto	Point de Galle	4,786	25	
Swan River	Madras	"	"	
Ditto	Calcutta	"	"	28

No. 5.

THE SANITARIUM.

To the Editor of the Swan River News Letter.

DEAR SIR,—In reference to the proposition for a sanitarium in Western Australia, I wrote to the *Times* thereon in September 1858. I did not notice that the *Times* gave insertion to that letter, but as you are on that subject, it may perhaps be of some interest to you to hear what I then wrote thereon, I therefore copy my letter.

I am, &c.

(Signed) THOMAS BANISTER.

5, Child's Place, Temple Bar,
January 1860.

Copy.

"To the Editor of the Times."

"SIR,—May I be permitted to say a few words in reference to the formation of a sanitarium for our soldiers in Tasmania? I should not trouble you if it were not for the remark in your article that 'there (viz. in Tasmania) is the hot wind blowing from the north, succeeded suddenly by a violent southerly breeze, a trial to any constitutions, but a very severe one to the constitutions of invalids.' Now, Sir, the south-west angle of Australia, Western Australia, is not subject to *hot winds*; it is very easy of access from India. Experience has proved the climate to be most salubrious and invigorating, and I believe inquiry will satisfy you that it possesses many advantages beyond those enumerated for the object, and which, if duly weighed, the locality would be found to be one of the most desirable quarters which could be fixed upon. The shortness of the time in arriving there, freed from the tedium of a long voyage, would greatly aid in restoring to convalescence those needing the benefit of change.

"I remain, &c."

No. 6.

(From the Western Australian News Letter of 20th Feb. 1860.)

"We have been favoured by Dr. Rennie with the following interesting communication on the subject of the sanitarium."

SIR,—In reply to your letter of yesterday's date, requesting me to furnish you with some remarks for publication respecting the capabilities of Western Australia as a sanitarium for the invalids of the Indian army, I have to state that I have no hesitation in doing so; a residence of upwards of six years in the colony, during which I had a very large professional charge, consisting of soldiers, women, children, foreign officers and convicts, having afforded me extensive opportunities for forming definite conclusions on the subject. The following embrace the chief facts upon which an opinion very favourable to the formation of an invalid establishment in Western Australia for the sick of the Indian army has been based by me:—

1. *Climate*.—It would be difficult to imagine a more delightful temperature and climate generally than that of Western Australia, more especially the winter, which, though invigorating, is never very cold. The summer is very warm, but the average heat does not very materially exceed that of the warmer portion of the winter months; and, as a general rule, it is free from any depressing effects, readily admitting of active occupation and ordinary labour being carried on in the sun by the European settlers, military, emigrants, and convicts, without detriment to health. At Fremantle the temperature of the winter months, extending from May to October, is 60°, and that of the remainder of the year about 73°, which figures may be taken as giving a fair average of the temperature over the colony generally, and certainly neither of them in excess, being, if anything, rather over than under the average ranges of the thermometer in other parts of Western Australia. The climate of this portion of Australia is materially modified by its geographical position, the whole of the inhabited parts of the colony being within the influences of the sea breeze, which, as a general rule, sets in every afternoon, and is distinctly perceptible seventy and eighty miles inland.

2. *Physical Effects of the Climate on European Constitutions*.—It is almost impossible, by any description I can give, to do justice to the Western Australian atmosphere. To be appreciated, it must be experienced. Many a time, on leaving my house in the morning, have I been struck with the wonderful elasticity of body and mind which the cloudless sky and refreshing atmosphere seemed to develop; and often has the thought occurred to me, "What a splendid climate for a sanitarium!" My impressions in this respect are by no means singular, and I believe them to be those of residents there generally, except perhaps a few whose vicious habits tend to counteract the blessings of climate they enjoy; sensations of debility arising from sensuality and vice being by them attributed to their residence in a temperature warmer than England, climate being too frequently made the scapegoat for the evil effects of gluttony, narcotism, and intemperance. I have been frequently assured, by old settlers, that at a time when the affairs of the colony presented the gloomiest aspect, and everything connected with it was calculated to depress them, still that their minds seemed to refuse to yield to the pressure from without; and their spirits kept up in a manner so remarkable that they could account for it in no other way than by referring it to the clear and exhilarating atmosphere in which it was, at that time their misfortune, in a financial point of view, to be residing.

3. *Effects of the Climate on Children*.—They enjoy a remarkable immunity from the infantile diseases which are so fatal elsewhere. The Registrar-General of the Colony, in his Report accompanying the last census returns, drew attention to the fact that one-fourth of the population of Western Australia consisted of children, as a proof of the comparative exemption which the Colony enjoyed from infantile disease of a serious nature; and I may here mention as a further illustration of the general salubrity of the climate, that smallpox, measles, scarlet fever, &c., are as yet unknown in Western Australia. I may add, also, that the same remark almost applies to acute pulmonary affections, their occurrence being rare in the extreme.

4. *Effects of the Climate on Longevity*.—The settlers, as a general rule, retain their mental and physical faculties to a very considerable age in Western Australia. The percentage of deaths in the whole colony, by the last census returns, was only 0.55, or 5½ in the thousand. Frequently, on taking into consideration the habits of many of the residents, I have been astonished at the apparent immunity from disease they enjoyed, and accounted for it only from the fact that they were living in a primitive atmosphere and in a settlement free from any of the ordinary external exciting causes of disease; also that their occupations were active, and their circumstances of life were generally such as to counteract the injurious tendencies of their special habits; the sun in Western Australia being, as a general rule, free from those debilitating effects which usually characterise great solar heat elsewhere. The climate of Western Australia is vastly superior to that of any other of the Australian Colonies, including Tasmania; and the period of the year best adapted for the arrival of invalids from India will be the end of March to the middle of July; through which, as a general rule, they will be able to enjoy six months uninterrupted cool weather, and, if sufficiently recovered, return to India as the cool season is setting in there.

I am, &c.

(Signed) D. F. RENNIE, M.D.,
Staff Surgeon.

J. S. Roe, Esq.

No. 7.

16 March 1861.

From the Report of the General Statistics of the Colony of Western Australia for 1859, by the Registrar-General.

"The climate of Western Australia is one of the finest in the world, the heat of summer is tempered by the sea breezes, and there are but few days during the year of really hot weather, caused by the land wind blowing across bush fires."

"In conclusion of this Report I trust the statement I made in its commencement as to the prosperity of the colony has been borne out by the foregoing statistics. I have shown an increased trade, an increased revenue, and a great increase in farming operations, and one sure sign of the progress of Western Australia is the general absence of anxiety as to the future; possessed of valuable indigenous articles for export, a large amount of land suited for cultivation, a considerable extent of mineral lands, combined with a fine healthy climate, it requires but energy and capital to raise it to an importance to which its geographical position entitles it."

No. 8.

OBSERVATIONS on the Climate and Geographical position of Western Australia, and on its adaptation to the purposes of a Sanitarium for the Indian Army; in a letter addressed to Sir J. Ranald Martin, C.B., by Vice-Admiral Sir James Stirling, Knt.

London, 24th November 1859.

MY DEAR SIR,—Having reason to believe that, in the spirit of a wise and generous policy, a board has been appointed to inquire into the circumstances which affect the health of troops in India, and into the means by which it may be best promoted; and understanding that any authentic information as to the suitability of Western Australia to the purposes of a sanitarium, would be acceptable to you at the present moment, I venture, on the ground of much experience in that colony, the Government of which I held for many years, to send you the following observations on its climate, geographical position, and means of communication with the ports of India.

In proceeding to explain the nature of the climate of the western side of Australia, you will, perhaps, excuse me, if I offer a few preliminary remarks on that of India, for the purpose of pointing out how much they stand in contrast to each other.

The climate of India appears to be generally characterised by a high degree of temperature, occasionally varied by great and sudden chills,—and, whenever this prevailing heat is aided by moisture, unwholesome exhalations are produced. The nature and effects of the malaria thus engendered, are found to vary in different localities; but it may be taken, as a general rule, that it exists in some degree, throughout the whole of India. An atmosphere of this description cannot be otherwise than highly congenial to British constitutions, even under the most favourable circumstances; but when to these predisposing causes of disease are added all the various depressing incidents of the private soldier's life in India, it need not be wondered at that 6·94 per cent. of the European troops die annually, and that 94 per cent. of the whole European force either die, or are invalided before they reach the age of 35.—(Vide *Ewart's Vital Statistics of the Indian Army*.)

To the climate of India, as above described, the climate of Western Australia affords a very remarkable contrast. The colony, as at present existing, is situated on the western shore of New Holland, between the 28th and 35th degrees of southern latitude. It is, consequently, within the range of the perennial westerly winds, which pervade the whole of that region of the globe. Its climate is, in a measure, brought to it, and regulated by these western breezes. In winter, they take a direction from the north of west, and moderate the coldness of that season. In summer, they come from the southward of west, and temper the heat of summer. There are occasions in the course of summer, when, from some accidental failure in the usual sea-breeze, the heat becomes intense; but these occasions are rare, and of short duration; and even then, although the thermometer may sometimes range as high as 100 degrees in the shade, the extreme dryness of the atmosphere prevents that heat from being injurious to health, and Europeans follow agricultural avocations without serious inconvenience.

From this description you will perceive that the climate of Western Australia is formed and governed by a constant cause—the prevailing westerly wind; that it is essentially a sea-climate, fresh and invigorating; temperate in point of heat; equable in point of temperature; free from sudden chills; and with this remarkable circumstance attaching to

it—that the season of greatest heat is also the season of greatest drought, and, consequently, malaria is not produced to any appreciable extent. Hence, therefore, fever, dysentery, cholera, and liver complaints, are almost unknown in Western Australia. The causes which produce these diseases in India do not exist in the colony—their climates are essentially and entirely the reverse of each other.

I regret much that I have not at present access to those reports, which would show in full detail the opinions of medical men upon the subject of the climate of Western Australia, and its effects upon European constitutions; but I may confidently affirm, that the medical officers employed from time to time in the colony have invariably borne testimony to its extreme salubrity. Those reports may be consulted, if you should deem it necessary. They are contained in the Blue Books periodically transmitted to the Colonial Office; but it appears to be sufficient for the present purpose to point out that a climate of the nature herein described, cannot be otherwise than conducive to health; and especially curative in its effects upon patients suffering under maladies contracted in India.

In geographical position, as in climate, Western Australia is unequalled by any of the other Australian colonies. It is the nearest to the ports of India. A voyage of 14 days would amply suffice to convey passengers between India and Swan River, and that voyage would be made for the most part within range of the healthy breezes of the south-east trades. A much longer and more boisterous voyage intervenes between India and the eastern Australian colonies, and the cost of conveyance must necessarily be in proportion to the length of voyage.

The last advantage arising from position in favour of Western Australia to which I shall advert is, that any troops stationed in that country for the recovery of health, and fit to return to duty in India, might be instantaneously recalled in case of need by electric telegraph, and re-conveyed to India in a few days, and therefore would scarcely be further from their work than if they were in any hospital in India.

The means of communication at present existing between India and Western Australia are the postal communication about to be re-established between Pt. de Galle and King George's Sound, and an irregular mode of communication by means of sailing ships, which occasionally carry timber for the railways in India, and horses of an admirable description for military purposes; but neither of these modes would afford suitable accommodation if a sanitarium were established in Western Australia. I would therefore suggest and recommend, if such an establishment should be formed, that two or more steam ships should be placed upon the line between Calcutta, Madras, Pt. de Galle, and Swan River: that they should be specially adapted to and devoted to the sanitary service; that one should start on a regulated day in every succeeding month from Calcutta, and contrariwise on the same day another should leave Swan River for Pt. de Galle, having corresponding communications with Bombay, in order to accommodate the patients from the latter presidency. I believe that such a line might be established and maintained at a definite and moderate expense, and that private persons might be found willing to establish and maintain such a line of suitable vessels under contract with the Indian Government, by which patients might be conveyed from and to the Indian ports and Swan River at an expense not exceeding 10*l.* per head each way, the Government engaging only that a certain number should be embarked, or at all events paid for in every month.

It is not for me to offer any opinion as to the advantages to be expected from the timely removal of certain classes of patients from the unhealthy plains of India to sanatoria in the hills, or in other localities exterior to Hindostan; but I may be permitted to observe, that there is a growing impression that many thousands of valuable lives might be saved by such occasional removal, and that there is an opinion gaining ground amongst those who are best qualified to judge, that the climate of the hills is only preservative and not curative in its effects on Indian maladies. If this should prove to be the case, the establishment of sanatoria in places out of India will naturally engage the attention of a beneficent Government, and I feel assured, in that event, that Western Australia in climate and position will be found to possess unequalled advantages over all the other colonies for the formation of such establishments.

I am, &c.

J. STIRLING,
Vice-Admiral.

To J. R. Martin, Esq.

No. 9.

EXTRACTS from a PAMPHLET entitled "WESTERN AUSTRALIA, and the Means offered by the Colonization Assurance Corporation, to assist the Enterprise and promote the Prosperity of Farmers, Artizans, and others wishing to Emigrate. London, 1860."

"The area of Western Australia is about 1,000,000 of square miles, or more than eight times the size of the mother country. It is well watered, possessing several considerable rivers. Valleys and luxuriant pastures spread themselves through various districts, and especially those of the south-west, where lakes of fresh water, springs, rivulets, and brooks are of frequent occurrence, their presence being attested by the lively verdure of the vegetation. A most important consideration for intending settlers also exists in the fact that the colony, owing to the prevalence of westerly winds, is not subject to the calamitous droughts which so frequently interfere with the operations of the agriculturist and stockholder in other parts of Australia. The climate of Western Australia is generally considered to be more suitable to Europeans than that of the other Australian colonies, and the soil is acknowledged to be capable of producing crops equal in quality and abundance to those of the most fertile regions of the world. All sorts of grain, Indian corn, garden vegetables, and all green crops, wool, tobacco, silk, cotton, wine, oils, raisins, and fruits, as well as drugs and dye-stuffs, &c., of the finest quality, admit of abundant production. Fruits of all descriptions are of the choicest growth. Timber is abundant," &c. &c. &c.

No. 10.

EXTRACTS from OFFICIAL DOCUMENTS.

From a speech of Lord Grey, when Colonial Secretary, in the House of Lords, on 13th of March 1850:—

"The development of the resources of Western Australia is a matter of the highest moment. Coal is to be found there, and in steam communication with India, I need scarcely remind you of the vast value of such a product. Further, I may state that Western Australia abounds with forests of the finest timber, while it possesses a climate and a soil capable of producing anything which a tropical region of the earth may be expected to yield."

Dr. JONES, (Staff Surgeon, late 77th Regiment,) examined.

1923. (*Chairman.*) You are, I believe, well acquainted with the climate of Western Australia?—I was four years there.

1924. How lately?—I left in February 1856, and I went there in the early part of 1852.

1925. You are aware probably there has been some discussion as to the possibility of establishing a sanitarium in Western Australia for European troops invalided in India?—Yes.

1926. Have you at all considered the advantages of the climate and the locality suitable for that purpose?—Yes; I have advocated the colony myself. I had charge of one of the largest depôts in India. From the opportunities I had of witnessing the effects of the climate of Australia on Europeans, I consider it one of the best adapted for invalids from India. The climate is peculiarly exhilarating.

1927. Will you be good enough to state what the peculiarities of the climate are?—There are not the same extremes as in other countries. The statistics are favourable—I think, with the exception of New Zealand, it is about the healthiest colony in the world.

1928. You say that there are no very great variations of temperature in Western Australia?—There are not the same extremes of temperature as observed elsewhere.

1929. A paper has just been handed in to the Committee in which it appears that the fluctuations in one month exceeded 30 degrees?—There are some hot days in the summer, but these arise from local causes, usually bush fires. The temperature then rises rather high.

1930. It rises to 100 degrees in the shade, does it not?—Above 100 degrees, I have registered it 115°;

From a report made by the Colonial Secretary, dated *J. S. Roe, Esq.* Perth, 11th November 1858:—

"The colony possesses one of the most healthy climates in the world. The mortality since its occupation has not averaged 1 per cent. I doubt if any portion of the world is better suited to the European constitution. The mean of the barometer is about 30 inches, and of the thermometer about 63°. I believe that in general salubrity of climate, Western Australia possesses a marked superiority over any of the Australian colonies. It is subject to no extremes of heat or cold. Cattle have never been known to die from lack of water, and in the very driest weather there is a sufficient supply of food for them. Exposure to weather, by night or day, appears to produce no ill effects on the constitution of the colonists, many of whom, for months together, rarely sleep under any beyond the most temporary dwelling. Snow is never seen, ice only in the depth of winter, and then only in the very early morning. As in New Zealand, both maize and potatoes ripen in this country, and the latter crop is grown to a considerable extent. The apple and the pear, the orange, banana, fig, peach, and apricot, with the melon and the vine, grow luxuriantly, and may be seen ripening at the same time. The colony is peculiarly adapted to the growth of the vine, on the cultivation of which much attention is bestowed, and which is likely to prove very remunerating. English and tropical vegetables are largely cultivated, and yield profusely. Attention is also being directed to dried fruits; and specimens of figs and raisins that have been sent to the periodical horticultural exhibitions for competition are little inferior to those imported from Europe."

16 March 1861.

From the "Colonization Circular," issued under authority of Her Majesty's Emigration Commissioners in 1856:—

"Western Australia.—In an official report to the Secretary of State, dated 11th July 1848, this colony is said to have a climate of remarkable salubrity, and to be (from the prevalence of westerly winds) but little exposed to drought."

From a similar "Circular" of subsequent date:—

"Western Australia possesses one of the most healthy climates in the world. The mortality during the last 25 years has not averaged 1 per cent. of the whole population. Fruits and vegetables from all parts of the world grow to great perfection; the vine in particular, the culture of which for wine and dried fruit is now engaging much attention."

Dr. Jones.

but this is generally the consequence of bush fires, and the wind prevailing from the interior.

1931. There is no long duration of great heat?—No; the depressing effect is not the same as it is in the tropics; it is a dry atmosphere.

1932. (*Sir R. Martin.*) There are hardly any sources of malaria in the colony?—None; but where malaria has been developed it has been from causes which have been induced by neglect.

1933. (*Chairman.*) These are the advantages which you put most prominently forward as belonging to that climate, freedom from malaria, except where it arises from preventable and local causes, and a generally uniform temperature?—Yes.

1934. Do you consider that the temperature frequently rising to 100 degrees, is too high to be beneficial to men suffering from the effects of tropical service?—It is of such a short duration that it would not, I think, affect them; the heat is not permanent.

1935. Not at any season of the year?—Not at any period of the year.

1936. Have you considered the question of distance and expense?—Yes; in comparison with other colonies. I think that the great object in many cases of disease in India is to remove men from the influences which induce the diseases, and this can only be done effectually by sending them to sea for a short period, by crossing the line. As soldiers are now enlisted for 10 years service, the principal consideration I imagine to be, to obtain the full benefit of their services abroad, especially when serving in India, and this I conceive might be accomplished with most men, by affording them opportunities when ailing of leaving the country before any serious disease is established. The system of invaliding in India at present

Dr. Jones.
16 March 1861.

is only once in 12 months, and those men in whom disease has been induced are obliged to remain in the country until the invaliding period arrives, when they are sent home, if required. Now if a colony were selected like Western Australia as a sanitarium, men might be removed at all periods of the year. This would afford relief, and give sufficient tone to their constitutions to enable them to endure a further residence in India. Depôts would be reduced, most of which contain sick of various corps; thus also the enormous expense entailed by sending men home would be avoided.

1937. You think that that object would be more effectually attained by a sea voyage and subsequent residence in Western Australia than by sending them to the hills in India?—Yes; by the Peninsular and Oriental Company running their vessels to Point de Galle and from there to Western Australia, the vessels might reach Fremantle at the outside in 12 days; they go to King George's Sound now. The conveyance might be effected by Government vessels.

1938. But they take a longer time than 10 days, do they not?—12 days or a fortnight, I believe, to King George's Sound; Fremantle is two days nearer India.

1939. Adding a week to that, which it will take to go from Calcutta to Galle, a soldier invalided, say at Calcutta, would be 21 days at the most moderate computation in reaching his destination?—It would be the outside; I should say 17 days.

1940. And that would not include the land journey that he might have previously made from any inland station in India?—No.

1941. You think that taking the case of a soldier who might be invalided, say at Agra, or Delhi, or Cawnpore, that the benefit to be derived from the sea voyage and going away altogether from India, would be such as to compensate for the additional expense, and the fatigue to the man himself of sending him first some hundreds of miles by land and then taking a sea voyage?—Yes, I think so, because both body and mind are influenced, the restorative effects of the change is stronger when directed towards the mind; in India the mind is operated on more seriously by bodily ailments, I believe, than in any other part of the world.

1942. But the presumption is that in such a case you wish to send a soldier to the nearest healthy climate?—Yes; entirely away from Indian influences.

1943. Would not the hill stations effect the same thing?—I have not had much experience, but the hill stations do not do for all classes of diseases.

1944. (*Sir R. Martin.*) Bowel complaints, for instance?—Yes; or for liver disease, I feel satisfied that the restorative effects would be greater in the other case.

1945. (*Chairman.*) You think that there is a special class of diseases that cannot be treated by sending patients to a hill station?—Not so effectually; the hill stations are more or less damp, while the atmosphere of Australia is dry.

1946. You doubtless attach great importance to the effect produced on the mind by actual removal from India?—Yes; I have witnessed the effects myself.

1947. (*Sir R. Martin.*) You would regard the climate of the mountains of India as more useful for the preservation of health than the cure of disease?—Yes; as preservative measures the hill stations are well adapted for Europeans.

1948. I understand you to say that the curative influence of the climate of Western Australia would probably apply to all or to almost all the diseases of India?—I think so.

1949. Fevers, bowel complaints, and other diseases?—Yes; once upon crossing the line, I had an opportunity of judging of the curative effects of the change. The effect was remarkable; suppose, for instance, a man to have suffered much from fever, and the fever is still latent in the system; the effect of crossing the line and entering into the south-east trade is to induce a disposition on the part of the fever to lose its

periodicity, while if he remained in India, the fever will still adhere to him in many instances; I think, that where there are local complications with fever, the curative effect is more certain.

1950. Have you had any opportunities of witnessing the effect of the climate of Western Australia on visceral enlargements of the liver or spleen?—Yes, I have in the case of gentlemen, who had visited the colony; the results were generally favourable; I do not remember a single bad result in all the cases that I saw.

1951. Did you observe the physical character of the children of the residents in the colony?—Yes, they are very good, though they are certainly not so fine as the children at home; they have not the same development, otherwise they are perfectly healthy. There are no local diseases peculiar to children.

1952. They are not subject to visceral disease, as the children of Europeans, who have been brought up in India are?—Not at all.

1953. (*Dr. Farr.*) In what part of the colony did you live?—I was in Perth, in charge of a detachment of a regiment, but I had a pretty extensive practice among the civil population.

1954. What did you find to be the effect of the climate on the regiment you had in your charge?—I was for 10 weeks without a single man in hospital.

1955. Have you any return of the sickness and mortality in the regiment?—No, the deaths were principally from consumption, heart disease, and from accidents.

1956. Have you resided at the Cape?—No, I have been there twice.

1957. That climate, I believe, does not differ very much from the climate of Western Australia?—No, so far as I could judge; but my experience will not enable me to answer that very correctly, I should imagine that there is a great similarity.

1958. The latitude is nearly the same, is it not?—Yes, I believe that the southern extremity of the Cape is 34°, and that the southern extremity of King George's Sound is 34°.

1959. Generally speaking, the atmosphere is dry in both places?—Yes, I believe so.

1960. You are aware that the Cape is an exceedingly salubrious station also for the troops?—I believe that it is a very healthy place; but they have endemic diseases at the Cape.

1961. Such as what?—They have fevers there, and from what I have understood and read have had epidemics.

1962. In what part of the Cape?—My experience is confined to Cape Town; they have had smallpox there, and other epidemics, which they have not had in Western Australia. Syphilis is common at the Cape, and never met with when I was at Swan River.

1963. We have here a return of the mortality in the civil population; do you think that it is authentic?—I cannot speak as to its accuracy.

1964. Do you think that they have the means of ascertaining there the deaths which occur, and of registering them?—I fancy so.

1965. Do you think therefore that the mortality represented in these returns may be considered correct?—I should fancy so.

1966. Are there any diseases prevailing in the colony, any epidemic diseases?—They have had slight influenzas.

1967. Are they often fatal?—They were not when I was there, they appear in the form of common catarrh; they were very mild, and could scarcely be called influenza. They are ushered in by the change of the seasons, and accompanied with a slight running from the nose and watering from the eyes; they did not lead to organic disease, and did not affect the chest.

1968. (*Dr. Sutherland.*) On referring to the returns of mortality in the colony, I find that there is a very considerable amount of bowel disease?—That bowel disease is very comprehensive, and that which is registered would comprehend a great number of

diseases of the bowels, it is not merely bowel complaint, but liver disease, or bladder disease, or kidney disease.

1969. What is the nature of the bowel disease that prevails in the colony?—It is sometimes in the form of diarrhoea. There is a good deal of intemperance among the lower classes, diarrhoea is induced more by irregularities.

1970. Fatal diarrhoea is induced by irregularities?—It is not fatal.

1971. The amount of mortality is very considerable, and I find that out of a total mortality of 726 there were in six years 107 deaths from bowel disease; can you say what is the precise nature of that disease?—I have not met either with dysentery or diarrhoea that was not tractable; I think that the return is given in a very general form, and that the diseases are not sufficiently specified.

1972. Is diarrhoea the prevailing disease?—No, there is very little diarrhoea; perhaps during the very hot days diarrhoea is more aggravated.

1973. Have you had an opportunity of making post mortem examinations of children?—I have made some.

1974. What changes have you observed?—Generally in aggravated cases, there has been slight ulceration of the bowels.

1975. Do you think that the climate in which so large an amount of bowel disease exists, is one to which you would recommend men to be sent?—These diseases have evidently been among children—as far as adults are concerned I saw very little of them.

1976. (*Dr. Farr.*) The mortality among children appears to be excessive in the first year of age, it is as much as 14 per cent.?—I have not any idea of the statistics, for my attention was not sufficiently attracted to them at the time.

1977. (*Sir R. Martin.*) Have you had any opportunity of knowing the habits of life of the mothers of the working classes of the people?—Among the settlers I have had opportunities.

1978. Were they careless of the health of their children?—They are obliged to be, because they are called upon to do a great deal of out-door work.

1979. (*Dr. Farr.*) Are the houses of the people kept clean?—They are like all labouring classes generally. The better class up to a recent period were obliged to depend upon themselves in a great measure for their domestic comforts, the lower classes entirely so. The mortality among the children I attribute to the absence of medical men in the rural districts. A child if sick is left to nature or brought to town for medical aid, when far advanced in disease. This is particularly the case when teething.

1980. The water appears to be bad at Perth?—It was very good indeed, it is all obtained from wells. There is a number of large lakes at some distance in the rear of Perth.

1981. You think that the water is good?—Yes, as far as my observation went. I never found any evil consequences arising from it. In travelling through the country districts you are obliged to drink water which is not very palatable; but that is stagnant water. As far as the bowel complaints of the colony are concerned, the colony possesses a very powerful astringent gum, which I experimented with in India, and found most successful.

1982. (*Dr. Gibson.*) Have many persons attained an advanced age in the colony?—The old residents have generally died from organic disease, that is disease either developed at home or further matured in the colony; but diseases that would have induced death anywhere perhaps earlier.

1983. You mean disease that existed when they left this country?—Yes, such as consumption; but I think that if a man is careful in the colony, he may prolong his life there when suffering from tubercular disease.

1984. (*Dr. Sutherland.*) The meteorological table shows very considerable monthly variations of temperature, as much as 30°, what effect have those

variations upon the feelings?—To tell the truth, people do not appear to notice them, they are not conscious of them; you may go out in the hottest day with the thinnest straw hat on, and sleep exposed at night without covering or protection of any nature.

1985. Is there much variation between the temperature of the day and the temperature of the night?—The nights of the hottest days are generally comfortable, and your rest is not disturbed as it is in India.

1986. Are there many fogs on the coast?—No; the atmosphere is a clear atmosphere.

1987. (*Dr. Farr.*) Have you any meteorological returns of your own?—No; I have not.

1988. Are the insects troublesome at all in Western Australia?—The flies are troublesome in summer.

1989. Do they disturb your sleep?—No.

1990. (*Dr. Gibson.*) You are of opinion that there will be a great saving of life in India if there was a facility for removing men to such a climate as Western Australia, before organic disease had taken place?—I think so; I think that a considerable amount of life might be saved by removing men when disease is first developed, or when the constitution was at all affected so as to indicate protracted suffering. Men should be removed to the colony of Western Australia, between the 15th of March and the beginning of November, or to the middle of November. I do not believe that there is a finer climate in the world. I think that the removal of such men to that colony would facilitate their recovery, and tend to give them sound constitutions.

1991. Do you think that they would be able then to return to India?—Yes; in November.

1992. As efficient men?—Yes; efficient in most instances, even if they were to remain during the hotter weather, the debilitating effect does not approach to the same sensation experienced in India; the atmosphere is certainly hot, but you never keep in-doors, you feel that your circulation is carried out freely, and that your lungs are expanded; but in the moist atmosphere of India there is a sense of oppression, which is not describable.

1993. Would the invaliding in your opinion be greatly diminished?—Yes; you would restore a man, and he could then return to his duties in India. The convalescents would be able to act as a military force in the colony. The colony is a penal colony, and requires more military protection. I believe the colonists have petitioned the Government to allow them a larger force.

1994. (*Chairman.*) The military force at present is very small, is it not?—It consists chiefly of the pensioners, with a detachment from a regiment in Tasmania, a company of engineers.

1995. (*Dr. Gibson.*) What is the general result when a soldier in India has severe fever, or liver complaint, or dysentery?—If he cannot get away the probabilities are that the disease will become serious and that the man dies. I have seen many men at Kurrachee, who have come down from the Punjab, and who I am quite satisfied might have been saved by removal to Western Australia.

1996. That is before the invaliding season comes round they are thrown into an incurable organic disease or they die?—Yes; I have had men for ten months in hospital not being able to remove them. The gum which I spoke of exists in large quantities; it is natural exudation from a tree, and the stringent effect of it is such that I have no hesitation in saying that many cases of chronic diarrhoea and dysentery that are found incurable would be cured by it. I exhibited it first at Western Australia in the case of a consumptive man who had been a long time in hospital, and was suffering in the last stage of diarrhoea—I tried the gum in large doses—I gave it him every two hours in powder, the man recovered from the diarrhoea, and lived for two years afterwards; he was a very intemperate man and thus destroyed himself. I got a pound and a half of this gum sent to me in

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India, and I treated with it 10 invalids; one was a woman, two were men who had been invalided in the station I was residing at, and seven were invalids who had been sent down from the country, with every one the success was complete. I sent the particulars of these cases on to Calcutta to Dr. Linton, the Inspector General.

1997. (*Dr. Gibson.*) Have you ever been in King George's Sound?—No; I have been about 100 miles south from Perth, the capital.

1998. The prison diet is very high in Fremantle?—Yes; I think it is too high, I think that the amount of animal food and bread was rather too much; there was no necessity for the same amount of diet, the convict authorities kept up the scale in use at our prisons at home, which was in excess for the colony. The amount of diarrhoea, constipation, and other diseases of the bowels prevailing among the convicts resulted from bad cooking and bad baking, and not from any local miasmatic causes, but purely from bad cooking and bad baking of the bread. I was on a committee on their diet, in 1855, and on examining into the cooking it was proved to be carelessly effected.

1999. They suffered from fever, did they not, during the summer?—Not that I am aware of.

2000. (*Chairman.*) You have not, I suppose, considered the question of expense as to conveying

invalids from India to Western Australia?—No; I have never seen any estimates nor made any. I know that they could be conveyed at a very reduced rate, I should fancy that 10*l.* ought to cover the expenses or 15*l.* at the outside.

2001. That is in sailing ships?—No, by steamers.

2002. Do you mean steamers to be specially chartered for the purpose?—No; I believe that the Peninsula and Oriental Company would not hesitate to accept returns to convey them down to Ceylon; and Government vessels might be employed to take them from Ceylon to Fremantle.

2003. For the sum which you have named?—Yes.

2004. They would not be over-crowded and would enjoy all those comforts which invalids require?—Yes; I think so on board ship. It has been recommended to employ vessels in the Bay of Bengal, but I do not think that would afford a sufficient change, and besides that it could not be done at all seasons of the year.

2005. The length of the voyage, I presume, is not an unimportant consideration except its cost?—No; men improve after crossing the equator.

2006. (*Colonel Durand.*) You attach great importance to getting into the south east trade?—Exactly so.

2007. (*Chairman.*) Is there anything that you can add to what you have already told us?—No.

The witness withdrew.

Saturday, 23rd March 1861.

PRESENT :

The RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

The Right Hon. LORD HERBERT.
Sir PROBY CAUTLEY, K.C.B.
Sir RANALD MARTIN, C.B., F.R.S.
J. B. GIBSON, Esq., C.B., M.D. D.G.A.M.D.

Colonel DURAND, C.B.
WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

Maj.-Gen. FREDERICK CONYERS COTTON, Madras Engineers, examined.

*Maj.-Gen.
F. C. Cotton.*
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2008. (*Chairman.*) I believe you have been engaged in inspecting many of the military stations in the south of India?—Yes, I have been constantly employed amongst the military stations.

2009. Will you be good enough to state to the Committee the principal stations which you have inspected?—The barracks on the Neilgherry hills are the most interesting modern ones; Bangalore I have inspected, but not officially.

2010. Are there any others?—Cannanore, and the old barracks at Trichinopoly, and all the old barracks in Madras.

2011. You have not, I believe, been yourself employed either in planning or constructing any military buildings?—None of the modern ones.

2012. In the course of your inspections have you become sufficiently acquainted with the peculiarities of the different barracks?—I have discussed continually all the peculiarities of the different barracks.

2013. To take first the barracks on the Neilgherry hills, of which you have spoken, are they of considerable extent?—They were built, when I saw them, for only one wing of a regiment, and the hospital.

2014. Are they in the neighbourhood of Ootacamund?—Yes, at a place called Jackatalla.

2015. At a height of about 4,000 or 5,000 feet?—About 6,000 feet.

2016. Have you any remark to make as to the nature of the country about that station?—I was at the spot when the Inspector-General of Hospitals was first examining it, and subsequently with Lord Tweeddale when he determined upon it as the site of the barrack, because it was a fine open valley, well supplied with water, and, as far as the slope of the country went, as good a position as any that could be found. It has lately become a question with the

doctors whether it would not have been better to build a thousand feet higher.

2017. I believe that the Neilgherries possess an advantage over most mountain ranges, being an open undulating country?—I believe that the Neilgherries will be found the very best home for Europeans in all India; they are much more open than the mountains in general, not so precipitous as the Himalayas, and everywhere more level and habitable.

2018. The general fault of hill stations is, that there are only two or three roads on which it is possible to move; but that is not the case, I believe, in the Neilgherries?—No, it is strikingly different; there is no actual flat, but the country is not precipitous, and roads can be opened with facility through the country.

2019. Are the troops quartered at this station all the year round?—Yes, the whole year round; it is out of the very rainy portion of the hills, and the site was chosen partly on that account.

2020. Has any tendency to such diseases, as prevail in other hill stations, been noticed, such as dysentery?—Dysentery is not a common complaint on the Neilgherries; but as it is a very fatal complaint when it does occur it is naturally a good deal feared and talked about. I may mention that I was employed to examine the Jackatalla barracks, when the late General Anson,—having seen Lord Dalhousie's order giving great additional space to the barracks then building in the North of India,—was led to suppose that the rooms in these were too confined; and suggested their being pulled down, and begun again. But on consideration of the subject, the size of the rooms was determined to be ample; and it was allowed that any increase would make them unnecessarily cold. I found that the wing of a regiment had

been in temporary barracks for six months; and though the walls of these buildings were not more than six feet high, the beds almost touching, and every hole that could afford ventilation filled up in order to keep the rooms warm,—yet there was no sickness. This was the more remarkable as there had been a considerable loss of life on the first arrival of these men on the hills from inflammatory complaints.

2021. Although the sanitary conditions were bad?—The position of the buildings was good, but the rooms were so confined that any one would have thought it injurious to the health of the men. Yet, when I enquired of the medical officer what sick he had in hospital, he told me that there were only three per cent. of the whole number, and that two out of these three were on the sick list from contusions.

2022. The peculiarities of the climate seemed to compensate for the artificial disadvantages of the place?—Yes; the men were living apparently a healthy life, very much out in the open air; the mortality that had occurred was only in cases which had appeared in an inflammatory form below.

2023. (*Sir R. Martin.*) And especially in bowel complaints?—Yes; what we should describe as dysentery, and liver complaints.

2024. (*Dr. Gibson.*) Did none of the men die, except those who came up as invalids?—The general report made to me was, that those men who had died were those who had come up sick. There appeared to be no illness on the hills at all from the climate alone, nor any bad effect produced upon the health of the men, nor is there any such sickness amongst the people who live on the hills generally, and who remain there permanently; but if anybody remains on the hills who has been attacked with liver complaint, it is almost certainly fatal, not to soldiers only.

2025. Were the buildings which you have mentioned wooden buildings?—They were made of mud with a wooden roof and thatch, and they were theoretically as unfit to put men in, in such numbers, as they possibly could be. With regard to the new permanent barracks under inspection, my opinion was, that a very undue importance was set upon the height of the rooms. The cubical content of air is calculated by the height, length, and breadth being multiplied together, so that the same value is given to the air high above the men's beds as that on the same level with them. This is, in my opinion, fallacious, as the air immediately near the men must be of much more importance than the air far above them.

2026. (*Chairman.*) Was not the idea under which the barracks were constructed of great height, this, that if you gave much space laterally, there would always be a danger in a time of emergency of the barracks being overcrowded, while if you gave the space vertically such overcrowding would not be possible?—That is another matter; and in point of fact, it would be well to have the barracks so constructed, that in case of emergency, they might be capable of holding more men than they ought to contain, under ordinary circumstances. And I think that where the difficulty about building suitable cover for soldiers is found to be the excessive cost, as has been the case in India, it would be better if less money had been spent in the height of the rooms, especially in India; as in that climate generally, the upper ventilation may be made very perfect, without the rooms being made too cold. Some rooms have, I think, been built 22 feet high.

2027. (*Sir R. Martin.*) The ventilation which you speak of could be secured, could it not, by night as well as by day?—In the hill stations the objection was that the men would not have the place open, as it would be too cold.

2028. That is at Jackatalla?—In the warmer months even they would close the ventilation if they could; but such ventilation might be given as would be quite sufficient if it was well contrived, so as not to affect the temperature materially.

2029. (*Chairman.*) What number of men would these buildings hold?—I do not remember the details,

but they were fine large buildings, and they were for the wing of a regiment. I cannot give you the actual measurement of any of them.

2030. At that station how far distant were they from the plains, or supposing that anything had occurred in the plains, and that their services were required, in what time could they have come down?—On the southern side the distance from Jackatalla to the plains is 20 miles, and can be marched in a day; but there are, at present, no roads fit for wheel carriage in that direction. There is a road to the north which leads into Mysore, and from Jackatalla to the open plains in that direction is about 40 miles. There is no road fit for wheel carriage to the westward, except by a long circuit of many days march through the Mysore country. But the distance by which men may be marched from Jackatalla into the open country of Malabar is about 70 miles; of which 46 are on the tops of the mountains. A good road is very much needed in that direction.

2031. Is there not an intervening belt of unhealthy country between the hills and the plains?—Yes, there is more or less jungle and dangerous country on all sides. On the south, including the pass, it is 20 miles broad, and if the pass was lengthened to a suitable slope for wheel carriages it would be at least 30 miles long. On the north the plain of Mysore is about 2,500 feet above the sea, and the breadth of unsafe country in that direction is about 25 miles broad. On the west, by the most direct route, the dangerous country could not be passed under 20 miles; but if the pass were made of a moderate slope, the distance in which fever might be met with would be about 30 miles.

2032. Have you any means of ascertaining what the cost of maintaining troops at that station would be, as compared with maintaining a similar number of troops in the plains?—I think that when the thing is thoroughly done, there will be very little additional cost; because they may have the cattle bred, and all the vegetables grown on the hills; but in a transition state it must of course be more expensive, as everything has to be obtained from below.

2033. That is a peculiarity, is it not, of the high undulating land of the Neilgherries, that the large amount of provisions which they require can be obtained there?—Yes; but not only that; there is a greater extent of country capable of cultivation, and there is a good population of cultivators, a very hardy, industrious, and peaceable race, willing to undertake any profitable cultivation. In this respect, the Neilgherries have, I believe, the advantage over the mountains of India generally.

2034. That is not the case in all the hill ranges of India?—No, by no manner of means.

2035. (*Sir R. Martin.*) When new hill stations are to be selected for occupation by British troops, would it not be well, before constructing permanent barracks and hospitals, to have the localities occupied, with the view of testing the climate, first by native troops and then by European troops?—I do not think that there is any object in native troops being sent there; but I think it would be very advisable to have temporary buildings erected for Europeans, so as to test the climate.

2036. Before constructing permanent buildings?—Yes; if they were entirely in a new country that had never been visited; but it would be quite unnecessary in the Neilgherries.

2037. For the purpose of testing mountain climates, would not huts, constructed of ordinary materials, answer well enough for the temporary purpose indicated?—Our experience was, that the people were better in huts than in barracks; that is to say, the European pensioners, who lived in their own huts, were in as good a state, or better state of health, than the people in the barracks generally.

2038. (*Dr. Sutherland.*) In what parts of India have you carried out works of irrigation?—In the southern portion of India.

2039. What is the general character of the soil that

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F. C. Cotton.

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has been irrigated?—All sorts of soils are irrigated in the South of India.

2040. Will you describe generally to the Committee the nature of the works which have been carried out, and how the water is applied?—We have two distinct kinds of works, one in which we keep the water in reservoirs, and so cultivate; and the other in which it is turned from the river without storing it.

2041. Is the surface of the land very much flooded?—The surface of whole deltas are kept flooded for the greater part of the year, and are dry during the other part of the year.

2042. Are the works carried out near any large cities or groups of population?—Yes. Trichinopoly has much irrigated land close about it.

2043. Are the works carried out near any large station?—Yes; they have irrigation near Bangalore; in short, in Madras, irrigation is carried out in almost all places wherever we have European stations.

2044. Have you ever received any complaints of injurious effects produced upon health?—In Southern India we know nothing of ill effects to health from irrigation. Officers who come from the northern parts of India say that the people of that country suffer from spleen and other diseases arising from malaria; but we have nothing of the sort.

2045. In such a case as Trichinopoly, for example?—Very great works have been carried out there, but there have been no complaints of fever. We know nothing of it.

2046. Do you combine works of drainage with works of irrigation?—Very indifferently.

2047. Do you allow the water to lie upon the surface of the ground?—The water lies upon the ground during the growth of the crop, which is the case with rice, the grain chiefly irrigated, from four to six months; where there is a second crop the land is again laid under water during some of the remaining months; but much of the land is flooded one half the year, and is dry the other half.

2048. Would it be any improvement, do you think, to combine works of drainage with irrigation?—It would be very advisable no doubt to be very careful of drainage in countries where fever was caused by irrigation. Our experience led us to suppose that excessive and continuous heat made countries more safe from fever. And this supposition was borne out by the comparative unhealthiness of the northern provinces of India and Italy; those countries suffering while our tropical climate did not.

2049. Have you ever heard it stated that water improves the climate?—We consider that it improves the climate of hot stations, by making them cooler.

2050. (*Sir R. Martin.*) By the evaporation which takes place?—Yes; the evaporation decidedly cools the air.

2051. What you have stated would seem to imply that extreme heat, as well as exceeding cold, tends to depress malaria?—Quite so; that is quite my impression, judging from my experience, and it was very generally thought so. We believe now that temperature has a great deal to do with the malaria getting into a poisonous state. I have been in Hong Kong, the climate of which is called hot; but it is not hot in the sense in which I speak of heat in the Carnatic; I should consider it among the dangerous climates, as being moderately hot, and therefore conducive to poisonous malaria.

2052. (*Chairman.*) You speak of Southern India as being hotter than the north of India?—Yes.

2053. And so I believe it undoubtedly is, taking the average of the year through; but is there not a season of greater heat in Northern India than there is in the south?—Not altogether, I think. There are parts of the south which are quite as hot. We had the thermometer in the delta of the Godavery at times as high as it ever is in the north of India.

2054. (*Dr. Farr.*) Can you state what the temperature there is?—I have seen it with a very hot land wind at 113° in the inner room of a good house.

2055. (*Chairman.*) With regard to establishing new hill stations, are there any remarks or suggestions that it occurs to you to make to the Committee?—No, not beyond the fact that I would occupy every hill station that I could find with Europeans, which was not actually proved to be unhealthy.

2056. As a general rule you would assume that the high ground was healthy, and the low ground unhealthy?—Yes, and that the higher ground is, therefore, better for Europeans. I have not the slightest doubt that there are hills, of a certain height, which are unhealthy, and must, therefore, be condemned; but, as a general rule, it is worth while to make inquiries everywhere, and wherever hills are found to be healthy, Europeans should be placed upon them, if they are required in the neighbourhood.

2057. Taking the part of India with which you are acquainted, is it the fact that hills of a moderate elevation, are to be found almost everywhere within two or three days march of an existing station?—Yes, that is so. Every year seems to prove that you have some range of hills within reach of you; there is hardly any province without some hills.

2058. (*Dr. Farr.*) You do not, I presume, extend that observation beyond the Deccan?—There are hills there at no great distance.

2059. (*Chairman.*) In the Mysore country there are, I believe, abundance of hills?—Yes, ranges of hills, with fine climates, almost every one of them.

2060. Where the old native hill forts were erected?—Yes, and extensive ranges also.

2061. (*Sir R. Martin.*) Are there not unexplored ranges in the Travancore country?—Yes, one of which I have crossed; and my experience in such forests is; that fatal fevers are very local, the malaria or whatever causes them being confined to narrow spots. I was led latterly to conceive that the form of the ground had much to do with it, as the poison became condensed and increased in strength in places from which it could not flow off or the wind could not disperse it.

2062. It had lodged in those places?—Yes, where there was no outlet; and I have little doubt that surrounding trees form a tank for malaria in many cases; hence the danger of close belts of trees about buildings even in the open country.

2063. (*Dr. Farr.*) What was the quality of the water to be found in those districts?—I think there was only one place in which we came to the conclusion that the water was bad in all that country.

2064. Did you test the quality of the water in any way?—It has been tested again and again, but there was nothing to detect. The particular point to which I refer was at the foot of the Neilgherries, near Seegoor; there was a stream from the hills there, which all the doctors thought was poisonous; that was the only case that was established, but the natives attribute everything to the water.

2065. (*Sir P. Cautley.*) How would you test the value of a position in the hills?—There is no way of testing the climate of the hills but by actual trial. There are places where a fine healthy population of natives live which are decidedly dangerous to all strangers. If the inhabitants suffer from fever there is no doubt that strangers will suffer; but their exemption from fever is no security to others, though it may give fair promise of the climate suiting Europeans, who seem to bear a change of climate, and even to bear up against a bad climate better than Asiatics. It seems quite necessary that to test a climate Europeans should be stationed in it to make the experiment.

2066. Are you acquainted with the hills near Vizagapatam?—I have never been over them, but some of the worst fevers are found in that neighbourhood.

2067. (*Sir R. Martin.*) Those are ranges, I believe, of medium elevation?—Yes, of something like 2,000 feet.

2068. But all of medium elevations?—Yes.

2069. (*Chairman.*) I understand you to recommend that wherever a hill station is established, or is pro-

posed to be established, the site should first be tested as to its healthiness by sending up a small number of men to occupy it temporarily?—Yes, I think that that is the only way.

2070. (*Sir P. Cautley.*) It would be impossible, would it not, to send up a number of Europeans to test the value of a place?—A few men going up to prepare huts would test the climate. It is impossible to avoid all risk, but by taking ordinary precautions, and avoiding what would appear to those experienced in the kind of climate dangerous positions the risk need not be great. I must admit that there is one range which has deceived everybody; I allude to the Shevaroy Hills, near Salem, which seem perfectly healthy for years together, but have been visited at long intervals by violent and even fatal fevers. Such a case makes it highly desirable to build temporary rather than permanent buildings in new localities; but I consider it so important that European troops should have the advantage of the cool atmosphere of the hills that I would always test their climate when troops are required in their neighbourhood.

2071. (*Sir R. Martin.*) It cannot always be done, either, by means of native troops, who are very susceptible of malaria?—No, not with certainty. The natives of Malabar cannot live in safety in what we consider the most healthy climate of the Neilgherries, while the people of Mysore, Coimbatore, and other districts to the eastward, find the climate no less healthy to them than to us.

2072. (*Chairman.*) You do not find the natives willing to go beyond a certain elevation, I believe?—They do not like it at first, but they all like it when they get there. The town of Ootacamund is composed of men who wish to go nowhere else, although it is very cold in the winter.

2073. (*Sir P. Cautley.*) It is, in fact, a European climate, is it not, and not a tropical one?—It is more European than tropical.

2074. When you go to the lower elevations of between 3,000 and 4,000 feet, such as where Harris's valley is, then arises the question how you are to test the value of such a position, because people do not reside there, and there is no cultivation, no villages, and no indications by which you can ascertain whether people can live there?—It would be difficult to test it in a moment, but I should not hesitate in places of good promise to send up a party to open the ground and to make arrangements for a station.

2075. (*Chairman.*) If there is any opening of the ground afresh, is it not likely that a site may be prematurely condemned as unhealthy; for example, does it not often happen that after first opening the ground mischief follows?—Yes; Hong Kong the first year after it was opened was most deadly. Since that it has never been so bad.

2076. (*Col. Durand.*) In the course of carrying out works of irrigation and turning up new ground, have you observed any such consequences to result in the south of India?—The greater part of the land we have watered has been cultivated before, but in healthy situations newly cultivated land has not led to sickness in the south of India.

2077. You have stated that you think it worth while to try experiments on the lower hills, would you make any limitation as to the height above the sea, or would you include ranges of moderate elevation, say of 2,000 feet above the level of the sea, as well as the higher ones of 5,000 and 6,000?—Certainly; but I should feel more confidence in beginning with some than with others. All those of anything like 6,000 feet elevation might boldly be tested if the extent was considerable, and the forest not dense, and you might, I think, very boldly go to 2,500 feet, but there are hills of 2,500 feet in elevation, the spurs of greater hills, on which I would not venture, but for all that local knowledge is the only guide.

2078. (*Sir R. Martin.*) As a general principle you would say, I presume, that the higher the elevation the greater certainty there was of coolness and of purity in the atmosphere?—Unquestionably.

2079. (*Sir P. Cautley.*) In Harris's valley near Vizagapatam, the experiment was made by sending up a small party of troops for one season, huts were built for them, and everything was done apparently that was necessary; but after a few months the whole party was attacked by fever, and had to be carried down, and the place has been condemned after an expenditure of from 50,000 to 60,000 rupees. Do you consider that the condemnation of that place was a justifiable condemnation?—That would depend much upon local circumstances, if it was a valley almost surrounded, and there was anything like dense forest below it to prevent the free circulation of the air, I should say that it was not an eligible site, and if there were other localities very different facing the opposite way, I should say that the country was worth further examination. There are things of that sort to which no general rule can be applied, and it must depend upon the intelligence of the local officers.

2080. (*Dr. Farr.*) If the water should break out at particular points, it would make a difference, and the soil might become marshy?—We have a sort of general idea, that where there is much higher ground near at hand, the spurs are not so safe as the highest table lands.

2081. (*Colonel Durand.*) In fact, wherever the ground is enclosed a good deal, so as to check the free circulation of the air, the place is objectionable?—Yes; and that is a most important thing to observe. I think it is in Lyell's Geology that a case in point is stated, where an ancient wall stood across a valley, and the country above it was full of forest and fatal malaria. By some accident a part of the wall fell, and the consequence was that the whole country below suffered from the fever, showing almost certainly that the malaria had been held in by the wall as in a tank, and had poured down the valley when the opening in the wall admitted it. I believe in many cases that a valley which has a heavy belt of trees across it is formed into a tank of the kind in which malaria gains strength.

2082. (*Sir R. Martin.*) The influence of high walls and belts of trees has long been a matter of observation in Italy?—So I have understood; and this particular case I recollect reading.

2083. (*Dr. Farr.*) Have you employed bodies of men in irrigation works upon detached duties in different parts of India?—Yes. I have employed many Europeans as supervisors; not in actual labour. In the Godavery works I had about 20,000 men at work, and about 40 Europeans, and our experience there went to prove that the exposure did little or no harm to the men who led temperate lives; and, I believe, if men are to be in a hot climate, they are better employed in the open air than confined to buildings.

2084. Can you state generally from your experience whether a place is likely to be healthy?—Yes, in the open country of the south of India we can speak pretty confidently as to the healthiness of any position. And our experience leads us to know what are undoubtedly dangerous spots.

2085. So that you would have had some indication as to the points to which it would be right and safe to send troops by way of experiment?—Do you mean on the hills?

2086. Yes; I mean that you could point out certain localities which would probably be healthy?—My own impression is, after long experience, that I could point out many hills on which I should not hesitate to place anybody; but I fully admit that I could not judge with certainty of any spot.

2087. (*Chairman.*) I believe you have had considerable experience in providing shelter for the army in China?—I was with the army there for two years, constantly changing places; but we sheltered them there chiefly in buildings that we found ready built (native buildings), requiring only to be altered to suit the purpose, and the experience was valuable in every way, for nothing could be more unsuccessful

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2088. That was in the first China war?—Yes.

2089. You stated that the early experiments were unsuccessful?—The army was for many months ruinously mismanaged. And there was an epidemic in the country which took a most fatal form with the army in Chusan. The same disease ran through the navy, but the men being well fed and well sheltered, few, if any, died of it; whilst the 26th Cameronians were almost destroyed by it.

2090. That was in a low-lying marshy country, was it not?—Yes; but we ascertained that there was an epidemic in the country generally.

2091. (*Sir R. Martin.*) Was not the force planted in a marsh, while there was a town of comparative salubrity close at hand?—They were not actually in a marsh; but there was low land about the camp, and many of the men were for a length of time in open buildings, in a pillaged town, with the contents of the shops thrown out and rotting in the drains of the streets. The provisions brought from India with the army had become unfit for use, and no steps were taken to procure fresh meat for the soldiers, whilst the navy demanded and obtained fresh provisions from the Chinese inhabitants of the islands, and the epidemic proved in general harmless with the sailors.

2092. (*Chairman.*) Speaking generally with regard to the arrangements adopted for cleansing military stations, and for removing impurities, do you consider that those arrangements are satisfactory?—In the modern barracks great trouble has been taken to make them so; in the old barracks there is comparatively little done, but the hill stations generally have great advantages in that respect, the rapid fall of the land facilitating the drainage from the barracks.

2093. The force of gravity is sufficient, I suppose?—Yes.

2094. Are you acquainted with the station at Bangalore?—Yes.

2095. What is your opinion of that station in a sanitary point of view?—I think it is very good; the Mysore country has undoubtedly fevers all over it; but Bangalore, considering the nature of the country generally, has been a very healthy station, and I think that this last year was the first time that it ever had cholera, or, at all events, severe cholera.

2096. (*Sir R. Martin.*) Have you observed the influence of the red sandstone rock about Seringapatam?—The laterite is not a sandstone; it is perfectly distinct; it has more of the ingredients of granite; iron is also one of the great ingredients. I have not detected any peculiar influence from that. It is very generally distributed.

2097. It has been noted by some gentlemen in the south of India that the laterite formation, wherever it prevailed, has been associated with the prevalence of fever?—It has not certainly, according to my experience.

2098. Probably you are aware that Dr. Haines of Madras wrote upon the hill fevers?—I think he must have written a great many years ago, and before much was known. I do not think the opinion prevails now; he must have written 30 years ago.

2099. The same thing has been observed in the province of Gondwana and at Hong Kong, and on the west coast of Africa?—I should distinguish between the rock at Hong Kong and the rock on the western coast; one is quite unlike the other; they may have the same effect, but they are perfectly unlike in geological formation.

2100. (*Col. Durand.*) What is the nature of the soil at Bangalore?—It is a white granite rock which splits in slabs of any length, and is used for building; the rock is very near the surface.

2101. Do you recollect the nature of the soil at Chusan?—I do not recollect it at this moment; but I remember perfectly well that they had there very much the same sort of granite, as far as its splitting went, at Chusan, that there is in Bangalore; it is

split in cubes in the same sort of way. I think it very important that some further and systematic inquiry should be made as to the causes of fever in India. The districts in which fevers prevail, and the confined spots in which they are fatal, are now in so many cases well known that it is highly probable that a careful investigation and comparison would lead to a detection of the source of the evil, and the cause of the poison being so much more virulent in certain places, and those frequently of very limited area.

2102. (*Dr. Farr.*) Do you mean among Europeans, or among natives?—I mean where the malaria is found. There are many ailments which the natives call fever, but which I think a medical man does not, which are the effect of malaria. They have colds and chills, which do not appear to us to be the effect of malaria, but which they call fever.

2103. You would inquire into the cause of fever among Europeans?—Yes, where it was palpably fever, beyond a doubt. We have what we distinguish by the name of jungle fevers, and those fevers are unmistakably the effect produced by some poison, and people have been known to die of them in a few hours. I have known a man die in nine hours from the time he was attacked.

2104. (*Sir R. Martin.*) There are also, I believe, very fatal hill fevers in the south of India?—Yes; I speak of the south of India.

2105. But peculiar to the lower ranges of hills?—Fatal fevers are found at all levels from the level of sea to the height of 4,000 feet, and they have occasionally appeared higher still in the Neilgherries, but when this has been the case the place affected has been at the head of a ravine leading from a fever jungle.

2106. (*Chairman.*) Can you lay down any general rule as to where a hill station should or should not be placed?—I should say only in open valleys if possible, where there should be a free circulation of the air about them.

2107. There should be no jungle immediately near to the station?—Certainly not very near it. We have now come, I think, to the conclusion that there are just as bad fevers where there are no jungles; but still I think, for the sake of ventilation, it is better not to have stations in crowded places.

2108. (*Dr. Farr.*) You would desire to secure a free circulation of air, and a good supply of water, I presume?—Yes, undoubtedly; an abundant supply of water ensures your having the place clean; as drainage is effected by that only.

2109. (*Col. Durand.*) With regard to the frequency of cholera among the troops marching in the Madras presidency, have you at all turned your attention to that?—Yes, but with little or no good; for it comes at times when you least expect it.

2110. You have not connected it with particular sites?—No. There are lines of road along which troops have marched frequently, and on a single occasion a regiment will have attacks of cholera along that line, where perhaps for years they never had it before; and I might refer to the extraordinary instance that occurred at Kurrachee; there was a case in which there was a visitation of the most fatal cholera ever known; it came in one moment, and it was three days in existence there only; but it nearly destroyed the whole population. I have witnessed the effects of fatigue among my own followers, and in one case, when I was young, I was moving along a very fatal jungle, examining the line of a river, and I went as fast as I could, in order to save my people, but I lost the greater part of those who went with me, and I was afterwards cautioned that over fatigue aggravated the evil I tried to avoid.

2111. (*Dr. Gibson.*) Are the jungles all alike with respect to marsh?—No, some are perfectly dry; and there are jungles of vast extent on the slopes of the mountains without any marshy ground in them, and they are feverish nevertheless.

2112. (*Chairman.*) Is it the custom to move troops much from station to station, apart from military or

political reasons?—No, I do not think it is with respect to European troops.

2113. (*Col. Durand.*) In fact, European regiments on the Madras side are usually given a very long spell?—Yes, I think they are; I think that the only object is to move them when they have been at a bad station, to give them a better chance by moving them to a good one.

2114. (*Chairman.*) Do you consider that the troops suffered much upon the march?—The march was always a danger. When they moved some escaped and some suffered; but it was always a danger, and troops moving were never sure that they would not meet with cholera. They certainly suffered more on the march than in a station.

2115. (*Col. Durand.*) Have you ever heard any satisfactory reasons assigned for the cause of the outbreak of cholera on those occasions?—Nothing that ever satisfied me, I was more puzzled every year. The case at Bangalore, since I have left the country, is a very curious one. There was a very severe attack of cholera at Bangalore last year, and it had hardly been known there before.

I would venture, with the permission of the Committee, to suggest what I have on a previous occasion proposed to the India Office. It is, that the secret and right of manufacturing "Warburg's fever drops" should be obtained by purchase. I and others engaged in opening the passes through the fatal jungles of the western coast of India have found that medicine invaluable. In the Perambaddy pass especially, a trial of it was made on a very extensive scale, and with admirable results. When its efficacy became known, the coolies employed would work in the most dangerous parts of the forest, if they were assured that the medicine was at hand. After a long experience of its efficacy, I have no hesitation in saying, that it is a most valuable medicine, and ought to be in every hospital and camp in India.

2116. (*Dr. Farr.*) Does it contain arsenic?—No, I believe not.

2117. (*Dr. Gibson.*) Is the effect of it immediate?—It affects so immediately those fevers on the west coast, that I have had a man who was barely able to swallow it cured in a few hours by it. I don't mean to say that it restored the lost strength of the patient at once, but it entirely cured the disease. The effect of it is to produce violent perspiration almost in all cases. It is a very expensive medicine, costing something like 10s. or 12s. a bottle, which contains a single dose; here it costs, I think, about 4s. The secret might be purchased, and I think it ought to be so. The practice was to give half of the bottle as a dose, and three hours afterwards to give the other half; and usually a short time after it had been administered, say, half-an-hour, the patient was thrown into a violent perspiration, and it produced no after ill effects in any of the cases that I ever saw.

2118. Was a second bottle often given?—No, I never had to use it.

2119. (*Sir R. Martin.*) Did you use it as a preventive to fever?—No, it was used only in extreme cases, when the fever was very severe.

2120. (*Dr. Gibson.*) Did the fever occur again at the usual period?—No; and I could refer to some very

striking cases of its good effects. Many cases of China fever of long standing, which all who caught suffered from for years afterwards, were completely cured by a single bottle of this medicine.

2121. Were those persons who had used quinine largely?—Yes. I may mention one case of many that I have seen in which Warburg's drops cured at once, when quinine had been long tried without effect. Colonel Pears, of my own regiment (the Engineers), when on the Neilgherries under treatment for China fever, had a return of it after taking a large dose of quinine. Dr. Sanderson then tried Warburg, and the fever was at once cured; after which, he used it whenever he could procure it, and I know that he has the highest opinion of the medicine.

2122. Had he been taking quinine for some time?—Yes, for a length of time.

2123. Did you often witness the same result?—Constantly; in cases where quantities of quinine had been used. There was another case of an overseer who had been in the Godavery jungle, and had been left there a little too late in the season; he came down with a tremendous fever upon him, and I recommended the doctor to use this medicine, but he said, "We have analysed it; we know what it is; the 'Lancet' has given some account of it; and we are giving him now the very same ingredients." The fever, however, went on, and at last the doctor came to me, and said, "Poor Bevan is very ill, and I am afraid we shall lose him." We then gave him Warburg's medicine, and it entirely stopped the fever.

2124. (*Dr. Farr.*) Are the hill stations supplied with garden stuff for the troops, so that they could obtain an adequate supply of fruit and vegetables?—On the Neilgherries fruit is not now obtained in abundance; and the climate in some parts is not found favourable for English fruits. There is one wet and one cold season in the year, in consequence of which there is no time for fruit to ripen in the highest station of Ootacamund; but at Jackatalla, they have a very good season for fruit; and I suppose that when the trees are grown they will have it in abundance.

2125. Do they get potatoes there?—Yes.

2126. Do you think that there would be any difficulty in supplying the troops with potatoes?—Not the slightest; it is the finest climate in the world for all common kitchen garden stuff.

2127. It is reported that at some stations in the hills the troops become scorbutic?—There is no occasion for that, on account of the want of vegetable food, as they might be supplied with any quantity they want. In the Neilgherries, at Jackatalla, I fancy they must have an abundance, for they have acres upon acres of ground—many hundreds—under potato cultivation.

2128. Do you think that the troops, in all cases, get a sufficient supply of vegetables?—I see no reason why they should not; at Jackatalla they certainly would do so, for there is an abundance to be had at a moderate price.

2129. You think that arrangements might be made to supply the troops with fruit and vegetables at all the large hill stations?—Quite so.

The witness withdrew.

THOMAS LONGMORE, Esq., Deputy Inspector-General of Hospitals, Professor of Military Surgery at the Army Medical School, Chatham, examined.

T. Longmore, Esq.

2130. (*Chairman.*) You have been, I believe, sanitary officer in Bengal?—Yes; at Calcutta for a short time.

2131. How long have you been engaged in that capacity?—I was three months engaged as head of the sanitary department in the Inspector-General's office at Calcutta.

2132. How long have you served in India altogether?—A little under two years.

2133. In what part of India have you served?—In Lower Bengal.

2134. Have you served with European or native troops?—With European troops.

2135. At what stations?—At Calcutta, Barrackpore, and Dinapore. I was also for a short time at Dumdum.

2136. The three stations which you have named are situated on very low ground, are they not?—Yes, they are.

2137. In point of fact, there is in that part of the country no elevation where they could be placed?—No; not in the neighbourhood of either of those stations.

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2138. Have you any remarks to make as to the sanitary condition of those three stations?—In regard to Calcutta, as the general sanitary condition of that city is, I think, well known, I would refer merely to the reports and correspondence which I sent in, among other matters, on the sanitary condition of Fort William, during the outbreak of fever which occurred in the early part of 1859.

2139. (*Dr. Farr.*) Have they been published?—No. They were reports to the head of my own department, as sanitary officer of Bengal, to which I refer, and were connected with an outbreak of fever which occurred more particularly in the barrack, known as the “Royal Barrack,” in Fort William.

2140. (*Chairman.*) Is Fort William on the whole an unhealthy station?—Certainly it is.

2141. Is that in consequence of its being placed within a fortification, so that a free current of air is obstructed?—Partly on that account, and partly from its situation in connexion with circumstances to which the whole of Calcutta is equally exposed.

2142. That is from being on low ground in the neighbourhood of the river?—Yes, and from that part of the river near the Fort being very densely crowded with shipping; and also from the effects of imperfect drainage, in consequence of the flatness of Calcutta, and the habits of the natives in the bazaars, which, in one direction, are at a comparatively small distance from the fort, and many other circumstances.

2143. Assuming that it would be always necessary to maintain a garrison in Fort William, do you think that much could be done to remedy the causes of disease which you have mentioned?—Improvements were made in the royal barracks, which were the worst constructed barracks in the Fort, while I was there, and other improvements were in progress at the time I was leaving. The sanitary regulations and the conservancy arrangements in the fort, I think, are as thoroughly attended to as they can be, and I do not think that much more could be done to improve the sanitary condition of Fort William, keeping the military necessities of such a fortress in view, beyond what was being done at the time I left Calcutta.

2144. There is no overcrowding, is there?—There was not when I was there.

2145. There are two causes which obviously cannot be prevented if the station is to be retained—that is, the being enclosed within the walls of a fortification, and the lowness of the site?—Yes, those are the two principal defects of a sanitary nature.

2146. Did you not state that the neighbourhood was crowded by low native houses?—At a short distance it is so, in the Colinga, Durumtollah, and Bow Bazaar neighbourhoods, for example. The influence in certain winds of these places is quite perceptible at Fort William, although there is a very good esplanade between the fort and those bazaars.

2147. Is there not considerable space of open ground surrounding the fort?—Yes it may be called a considerable space; but on ascending to a height, Ouchterlony’s monument, for example, a person at once perceives how trifling this space is when compared with the vast densely-covered area by which it is immediately surrounded. And as regards the chief part of this extensive city,—that inhabited by the native population,—the pestilential condition of the surface drains, and yards, and many of the tanks among the huts and houses, would not be credited by any one who had not been among them. There is no doubt there would be much more mortality among the troops were they not to some extent separated from these influences by the open space surrounding the fort.

2148. (*Sir R. Martin.*) Meaning the glacis of Fort William?—Yes; and beyond the glacis of Fort William there is also an extensive racecourse, more particularly in the direction towards Allipore; between the fort and the bazaars in the opposite direction the esplanade is little more than the glacis of the fort itself.

2149. (*Chairman.*) It is your opinion that whatever may be done, Fort William will always remain comparatively unhealthy?—Decidedly so; it will be unhealthy for troops.

2150. When you were there, what number of troops were maintained there?—One regiment, and two companies of another regiment.

2151. Now what remarks have you to make as to Barrackpore?—That, although only 16 miles from Calcutta, I consider it a very superior place, in a sanitary point of view, to Calcutta; although, generally speaking, the local features are much the same as to level and general geographical condition. From various circumstances, more especially that in addition to the large open parade ground, there is the Governor-General’s park, which occupies a very extensive area, being four miles in circumference, and kept in most admirable order, the atmosphere is purer; and, again, the river is a mile in width at Barrackpore, and is quite free from shipping, and with a good current. Then, the drainage at Barrackpore, although not so good as it might be, is still much better than it is at Calcutta, and, of course, being a military station, the general conservancy is more under control; and the native bazaar, which is near the station, is always kept in good order from being under military supervision.

2152. You speak of the absence of shipping in the river as being the cause of comparative good health; in what respect is the shipping injurious to a station?—In the neighbourhood of Fort William the shipping is very densely packed, often in several lines deep, and in many ways the shipping is a source of great mischief, not merely as an obstruction to the atmosphere, but also from the amount of filth that is accumulated in and about them. It constantly happens that the corpses of the Hindoos get entangled among the vessels, and in several instances it has been almost traced that in particular ships little outbreaks of cholera have taken place from the effluvia arising from bodies which have become entangled in the anchorage of the ships. As it appears to be chiefly from poverty that the *bodies* of Hindoos are thrown into the river, instead of the *ashes* which would result from full cremation, and which would be comparatively inert, it always appeared to me that it would be a wise economy if the Government were to supply the fuel necessary for this purpose to the burning Ghauts. The Sunderbunds contain an endless supply of wood fit for the object at no great distance off. In addition to the occasional entanglement of corpses, a great deal of filth of various kinds becomes accumulated about the ships and the muddy banks alongside, most particularly where the shipping is densely crowded, as it is about Calcutta. At Barrackpore, of course, that evil is entirely absent.

2153. (*Col. Durand.*) Are there not very rapid tides, and do you not think that all these things are swept away?—There are rapid tides at certain seasons, but even then these evils exist in some degree.

2154. (*Sir P. Cautley.*) Are they not in the habit of throwing human ordure into the Hoogly just above or opposite to Calcutta?—No, it is chiefly below Calcutta; that is, below the part where the troops are quartered in Fort William, except the drainage from Fort William itself, which falls into the river Hoogly a little below the fort, and that is one source of difficulty; the little fall that there is, and the high rise of the tide at certain seasons, and the low state of the river at others, are a source of difficulty, and have always been a great source of difficulty in Fort William.

2155. The tide, I suppose, throws back the fœces on to the shore?—Yes, it does to a great extent; but there were some important works going on when I left Calcutta, with the object of forcing out the sewage of the fort at certain states of the tide.

2156. (*Col. Durand.*) Was there any plan adopted of systematically flushing the drains?—A plan had been settled upon, and the works for it were in course of construction. It was preparatory to the construc-

tion of those works that, in clearing out a portion of the ditch into which the drainage of the fort was chiefly carried, an enormous accumulation was found to have occurred at the bottom, and upon exposing this, with a view to its removal, the fever occurred to which I alluded just now, being apparently attributable to the emanations from this accumulated matter.

2157. (*Sir R. Martin.*) In a site so level as that of Fort William there can be no other mode of clearing the drains except by a systematic plan of flushing them?—No satisfactory mode.

2158. (*Dr. Farr.*) Are the barracks in Fort William raised from the ground?—All the barracks, both the old and the new, are raised upon arched basements. I will forward a description of them obtained from the garrison engineer in 1858.

2159. The men do not sleep near the ground, do they?—No, not under ordinary circumstances; they may occasionally become crowded, and then they do so in the old barracks. My own regiment when we first went to Calcutta, in consequence of circumstances connected with the mutiny, was obliged to occupy the arched passages on the ground. These were not intended for occupation or for the purposes of sleeping apartments, but no other place was available.

2160. By raising the barracks you get rid, do you not, of part of the difficulty which arises from troops being within the walls of a fortification?—To a certain extent we do, but the height of the walls of Fort William will still impede very considerably the free circulation of the air to the lower rooms of the barracks, even to the lower stories of the new barracks.

2161. But the higher the barracks are within the forts, the more healthy will be the character of the atmosphere, will it not, for the men?—Certainly.

2162. Do you know what the mortality in your own regiment was during the time you were stationed there?—I cannot call to mind at this moment, but we had no large mortality while I was at Calcutta, no outbreak of disease there.

2163. What kind of water do the men obtain in the fort?—In Fort William the water is ordered to be obtained from a tank outside the fort, which is generally known as the Havildar's tank. The well water within the fort is very objectionable, and there are positive orders that none of it shall be used for drinking purposes; but although the water is ordered to be brought from the Havildar's tank, it requires a good deal of watching of the bheesties to see that they do bring it from that tank, as it is some distance off. It was proposed by the resident engineer to have a small engine within the fort, and to force the water into a tank where it might settle, and no doubt that would be a very great advantage, but I believe that the expense prevented the adoption of the plan.

2164. Do the men drink a good deal of water in India; do they take their spirit in water, or do they take the spirit pure?—A great deal of water is drunk by the men. They get no ration of spirit; the spirit which they obtain by purchase at the canteens they can take as they please. While I was marching up to Dinapore it was an object with me to try to get the rum watered, the same as we do on board ship; I spoke to the colonel about it, and he agreed with me in the advantage that it would be; but on examining the regulations we found that it was not legal, that we could not insist upon the men having it watered, that it was a purchase of their own, and that they were merely limited as to quantity, and had a right to take it as they liked, and therefore we did not water it.

2165. Practically it is of great importance, is it not, that the water supplied to the troops in Fort William should be pure?—Undoubtedly.

2166. At the present moment do you think that the arrangements are such as to secure to the soldiers a supply of pure water?—I think so, with a proper watching of the bheesties; we did occasionally find that they got the water from one or two reservoirs which there are in the ditch, and which were objected to because the drainage of the fort, no

doubt, to a certain extent found its way into them; but the rule is that the water shall be taken from the tank outside, which I have mentioned, and I believe it has been generally taken from that tank, and that that water is as pure as any water that can be got in that neighbourhood.

2167. (*Col. Durand.*) Is there not a guard always over that tank?—Yes, there is over the Havildar's tank.

2168. (*Dr. Farr.*) From what source is that tank supplied with water?—It is supplied by rain water, but in all the tanks of Calcutta there is a certain amount of water which percolates from the river into the tanks.

2169. The river being very impure at that point from various causes, dead bodies and so on?—Yes.

2170. In London you are aware that it was discovered that the great cause of the mortality from cholera was from drinking the impure water of the Thames; that the inhabitants of those parts which were not supplied with that water suffered very little from the cholera, while amongst those who were supplied with water by companies drawing their supply from polluted parts of the Thames, there was a very high rate of mortality?—To obtain a supply of pure water for the neighbourhood of Calcutta is a very great difficulty. It has been proposed to bring water from above. I believe it is contemplated, and that there is an attempt now being made to establish a company for the purpose of bringing purer water to Calcutta, but the accomplishment of this object is one of the great difficulties they have to contend with there.

2171. (*Col. Durand.*) Is the water supplied to the troops in the fort for the purposes of cleanliness, well managed?—It might be improved. The water is simply brought by bheesties, who fill the chatties or vessels, and to obtain a larger quantity less laboriously was one of the objects for which the steam engine was proposed. Its purpose was to pump up the water so as always to have a good supply, and this would have been advantageous in many ways, in cases of fire, but more particularly that there might be a bath for the troops. There was no bath in Fort William in my time, and the establishment of one would have been a great benefit to the troops.

2172. (*Lord Herbert.*) Were you at Calcutta at the time of the outbreak of cholera at Dumdum?—I was stationed at Barrackpore when so much sickness occurred in the general dépôt at Dumdum in 1858; and I was on the commission of inquiry which was ordered to assemble in consequence.

2173. Can you speak as to the rate of mortality which took place there?—Yes; I put into my pocket the memorandum book which I kept at that time, so that I can mention it exactly. Our inquiry went over five months, and during a period of five months the rate of mortality among the children was at the rate of above 50 per cent. per annum, and among the women above 27 per cent. per annum.

2174. (*Dr. Farr.*) And that was in five months?—Yes; there were in five months 64 deaths out of an average monthly strength of 554, and two-fifths, of women; and there were 166 deaths out of an average monthly strength of 770 children, or in other words an average annual per-centage among the women of 27·60, and among the children of 51·60.

2175. That was the annual rate of mortality?—Yes; the average annual per-centage at that time. The average for all Bengal, according to most authentic documents, was at the same time, of women 4·45; and of children 8·41.

2176. That was the mortality per annum?—Yes, the rate per annum during five months.

2177. (*Lord Herbert.*) What were the diseases that prevailed which caused that mortality?—Dysentery, fever, and cholera.

2178. In the inquiry in which you were engaged, could you trace the visitation to any particular causes?—I think we traced it very distinctly to a series of causes, such as overcrowding among others,

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and I think I may say a neglect of all sanitary arrangements.

2179. It was, I suppose, an entirely exceptional case, from a large influx of troops coming in during the mutiny, and women and children all being crowded together?—Yes; they were detained there on their arrival from England and elsewhere, their husbands being sent up country.

2180. You have referred to overcrowding, do you recollect the proportion of people to space?—I cannot state without referring to the report. I will furnish a copy of the report itself.

2181. (*Chairman.*) With regard to the third station which you have mentioned, Dinapore, can you give the committee any description of that station in reference to its sanitary conditions. I believe it is upon low ground?—Yes. My regiment, when it was quartered there, occupied some new barracks, which were known as the Temporary barracks, and which were very superior to the old barracks of the station. Dinapore has always been found to be a very unhealthy station, and this has been chiefly owing to the construction and the arrangement of the barracks, and their immediate neighbourhood to a populous native bazaar. To some extent it has also arisen from the effect of the overflowing of the Soane river, and a large nullah which goes round the station of Dinapore. This nullah, during the rainy season, is full from the river Soane, passing along it into the Ganges, but at other seasons it is left low, and at a little distance from the barracks becomes the receptacle of all kinds of filth. This does not occur in the immediate neighbourhood of the cantonment, because there it is looked after, but at a short distance it is a place of deposit for every kind of filth, and under the influence of certain winds I feel certain produces bad effects upon the inmates of the barracks. The barracks have been reported for many years to be as badly constructed, and to be as badly placed with regard to the arrangement of them in squares, as any barracks can be. Moreover they are very little raised above the ground, and in the morning, or after sunset in the evening, you may see, if there is not much air stirring, a dense vapour just resting on the surface of the ground within the several squares, while above this vapour, or a little below it, the air apparently is quite free from anything of the sort.

2182. You are of opinion that the vapour carries with it malaria?—Undoubtedly, and in many other ways it is also very injurious in a tropical climate.

2183. Do you think that much of the disease which has taken place there might have been avoided by merely raising the building to a greater height?—Yes, I do, by raising them upon arches, so that there might be a free circulation of air beneath the inhabited story; and by not having them constructed in the form of squares.

2184. (*Lord Herbert.*) You mean not in quadrangles?—Yes.

2185. (*Chairman.*) And by placing them so that the air could pass freely through them?—Yes. The station of Dinapore is raised a good deal above the level of the Ganges, excepting when the river is very high; and if the ranges of barracks had only been left open towards the river, I think a very great advantage would have necessarily accrued to the station.

2186. There is no raised ground anywhere, I believe, within a considerable distance of Dinapore?—There is no hill ground of any elevation. The new barracks which have been built there are according to the recent plan for temporary barracks, each containing a company. I think that they are badly arranged, for they are arranged in parallel lines, so that one shuts off the wind from the other. I may mention, as an illustration of the advantage of the recent sanitary arrangements of the Queen's medical service in India, that I was told on leaving Calcutta to go to Barrackpore, that, as senior officer to the Queen's troops at that station, I was also to consider

myself the sanitary officer; and one of the first things that I observed was, that new barracks were about to be built, all in parallel lines, and in the direction of the prevailing winds; so that it was evident one would keep the wind off from the other. The trenches merely for the foundations were laid, excepting two of which the walls were partly built. I called upon the senior surgeon of the Indian service, a regimental surgeon, and I asked him whether he did not consider such a position of these buildings objectionable, and he said, "Certainly, I do consider it very objectionable, and I have represented it in a written official communication; but the answer that I got from the brigadier was, that they are only temporary barracks, and no medical committee would therefore be required to sit upon them." I then considered it to be my duty, as these barracks were likely to be occupied by Queen's troops, to write to the Inspector-General on the subject in the regular sanitary report, which I was ordered to keep, to give him notice of the way in which these temporary barracks were about to be constructed; and the Inspector-General, I suppose, brought the matter to the notice of the authorities, for a committee was ordered, of which he was himself appointed president, and this committee came down and inspected them. In consequence the whole plan of the barracks was altered; the arrangement was altered with the exception of one, or, I rather think, of two that had been partly raised, and the buildings were placed *en echelon*; and every one admitted the change was very advantageous. If it had not been for this incident the barracks at Barrackpore would have been all constructed as they are constructed at Dinapore, in parallel lines, one shutting off the air from the next, and more or less enclosing spaces, an arrangement which I think is always objectionable.

2187. (*Lord Herbert.*) So that there was perfect readiness on the part of the authorities to listen to the recommendation, and to act upon it?—I think so.

2188. (*Sir P. Cautley.*) But they were going to erect the buildings without a medical committee?—Yes, they were in process of construction at that time, without any medical committee having given an opinion upon the subject.

2189. (*Lord Herbert.*) What is the difference of construction between barracks of a temporary kind and those of a permanent character?—The temporary barracks are built of two kinds of bricks; the portions on which the weight of the roof rest are built of kiln-burnt bricks, but the main portion of the walls is built of sun-burnt bricks, as they commonly call them "kachchà" bricks. Then again the floor of a temporary barrack is very little raised from the ground, and it is not hollow underneath; there is no space between the brick floors on which the men and the bedsteads rest and the surface of the ground.

2190. For what length of time were they to be used?—I think they are calculated to last, to the best of my recollection, about four or five years.

2191. Not for more than four or five years?—No. I think that that is what the engineer told me as to those temporary barracks; but I think it not unlikely they may be occupied for the next 20 years.

2192. (*Sir P. Cautley.*) The roof would last, I suppose, for only four or five years, but the walls for ever?—There is a very small proportion of kiln-burnt bricks in their construction.

2193. (*Lord Herbert.*) The rule with regard to the precautions to be taken by having a medical committee appointed for permanent barracks is not applied to these temporary ones?—The rule was not applied in the case of the temporary barracks at Dinapore; nor was it in the instance of those at Barrackpore, until I called the attention of the Inspector-General to the matter.

2194. (*Dr. Farr.*) In what year was that?—In 1858.

2195. (*Chairman.*) Are there any large number of these temporary barracks in Bengal?—I believe there are.

2196. They are constructed, are they not, without any reference to medical authority?—I cannot speak of all, but of only the stations where I have been.

2197. (*Dr. Gibson.*) Will they become permanent?—I think the term “permanent” is likely to be as correctly applicable to them as that of “temporary,” if troops continue to be quartered in the stations where they have been placed. The roof is thatched and covered with tile, and this will, no doubt, require renewal at certain intervals.

2198. (*Sir R. Martin.*) It has happened that such barracks have fallen down, and that many men have been destroyed by them?—Yes, in the Bombay presidency; but I believe these in Bengal are better constructed than they were.

2199. (*Dr. Farr.*) How many barracks are there in Dinapore?—There are the old barracks which were calculated for the accommodation of a regiment, and for a battery of artillery in addition, and there are now the new temporary barracks to accommodate another regiment.

2200. Did the company's troops and the Queen's troops occupy the same barracks?—While I was there, the old barracks were occupied by a regiment of the Queen's, and a battery of artillery of the Indian service.

2201. And how were the new barracks occupied?—They were wholly occupied by my own regiment.

2202. I observe in a return which lies before me that the mortality in the Queen's troops at Dinapore was 78 in 1,000, and in the Company's troops 34 in 1,000; do you know of any circumstances to account for that difference in the mortality in the two services?—No, I do not. I think that that average must have been taken before the new temporary barracks were constructed.

2203. But the station is a bad one, is it not?—Yes, under any circumstances.

2204. Would it not be improved if the barracks were raised from the ground and properly constructed?—Yes, it would be greatly improved, I think.

2205. Are you of opinion that that very enormous rate of mortality may be ascribed to a defective arrangement of the barracks?—A very great proportion of it. I have been told by resident civilians there that the health of persons in the neighbourhood of the station was very fair, and that they themselves enjoyed good health. We know that in Tirhoot, just on the opposite side of the river, the indigo planters enjoy very good health generally.

2206. The fall of the ground is from the river, is it not, at Dinapore; or is the drainage into the river, or from it?—Into the river.

2207. Could you suggest any improvements which you think would reduce the mortality at that station considerably below the figures I have named, it being ten times as great as in England?—I should think that the mortality might be very greatly diminished if the first principles of hygiene could be enforced in the vicinity of the station, and if the troops were properly housed, and healthy exercise and recreation encouraged, with proper protection from the sun during the hot months. I do not think that under any circumstances the old barracks ought to be occupied, as they are not fit to be occupied.

2208. (*Col Durand.*) Were they not for a long time left unoccupied?—I think they were prior to the mutiny.

2209. (*Dr. Gibson.*) When you became sanitary officer, did you find the sanitary arrangements satisfactory?—I think the arrangements that were carried out in obedience to instructions, I believe, from the late Director-General, Dr. Andrew Smith, were leading to very great good in India. By his order every medical officer was required to visit some part of his barrack station, or its vicinity, daily, and to keep a sanitary diary which was forwarded weekly to the Inspector-General's office in Calcutta; at the same time copies of all correspondence were called for, and the medical officer was required to state what sug-

gestions he had made, what was the result of those suggestions, and in case of meeting with local difficulties, they were reported to the office in Calcutta; it was my duty while sanitary officer in Calcutta, independently of being the local sanitary officer for Calcutta, to receive all those weekly reports from the north-west provinces, from Oude, and from Bengal, and to carry on the correspondence connected with them. Since that time I fancy the office of sanitary officer in the Inspector-General's office has ceased: there have, in fact, not been officers to carry it out, for it was impossible for the only administrative officer, the deputy inspector in Calcutta, to do this work in addition to his regular duties. But I think that it was leading to an immense amount of good, because it called attention at once to any circumstance that was calculated to be prejudicial to the health of the troops in a station. I observed many instances of advantage arising from this early notice of probable sources of sickness during the short time that I was acting as sanitary officer.

2210. (*Chairman.*) From whom did you receive the reports?—From whoever was the senior Queen's medical officer in the station, whether assistant surgeon or surgeon, he became the sanitary officer, being the senior of the station so far as the Queen's troops were concerned. I was told by officers of long standing in the Indian service that their system of sanitary reports was a failure; that they were only made yearly, when either the mischief was over, or the thing had been remedied. I know it was considered that our practice of keeping a daily diary and making a weekly report was very advantageous, and I know that in many instances during the short time that I acted as sanitary officer it led to a very great deal of good.

2211. (*Dr. Gibson.*) Were there many complaints made of defects in the arrangements?—Yes; but they were constantly being repaired, so far as the means of remedying them were available. Occasional difficulties arose, and led to correspondence and to misapprehension, and sometimes difficulties arose from medical officers going the wrong way to work about things, but as far as possible they were soon put to rights, and so I think mischief was prevented, and good done.

2212. (*Col. Durand.*) Is it not the duty of every medical officer of a regiment to bring to the notice of the commanding officer anything which he observes, and which he believes to be detrimental?—Yes, certainly it is, and it is now distinctly laid down and defined in the medical regulations; but before, if he were to go beyond his own immediate neighbourhood and his own barracks, or his own officer's quarters, to anywhere else around, he might be considered as laying himself open to the objection that he was interfering beyond his limits. But now, by virtue of these instructions, to which I have referred, a medical officer, if he sees a source of disease a mile off, or at any distance, is directed to call the attention of the commanding officer, not merely of his own regiment, but of the station, to it, if there be no senior medical officer there. He is directed also to make the head of his own department acquainted with whatever he does in this way.

2213. (*Dr. Gibson.*) And in this way matters are brought under the notice of the higher military authorities, which the regimental authorities are not able to deal with?—Certainly; and at the same time, if the returns in the Medical branch of the Inspector-General's office were showing that there was an increase of disease in any station, such as had not been before noticed, immediate inquiries would be made through the sanitary branch, to trace, if possible, the disease to its source, and to ascertain how it could be remedied.

2214. Why was that arrangement discontinued?—When I was removed, there were not the means in existence for carrying it out; there was not any sanitary officer; and with the work that the only remaining deputy inspector had then to do with boards of

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survey and invaliding boards, and all the medical duties of supervision and current business of that circle, it was impossible to carry it out.

2215. Do you mean from a reduction of the establishment?—Yes; the sanitary duties and correspondence occupied me the whole day, with the exception of the time spent in attending at various boards; and when I was sent from India on reduction, there was no Queen's officer available for this occupation.

2216. (*Dr. Sutherland.*) You are of course acquainted with the new medical regulations and the instructions given to medical officers as to sanitary matters in barracks and stations when in the field or in camps; will you be good enough to state whether you consider those regulations are equally applicable to the Indian service, or whether there are any respects in which you think they might be improved?—To the best of my judgment, I believe them to be equally applicable to India.

2217. You are acquainted with the means which are resorted to in barracks and hospitals of removing the excreta once or twice a day: did you ever observe any ill effects to health, either in barracks or hospitals, from the system in use for collecting and removing the excreta?—The only time that I remember having had to make a complaint about them was at Barrackpore, where the men were getting into the habit of removing them too late in the day, not sufficiently early before the sun was up, and there I had to make two or three times complaints that the work was not done according to the system prescribed.

2218. The usual way with the latrines is to connect them, in barracks or hospitals, by means of long covered passages; did you ever come in contact with the effluvia from them in barracks or hospitals?—Not in any hospital with which I was personally connected; but that was one source, no doubt, of a great deal of the mischief which occurred at Dumdum in 1858. The latrines were not, however, connected with the barracks by covered passages at the time I was there.

2219. In that special case, a large number of women

The witness withdrew.

ADDENDA.

No. 1.

EXTRACTS from the Report of a Committee of Inquiry, assembled by order of Major-General Sir J. Hearsey, K.C.B., commanding the Presidency Division, to report upon the Excessive Mortality among the Women and Children in the General Dépôt at Dumdum.

Barrackpore, 24th September 1858.

President :

G. G. BROWN, M.D., Superintending Surgeon.

Members :

Surgeon THOMAS LONGMORE, H.M. 19th Regiment.

Surgeon HUGH MACPHERSON, Bengal Army.

I. The Committee assembled on the 6th September 1858 at Dumdum, and, after examining several witnesses, adjourned until the 10th September, when the evidence of other witnesses was continued. An investigation of certain returns of deaths in the dépôt, furnished by the military and medical officers, was instituted, but considerable discrepancy was found to exist in the information these documents afforded. The Committee assembled at Barrackpore on two occasions, with a view to reconciling these conflicting returns, but, being unable to do so, found it necessary to call for additional documents. The return on which the Committee have finally placed their chief reliance in framing this report is the return furnished by Major Hawkes, commandant of the dépôt, received on the 17th September, on which date the Committee again met at Dumdum. The Committee were anxious to obtain the evidence of the Roman Catholic chaplain respecting the deaths among his flock, as they had done from the Protestant chaplain, but

and children, I believe, were labouring under dysentery, and they had to walk from the married quarters to those latrines; did the effluvia from the matter in those latrines reach the married quarters?—They did, and at the time of our visit they were exceedingly offensive; the whole arrangements connected with the latrines were very bad, quite unsuited for women and children. Then the urine was found to have been constantly thrown out into the open drains, and on the ground all round the barracks, creating additional effluvia. Such matters are of vital importance in a tropical climate, where decomposition progresses with the most wonderful rapidity, and disease itself is so prolific; but they are not generally considered to be of so urgent a nature, excepting by persons whose attention has been specially attracted to the subject. I could mention many instances in proof of these statements. The Committee which enquired into the causes of the mortality at Dum-dum, of which I was a member, called attention to the poisonous effects of the effluvia from decomposing excreta upon the inmates of the barracks there. The plan of daily removing the excreta is the best plan, I think, as far as my experience goes, that can be adopted in such a locality as Lower Bengal. I also saw that system adopted in the West Indies with great advantage. It should be done with sufficient frequency.

2220. (*Dr. Farr.*) Did you use disinfectants at all in the latrines?—We used lime; that was ordered to be used; but I cannot say that I ever placed much confidence in it. Immediate removal before any decomposition occurs, and perfect cleanliness, I conceive to be the most important.

2221. (*Chairman.*) Where labour is cheap, you think probably that that is a better arrangement than any system of removal, such as is provided in England?—Yes; in fact you have not the means of carrying any system out, such as we have in England, in Lower Bengal.

2222. Is there any other remark or suggestion that it occurs to you to make in addition to the evidence you have already given?—No.

the reverend gentleman declined to appear before them.* The Committee cannot help remarking that no register of burials has been kept by this gentleman, so that, in respect to the mortality at the dépôt, the Committee have been thus deprived of one source of comparing the tables obtained elsewhere.

In addition to the returns of deaths which have occurred in the general dépôt at Dumdum, the Committee also obtained a return of the deaths which have occurred among the women and children of the Bengal Artillery in the same barracks, with the women and children of the general dépôt.

II. From these various returns the Committee consider the following to be as near an approximation to correctness as it is in their power to obtain, respecting the strength and deaths among the women and children of the general dépôt during the five months ending August 1858:—

DATE.	Women.		Children.	
	Strength.	Deaths.	Strength.	Deaths.
1858.				
April - - -	457	8	699	38
May - - -	521	11	771	16
June - - -	527	8	753	23
July - - -	627	12	823	53
August - - -	640	25	807	36
Total - -	2,772	64	3,853	166

* Copies of correspondence on this subject, and of all the evidence collected by the Committee, accompanied the original report.

During the same period the strength and number of deaths among the women and children of the Bengal Artillery have been as follows:—

DATE.	Women.		Children.	
	Strength.	Deaths.	Strength.	Deaths.
1858.				
April - - -	67	1	104	0
May - - -	65	1	102	1
June - - -	69	0	100	1
July - - -	69	0	102	2
August - - -	67	0	88	5
Total - -	337	2	496	9

The first of these tables shows that in five months 64 deaths occurred out of an average monthly strength of $554\frac{2}{3}$ women, and 166 deaths out of an average monthly strength of $770\frac{2}{3}$ children; or, in other words, the average monthly per-centage of deaths for the five months referred to in the general depôt at Dumdum was—

Women -	-	$2\frac{3}{10}$
Children -	-	$4\frac{3}{10}$

which would give an average annual per-centage as follows:—

Women -	-	$27\frac{6}{10}$
Children -	-	$51\frac{6}{10}$

The second of these tables shows the average monthly per-centage of deaths for the five months among the women and children of the Bengal Artillery to have been—

Women -	-	$0\frac{59}{100}$
Children -	-	$1\frac{87}{100}$

which would give an average annual per-centage as follows:—

Women -	-	$7\frac{8}{100}$
Children -	-	$22\frac{44}{100}$

According to recent official tables, the average annual per-centage of deaths to strength for the whole Bengal presidency is as follows:—

Women -	-	$4\frac{45}{100}$
Children -	-	$8\frac{41}{100}$

The recent excessive mortality among the women and children at Dumdum is thus at once rendered apparent; but, at the same time, a great disproportion is shown to exist in respect to this excess, between the mortality in the women and children of the general depôt and those of the Bengal Artillery.

In respect to the tables and deductions above furnished, the Committee have confined themselves to the five months commencing in April 1858, that period having been specified in the letter of the Adjutant-General, dated Allahabad, 7th September 1858, to the Major-General commanding the division.* At the same time the returns for the whole period of the existence of the general depôt—15 months—show an unusually high rate of mortality, the average annual per-centage being—

Women -	-	$17\frac{4}{100}$
Children -	-	$33\frac{96}{100}$

while in the Bengal Artillery for the same period it was—

Women -	-	$5\frac{64}{100}$
Children -	-	$11\frac{88}{100}$

III. According to the medical returns the principal mortality has arisen from cholera, fever, and bowel complaints, but these returns are very imperfect as regards the causes of death in all instances. It seemed, however, to the Committee that sufficient evidence was brought before them to prove that the general causes which chiefly engendered and fostered the unusual sickness and mortality were the following:—Intemperance and immorality, reckless exposure to the sun, indulgence in unwholesome articles of food, want of personal and general cleanliness, and breathing an atmosphere polluted by overcrowding and other causes. The Committee refer to these several causes separately, but call attention to the evidence of the witnesses† for the more full elucidation of them.

* The Major-General commanding the division had ordered the Committee of Inquiry prior to the receipt of this letter from Allahabad.

† Appended to the original report.

1st. That intemperance and immorality have been leading causes of sickness and death was fully borne out by the testimony of all the most intelligent witnesses; and, although the records of the hospital note but a small amount of disease as having arisen directly from intemperance or incontinence, still the Committee have satisfied themselves that these evils have too frequently assisted in producing fatal results. The evidence of the Rev. Mr. Norman and others sufficiently showed that facilities of obtaining intoxicating liquors were not wanting both in Dumdum and Calcutta, while the close vicinity of this latter city offered temptations to immoral and vicious indulgence, which many women were too weak to resist.

2nd. Reckless exposure to the sun, during one of the hottest seasons on record, has added greatly to the causes of disease, especially among the families recently arrived in the country. Every effort short of actual force seems to have been employed to induce these persons to remain in quarters during the heat of the day, but to little purpose. It is fully proved that women and children were to be seen at all hours in the open air without even ordinary covering upon their heads. As far as the children were concerned, obtaining fruit, often unripe, from the trees in the neighbourhood, is stated to have been the great object of going out, at the same time it was proved that they were not unfrequently sent by their parents to watch clothes drying and bleaching near the barracks. Had there been sufficient school accommodation, the time of the children might have been profitably employed, and much of the exposure referred to avoided; but it was shown that there was no space available for such a purpose, without further aggravating the evil of overcrowding the inhabited compartments of the barracks.

3rd. The use of noxious food of various kinds was another source of disease, although the inmates of the barracks were supplied by Government with abundant rations of good quality. The articles referred to consisted chiefly of eatables likely to lead to bowel complaints and cholera, such as unripe fruits, stale vegetables, pickles, &c. In accordance with the recommendation of a medical committee, assembled in March 1858, strict orders were issued to prevent the sale of unwholesome articles of food, but these precautions appear to have been unavailing in checking the evil. According to the evidence of Schoolmaster Serjeant Boddilly, corroborated by others, deleterious pickles, prepared by natives in the bazaar, were daily consumed in barracks, and were purchased by the women to be given to their children as a luxury.

4th. Want of cleanliness, according to general testimony, prevailed to a great extent. The outhouses and accommodation provided for washing and bathing were quite unfitted for women, though they might have answered these purposes for men. The lavatories were visited by the Committee, and found not to be in use, in consequence, it was said, of being in the hands of the barrack department for alterations; but, when used before, they appear to have been principally employed as washhouses for washing clothes. The ordinary habits of the women were shown to have been dirty to an extreme degree, and on this account it is the more to be regretted that ample means of ablution were not afforded to such as were disposed to be cleanly. It was proved to the Committee that the very few women who used the lavatories for personal ablution were obliged to have their own tubs carried for bathing in, and to hang sheets up inside to screen themselves effectually from observation. Close to the lavatories were certain privies, and these, in common with all the privies belonging to the barracks, were constructed in so faulty a manner, that to keep them clean, and prevent them from being a serious nuisance to the adjoining neighbourhood, was almost impossible. The ground adjoining some of the privies was found by the Committee to be in a very offensive state.

5th. A polluted atmosphere in the barrack rooms, especially at night, has been noticed as a prominent cause in exciting disease.* Although it appears from the statements of the executive engineer, that the amount of cubical space allowed by regulation was not encroached upon; still, from the peculiar circumstances of the inmates of these barracks, as well as from the defectiveness of the buildings in respect to ventilation, the simple adherence to the rule of cubical allotment affords but little guidance in estimating the sources of disease. Where the provision for ventilation is imperfect, the definition of a given cubical space is insufficient for securing preservation of health. It is in this particular that the barracks of Dumdum have

* Some of the witnesses described the atmosphere of the barrack rooms at night to be so extremely offensive as to be perfectly overpowering on entering them.

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proved defective, and from this cause the occupants have experienced all the evils of overcrowding. The evidence of the engineers, Mr. Dodd and Lieutenant Gordon, fully support this statement. Moreover, the habit of keeping soiled linen and dirty clothes in the rooms, the neglect of airing bedding, the storing up of unused food about the berths, stated to have been a common practice, together with the total absence of punkahs during the night, tended greatly to contaminate the atmosphere breathed by these women and children, and to implant in them the seeds of disease and death. The women and children of the Bengal artillery, though quartered in the same barracks, were much more favourably situated with respect to the atmosphere in which they lived. They inhabited the verandahs only, the central wards being left vacant, and this important fact, together with other circumstances mentioned in the evidence of Surgeon Macpherson, in medical charge, will probably account for the greatly different rates of mortality between them and the families in the general dépôt.

It is right to state, in recording the existence of the sanitary evils in the dépôt, that all the evidence adduced before the Committee has tended to show that the local military authorities were not wanting in efforts to check and mitigate their severity as far as the means at their disposal permitted.

IV. Finally, the Committee desire to record their conviction that the close congregation of so great a number of women and children is likely to be attended with evil consequences under any circumstances; but, with a view to mitigate these results, they beg to offer the following suggestions, emanating from the present inquiry, for consideration, in case that the formation of a dépôt of like number should again be found necessary.

1st. In the selection of a locality for the dépôt, not only healthiness of site, but also distance from any large town or city, should be ensured.

2nd. The habits and circumstances of women and children require especial attention to be devoted to the thorough ventilation of the rooms occupied by them.

3rd. Efforts should be made to establish a system of female supervision in each room, more especially for securing personal cleanliness, the cleanliness of bedding and clothes, and for preventing the admission of spirituous liquors, and the collection of noxious articles about the beds and furniture belonging to the inmates. The evidence is doubtful as to the probable success of such an experiment; but if the female supervisors were armed with sufficient authority and support, and compensated for their labour, examples in other institutions encourage the hope that the plan might be attended with benefit.

4th. Lavatories particularly adapted to the necessities of women and children should be constructed, fitted with all essential utensils, and amply supplied with water.

5th. Covered ways should be provided to all outhouses connected with the main buildings.

6th. Especial care should be taken that in the privies the wants of children, as well as of adults, should be considered, and every means adopted to prevent the contamination of the atmosphere around the barracks by neglect in the regular removal of the urine, and all excrementitious matters.

7th. None but licensed hawkers should be admitted within the precincts of the barracks, and then only under strict observation.

8th. It is a question whether a system of messing would not obviate many injurious customs which existed in the dépôt at Dumdum, and therefore its adoption might be had recourse to as an experiment on a future occasion.

Dr.
W.C. Maclean.

Dr. WILLIAM CAMPBELL MACLEAN, Deputy Inspector-General of Hospitals, Professor of Clinical and Military Medicine, Chatham Military College, examined.

2223. (*Chairman.*) You have been deputy inspector-general of hospitals at Madras?—I have never been deputy inspector-general of hospitals at Madras; that is the rank which I have obtained since I came home.

2224. You have, I believe, lately returned from India?—Yes, after 22 years service.

2225. I believe you hold an appointment at the Army Medical College at Chatham?—Yes, I hold the professorship of clinical and military medicine.

2226. You say that you did not hold the office of deputy inspector-general of hospitals at Madras while you were there; what office did you hold?—While I was at Madras I was one of the presidency surgeons,

No. 2.

MEMORANDUM respecting the Construction of the Men's Barracks in Fort William.

South Barrack.

Upper floor, only used ordinarily, consists of 3 halls, each 279½ ft. long, 19 ft. 10 in. broad, and 18 ft. 8 in. high to under side of beams. The centre hall is open to the outside at the ends, but the side halls are enclosed at the ends by non-commissioned officers' quarters. There is an open veranda along the north and south fronts of the barrack. The upper floor is raised 16 ft. above the ground. The lower story, occasionally occupied by troops, consists of 14 vaulted chambers, 16 ft. 3 in. wide, running transverse to the building, communicating also with each other by large archways. The floor is raised 1 ft. 6 in. above the ground, and the height to crown of arch is 12 ft. 6 in.

North Barrack.

The upper floor is divided into 13 chambers transverse to the building, each 46 ft. by 18 ft. 9 in., and 18 ft. high to under side of beams; these chambers all open into each other by large archways, and at the ends into a long corridor 262 ft. long, 16 ft. wide, and 18 ft. high. At each end are non-commissioned officers' rooms, but arranged with a passage in the centre for the admission of air into the building from either end. An open veranda, 12 ft. 6 in. wide, extends round the north and south fronts and east end. The floor is raised 16 ft. from the ground.

The lower story is very similar to that of South Barrack; some of the chambers are closed at the ends, and used as guard-rooms, store-rooms, &c.

The New Queen's Barrack.

Three stories, all to be occupied as barrack rooms. Each story consists of 3 parallel halls; the first floor is raised 6 ft. from the ground, and the halls are all 18 ft. high to under side of beams. The centre one is 245 ft. by 20 ft., the side ones 245 ft. by 22 ft. In the second story, the thickness of the piers being reduced, each hall is 6 in. longer and 6 in. broader, and in the top story 6 in. more is added from the same cause. The centre corridor has an open staircase at each end; those at the sides are closed in by non-commissioned officers' rooms. Open verandas extend along both north and south fronts; 12 ft. 6 in. broad in the south, and 15 ft. 6 in. on the north. The centre corridor in each story is intended as a common room and for messing; and each side corridor is to be divided by wooden partitions 8 ft. high into 20 compartments; thus giving in the 3 stories a separate room for every married man in a regiment. The roof over it to be pent with openings for ventilation all along the ridge, and openings are left in the lower floors for the escape upwards of foul air.

The New Dalhousie Barrack.

Three stories, all to be occupied as barracks. The first floor is raised on vaults 14 ft. 6 in. above the ground. The body of the building consists in each story of 3 parallel halls. In the first story, 301 ft. by 19 ft. 6 in. each, and increasing 6 in. each way in the upper stories, and 18 ft. high in all to under side of beams. The halls communicate with each other by arched openings 12 ft. broad, supported by piers 6 ft. wide. The three halls will be used as sleeping rooms. The centre part of the building will have a pent roof, with openings all along the ridge-way; and openings will be left in all lower floors for ventilation, to allow of the escape upwards of foul air. The ends of the barracks are divided into non-commissioned officers' quarters in each story.

CHARLES J. HODGSON, Captain,
Garrison Engineer.

True copy.

Thos. Longmore,
Deputy Inspector-General.

as they are called, in Bengal; I had charge of a large district in Madras. I have been employed with native troops, and also with Europeans, both in Her Majesty's service and in that of the Indian army.

2227. It is not necessary to ask you about the peculiarities of the various stations in Madras; there are, if I recollect rightly, printed accounts to refer to?—Yes, of every station in Madras; of every barrack and hospital within the Madras presidency.

2228. At what time were those accounts made public?—They were made public by the authority of the Madras Government, many of them as far back as 15 years ago.

2229. They would only be accurate as regards the

prominent characteristics of the localities, and not as to buildings and arrangements?—Quite so. Many alterations have been made in the public buildings since those reports were printed.

2230. It is some time since you have been at any of those stations in India?—It is now more than 15 years since I did actual duty at Secunderabad; but I was employed at the Hyderabad Residency, which is within five miles of the station, and I was constantly in it and cognizant of all that was going on there, and I have been employed on committees on sanitary matters connected with the cantonment.

2231. Is your experience sufficiently recent to be practically available now as to the buildings and the mode of arrangement in those stations?—I think that information much more modern than I can give is to be obtained, particularly from the reports of Dr. Macpherson, the inspector-general of the Madras army, who has recently visited every station and given very minute accounts.

2232. Are those private reports?—No, they are official.

2233. Generally speaking, should you say that the stations in the Madras presidency have been selected with any special regard to medical considerations?—Not at all; many of them were occupied merely because they happened to be the spots where the troops first pitched their camps upon taking possession. I do not think that medical considerations entered into the selection, except with regard to those that have more recently been selected.

2234. Accident has had a good deal to do with it, and political considerations have determined the choice in other cases?—Quite so.

2235. Until lately the question whether the soil was good, whether the water supply was sufficient and of proper quality, and whether malaria prevailed, were not taken much into consideration?—They were never thought of at all.

2236. Even at the present time there has been no systematic inquiry to ascertain whether stations could be placed at moderate elevations upon the hills, and within a reasonable distance?—There has been more attention paid to that recently; for example, when the new barracks were about to be erected at Trimulgherry, near Secunderabad, which are now the best barracks in Southern India, certainly the most costly, a mixed commission was appointed, consisting of military and medical officers, to select the ground.

2237. That is the rule, is it not now, as to all new stations?—Yes, that rule, I think, prevails; but practically even now it is sometimes forgotten. I may mention, as an example of that, a circumstance that occurred in my own experience; a short time ago, when I was garrison surgeon at Vizagapatam, the Government directed that a piece of ground should be selected as a site for a barrack for the artisans employed in the arsenal, that I should be a member of the Committee, and that my opinion should be taken as to the selection of the ground. The Committee assembled without any notice having been given to me, and selected a piece of ground; and accidentally when the president of the Committee was about to forward the proceedings of the Committee, glancing his eye over his letter of instructions, he saw that I ought to have been included in the Committee, and sent me the proceedings, requesting me to sign them and return them. I did not do this, but I went myself to the ground and examined it, and found that it was in every way unsuitable, as it had been used as a place of public resort for the purposes of nature by the people in the town of Vizagapatam, time out of mind, and that it was in every way unsuited for the intended purpose. I therefore condemned the ground that had been selected, and there was an end of it.

2238. When power is given to a military and medical commission to report upon a site, would the power extend so far as this, that they might say, we consider that although this site is not objectionable, taking it as a site in a plain, yet that the health of

the troops would be better consulted by removing them some 10 or 15 miles off to a hill station?—That would depend upon military considerations.

2239. Have you at all considered the question of whether it is possible, and also whether it is expedient, to do away altogether, or almost altogether, with stations for Europeans in the low countries?—That is a subject upon which I have bestowed a good deal of attention, and I am strongly of opinion that it is possible to remove troops—perhaps not from all—but from a great many stations on the plains. If you look particularly to the formation of the country in Southern India, you will find in almost every part of it, that there is a hill station available, and I have brought with me a map which is on a much larger scale than usual; it was prepared by Dr. Macpherson to illustrate his report for this Commission, and the Committee will see that the hill stations are marked upon it with the elevations.

2240. (*Sir R. Martin.*) So that every province has its hill range if it be carefully inquired into?—There is not a doubt of it.

2241. (*Chairman.*) Looking at this map, I see that it is stated here that the Shevaroy and Neilgherry hills are contiguous?—No; they are not exactly contiguous, but they are within a very easy distance.

2242. What distance is it from Madras to the Shevaroy hills?—It is about 190 miles.

2243. Is there a railway to the foot of the hills?—Yes.

2244. Is that railway open?—It will pass close to the base of the range.

2245. Therefore troops stationed on those hills might be considered as being within from three to four hours' march of Madras?—Within one night's run by rail.

2246. Still that would not entirely do away with the necessity for a garrison at Madras?—No; as there is a fort there, and it contains an arsenal, a wing of a regiment is required in ordinary times to hold it, which could be relieved periodically at very little expense, an arrangement that would be an enormous advantage to the health of the troops.

2247. (*Sir R. Martin.*) The garrison being thus reduced to the minimum consistently with efficiency?—Yes.

2248. (*Chairman.*) There is a station now, I believe, on the Neilgherry hills?—Yes; it was formerly called Jackatalla, and it is now called Wellington.

2249. At a height of above 6,000 feet?—Yes.

2250. With the present facilities of communication what distance is that from Madras?—From Madras it must be about 300 miles by the road *via* Salem.

2251. How far is the railway now open?—The railway does not yet extend beyond Salem; but in a very short time it will go on to Coimbatore, which is almost at the foot of the Ghauts.

2252. When the railway is extended to Coimbatore it will only be three or four days' march off?—Not so much; only one march; they can go up in a night with the greatest facility from Coimbatore.

2253. Which do you consider is the military post next in importance to Madras?—The most important military position in the Madras presidency is, without exception, Secunderabad, which is the post of the Hyderabad subsidiary force in the Deccan, and is within five miles of the city of Hyderabad.

2254. It is the centre of that garrison which controls and keeps in order the Nizam's country, is it not?—Quite so.

2255. At what distance from Secunderabad is there any site for a hill station?—The nearest, which can scarcely be called a hill station at all, is Beder, 2,000 feet high—that is the nearest—but there is, in addition to that, the hill of Ramandroog, at Bellary, the height of which is over 3,000 feet.

2256. But that is a very considerable distance, is it not?—Yes, it is, but there are other places on

*Dr.
W.C. Maclean.*
23 March 1861.

Dr.
W.C. Maclean.

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elevated ground besides Beder, which are marked also on the map.

2257. (*Sir R. Martin.*) Are there not hill ranges in the northern circars in the immediate direction from Hyderabad?—There is a range of hills; the Gallicondah.

2258. Which are at present unexplored?—No. The inspector-general, Dr. Macpherson, visited them, and an experiment was tried, in the course of last year, to ascertain whether they were habitable.

2259. (*Chairman.*) Even this station of Beder, which appears to be at a height of 2,000 feet above the sea, is, I suppose, at a distance of two or three marches from the city of Hyderabad?—It is.

2260. Are there any means of conveyance better than the ordinary country roads?—No.

2261. Therefore the quartering of troops there would not do away with the necessity of maintaining a garrison at Secunderabad?—Secunderabad, as long as the city of Hyderabad remains, must ever be occupied.

2262. Then you could only contemplate the establishing of a hill station as a means of relieving the garrison at Secunderabad?—Yes; although Bellary is at a considerable distance the railway will by-and-bye connect Bellary with Hyderabad, and then the troops could be easily removed to Ramandroog from Hyderabad by railway.

2263. That is a distance of between 400 and 500 miles, is it not?—Not quite so much as that; about 300 miles.

2264. The height of Ramandroog is, I think, 3,500 feet?—Yes; and it is used as a sanitarium now for Bellary.

2265. Now to take the case of Bangalore, that is a station, is it not, on very elevated ground?—Yes.

2266. The height is about 3,000 feet, is it not?—Yes.

2267. Therefore the same necessity does not exist for removing troops from thence?—Not to such an extent; it is cooler, and it is within easy reach of the Neilgherries; within three days' transit.

2268. It is a healthy station, is it not?—Yes; but there is a good deal of liver complaint in Bangalore; there is a hot sun and a cold wind, and consequently there is a good deal of liver complaint there.

2269. (*Sir R. Martin.*) And cold night winds?—Yes; but the temperature is comparatively low all the year round, except for about six weeks.

2270. (*Chairman.*) It is such that Europeans can take exercise?—Yes, and they live almost in the open air.

2271. They enjoy themselves?—Yes, they do.

2272. Is not Bangalore one of the most popular stations?—It is the most popular station in Southern India.

2273. (*Sir R. Martin.*) That demonstrates the advantage of placing troops upon high table grounds, as also at Poona?—Yes; they do not merely exist there, but they live and enjoy life.

2274. (*Chairman.*) Trichinopoly is a station upon the plains?—Yes, and the hottest station.

2275. And it is subject to the full effect of tropical diseases, is it not?—Yes, men stationed there are exposed to the deteriorating influence of continued heat.

2276. I think, as it is set down in the map, the nearest contiguous mountains to Trichinopoly are Pulney and the Neilgherry hills?—Yes; the Neilgherries, for all practical purposes, being available for Trichinopoly.

2277. The railway will be open from Trichinopoly to Coimbatore?—Yes.

2278. Therefore, practically, the station of the Neilgherries will be within a day, or a day and a half's journey of Trichinopoly?—Yes.

2279. Still I presume you do not contemplate the entire abandonment of Trichinopoly as a station; but merely that a small force should be left there?—I should say that I contemplate the abandonment of Trichinopoly as a station for European troops, because of the distance being so trifling, and the

facilities for bringing the troops down so great; I cannot myself conceive the necessity of keeping a strong regiment of 1,000 or 1,200 men in such a hot station, where their health deteriorates.

2280. You would probably think it sufficient to leave native troops there, being ready to reinforce them by Europeans from the Neilgherries, if they were wanted?—Yes; and to use the Neilgherries not merely as a sanitarium, but as a station.

2281. Now state the case of Cannanore; for that, again, do you consider that the Neilgherry hills are the most conveniently accessible?—Yes.

2282. There is no railway on that side of India, I think, yet?—Not yet.

2283. Is there any railway projected?—The plan would be to move the troops, or the force required, by sea to Naguputun, which is the nearest seaport; and they could then go by railway into the interior.

2284. The Animallay hills are also mentioned as being contiguous to Cannanore?—Yes; they have been only recently explored, and they have never yet, therefore, been used as a station.

2285. Nothing is, therefore, known as to their healthiness or unhealthiness?—No. The only Europeans who, I believe, have ever been there are Dr. Cleghorn, the conservator of forests, Captain Hamilton, Lieutenant Beddome, and Dr. Macpherson, the inspector-general, who visited them a year ago.

2286. What distance are they from Cannanore?—About 80 miles.

2287. With regard to the four important stations in the plains, of which we have been hitherto speaking, Madras, Trichinopoly, Cannanore, and Bangalore, your evidence goes to show that the greater part of the garrisons in all of them might be replaced by a force concentrated on the Neilgherry hills?—Yes.

2288. Which would be equally available for a descent in any direction?—Yes.

2289. Then, proceeding to the northward, you would suggest that, instead of the station at Bellary, a force should be maintained at Ramandroog?—Yes.

2290. That is in the immediate neighbourhood?—Yes.

2291. So that for all political and military purposes it would be the same thing?—Yes, quite the same.

2292. Has the station at Ramandroog been examined?—It has been occupied; it was first visited by civilians as a place to run to in the hot weather; but latterly there has been a small detachment of troops there, and invalids are continually sent up from Bellary to Ramandroog.

2293. I do not ask you as to the advantages and conveniences of the Neilgherry hills, but we have not heard anything as to this station of Ramandroog. Is it a station where supplies would be plentiful and cheap, and where vegetables could be grown for the use of European troops?—Ramandroog is a detached hill, it is not of a very extensive range, and there is not a great deal of available ground on the top of it; but still there is quite enough to furnish supplies for a wing at all events.

2294. (*Col. Durand.*) What do you think is the area of the top of Ramandroog?—I was never there myself, but it must be, I think, about $1\frac{1}{4}$ mile in length and in breadth, $\frac{3}{4}$ of a mile.

2295. (*Dr. Farr.*) Is the soil favourable for the growth of vegetables?—The soil at the lower part of the platform is well adapted for the cultivation of all European vegetables.

2296. (*Chairman.*) At Vizagapatam, on the coast, I see that you suggest that part of the troops should be transferred to the station at Gallicondah?—The advantages of Gallicondah as a sanitarium may be considered as still *sub judice*. There is now in progress of construction at a place marked on the map as Waltair a barrack, and a European regiment is about to be quartered there. Waltair is the most salubrious station in the northern division of the Madras presidency; it is a small elbow of land that juts into the sea, having the sea on three sides of it,

and backed by a high range of hills, which completely cuts off the land wind. The northern division is the most feverish district in the Madras presidency, but at Waltair there is rarely any fever at all, and such cases as do occur are mild; it is, without exception, the most healthy station in that part of India. It was chiefly at my suggestion that the barracks were ordered at first to be erected at Waltair; the advantage will be very great, not only for the troops in the northern division, but as a sanitarium for the troops at Secunderabad. There are many cases of disease there, chiefly bowel complaints, that cannot be sent to the hill stations; and it is believed that they will do well at Waltair, for it is on the sea coast. Not only will Waltair be useful as a sanitarium, it will be a very important position for the head quarters of a regiment, as it is conveniently placed for embarking a force on an emergency either for Pegu or Calcutta.

2297. (*Chairman.*) Not speaking of it as a sanitarium, but as a station for healthy European troops, do you consider that a situation on the sea coast is equal in sanitary value to one on the hills?—That depends upon local circumstances, and the local circumstances at Waltair are highly favourable; it is a position not merely upon the seashore, but it projects into the sea, having the sea on three sides of it, and a high range of hills behind, which cuts off the influence of the hot wind during the hot months in the year.

2298. (*Sir R. Martin.*) It possesses, in fact, many of the advantages which are derived from an insular position?—Yes.

2299. (*Chairman.*) But the average temperature throughout the year must be very much higher than it would be at a height of 3,000 or 2,000 feet, must it not?—Yes, no doubt it is; but it is the most equable climate I was ever in; the sea breeze pervades the place throughout the whole of the day.

2300. Then, upon the whole, you would recommend that the station substituted for Vizagapatam should be Waltair, rather than a station on the hills?—Yes. There is a range of hills called the Gallicondah range, and an attempt has been made to locate troops there; but the experiment was imperfect, and on a very limited scale, and as far as it has gone, it has not been very successful. There are two points on the hills, one called Harris valley, and the other Grant's range; a small detachment of sappers and invalids from Vizagapatam was sent there by way of experiment, but contrary to the advice of Dr. Macpherson, who was the first medical man who went to the top of the hills, they were located in Harris valley, not on Grant's range, which he recommended, and the result was that it proved a very feverish place, and two, if not three, of the medical officers were sent down again, suffering from very severe attacks of fever, and the sappers were at last obliged to be removed.

2301. (*Sir P. Cautley.*) I believe that only two men of the party escaped?—Such was the case.

2302. Are you aware that that station is considered an entire failure by the Madras government?—Yes, but at the same time I do not think that the experiment was very fairly carried out. Almost all places of that kind when first occupied are unhealthy; but afterwards, when sanitary arrangements are properly carried out, they become different.

2303. You do not consider that a trial for one season is a sufficient test of the salubrity of a place?—No; nor do I think that the locality was well chosen for the experiment.

2304. (*Sir R. Martin.*) The worst locality was resorted to in place of the best?—Yes.

2305. (*Col. Durand.*) North of Harris valley there is a hill called Lunsingy?—Yes, and it is very high; but I suspect that the summit of it is not well adapted for a station for troops, as there is not a sufficient amount of table land there.

2306. (*Dr. Sutherland.*) Do you know Pondicherry?—I have never been there.

2307. Do you know anything about the diseases which prevail there?—I know that it is comparatively a healthy place, and that the sanitary arrangements at Pondicherry are very much better than those at Madras.

2308. Did you ever hear it stated that Pondicherry enjoys an almost total exemption from dysentery?—Yes, I have heard that stated, but that is not very prevalent at Madras, nor along the coast. In the town of Madras dysentery is a mild and manageable disease; all the bad cases of dysentery are imported.

2309. Are you aware of any other instance, in your experience, of marked exemption from diseases that prevail elsewhere?—Yes; I can give you an instance in the station at Beder, mentioned a little while ago. I believe that cholera has never obtained a footing in Beder at all, and there are various villages, stations, and points in the Nizam's country that have enjoyed a similar exemption.

2310. To take the case of Pondicherry, in what particulars is that better in a sanitary point of view than other stations?—In the general health of the people. In the first place it is not so crowded a city, and the comparison is therefore scarcely fair, for there are 700,000 inhabitants in Madras, and not a tenth part of that population in Pondicherry; there are fewer dead buried in Pondicherry; the burials among the living in Madras are very great; the wells are polluted by organic matter, and this exercises a marked influence on the health of the people, particularly in the district of Triplicarne; but I believe that the drainage of Pondicherry is very much better than that of Madras; they have less cholera and fever there, and they have fewer bowel complaints, and I have always understood that all tropical diseases there are in a milder form, and are more manageable than in Madras.

2311. Do you know anything of the drainage arrangements at Pondicherry?—No; beyond the general fact.

2312. Do you know anything as to the quality of the water?—The water supply is better than in Madras.

2313. Is it brought from a distance?—I cannot say.

2314. With regard to the other stations which you say are exempt from cholera, to what would you attribute that exemption?—I should not like to offer an opinion upon the subject, because I have not examined many of those places. At the station of Beder the soil is laterite, and in the greater part of the Nizam's country it is granite, a great part of it in a state of decay, and we know that wherever stations are situated in places where the granite is in a state of decay, those places are not healthy.

2315. Are there good natural facilities for drainage in those instances where, as you say, there is an exemption from cholera?—At Beder most decidedly, for it is on elevated ground, and I wish particularly to call the attention of the Committee to this fact, that Secunderabad, until within the last year, or the last 18 months, has enjoyed a wonderful exemption from cholera. I do not say that it has never been there; but I resided near the city of Hyderabad, within five miles of Secunderabad, and every month of May we had an epidemic of cholera in the city and in the bazaars near the Residency, while during the 12 years of my experience the disease never obtained a footing in Secunderabad. I have known cases here and there; an officer taken with it here and a soldier there, but never as an epidemic. However, within the last year it has appeared; but I may add that Secunderabad is now very much more crowded with troops than it was in my time; there is now a regiment of European dragoons, and two regiments, where there was formerly only one regiment, of Europeans, and cholera has prevailed epidemically during the last year, which it never did before.

2316. (*Col. Durand.*) Was it accompanied by similar virulence in the European part of the town

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as in the native part?—Cholera was always extremely virulent in Hyderabad and at the Residency.

2317. But I mean, when it broke out in the last year, was it equally virulent in one part of the town as in the other?—It was equally severe.

2318. (*Dr. Sutherland.*) With regard to irrigation in the south of India, what effect, in your opinion, has that upon health?—I have never been quartered in any places where irrigation was carried on on a large scale; but I have always understood that when the irrigation operations are first commenced, and large quantities of the soil broken up for the first time, the result has been considerable amount of ill-health, fever, and bowel complaints.

2319. Produced by the operation of digging and turning up the ground?—Yes.

2320. Can you mention anything as resulting from the application of the water?—I never heard anything about that, or that people suffered; but, on the contrary, that their condition in every way improved.

2321. (*Chairman.*) There are still two stations to mention, there is the station of Jaulnah, in the interior, that is a station on elevated ground?—Yes, at a height of 1,600 feet, but it is no longer to be occupied, except by a very small detachment of troops. It was a very important military point; but there is only a small detachment left there.

2322. The nearest hill station to Jaulnah is Booldana?—Yes.

2323. At a distance of two or three marches?—Yes; Booldana has never been used as a sanitarium for troops; but the political and the revenue officers constantly reside there during the hot weather, and they are remarkably healthy there.

2324. Nagpore is the last?—Yes.

2325. That is itself not absolutely on the plains?—No; the ground is very level on which the cantonment is situated, but it is at a considerable elevation; it is higher than Secunderabad, which is 1,837 feet above the level of the sea.

2326. (*Dr. Farr.*) Are there no troops stationed at Nagpore?—Only native detachments as a general rule.

2327. Are you acquainted with Kamptee?—I have passed through it; it is a place where there are very severe forms of remittent fever, and the sanitary arrangements of the station are very defective.

2328. (*Chairman.*) From Nagpore to Chindwarra, which is the nearest hill station, is, I suppose, a distance of four or five marches?—Yes; rather more than that. From 50 to 60 miles.

2329. There is no railroad there?—No.

2330. Therefore, practically, the troops stationed there would be quite unavailable for any sudden emergency?—They would get to Nagpore in four or five days; it might be available as a sanitarium.

2331. Nagpore is marked as being 900 feet above the sea?—Yes.

2332. Kamptee is higher, is it not?—Yes.

2333. The sanitarium at Chiculda is only 2,000 feet?—Yes; but at Nagpore it is a great matter to have a place of retreat, for the heat there is excessive, and the difficulty of getting invalids away for four or five months in the year, is very great; you cannot get them to the coast, but by-and-bye the railway will to a great extent obviate that, for the Bombay railway passes up by Nagpore; practically, it was impossible to remove sick officers or men for four months in the year.

2334. The substance of your recommendations comes to this, that the Neilgherry hills should be a great military station for all the southern parts of the presidency, that there should be an important station at Ramandroog, and that Waltair on the sea coast should be substituted for Vizagapatam?—Yes; Vizagapatam has not been used for many years as a military station, except for invalids; it is an old Dutch town lying down very low on a spit of land, and cut off from the sea by high sand hills, and with a large swamp in the rear, and it is altogether a very unhealthy town.

2335. You further recommend that sanitarium should be established in the neighbourhood of Jaulnah and Nagpore, although you do not consider that the whole of the garrisons of Jaulnah and Nagpore could be removed?—No.

2336. (*Col. Durand.*) Has there been any trial of the hill which you called Green hill, on the Shevaroy range, and to which you have proposed that a portion of a regiment should be removed?—No, it has never been occupied; but all the missionaries and people who have resided there only did so because it is in the immediate vicinity of the coffee plantations; they would all, if they had a choice, go higher up; there is an entire absence, on the Green hill, of jungles, and there is a good water supply. There is one point upon which I wish very much to say a few words to the Committee, with regard to all the experiments which have been made upon the hill stations; the Government are apt to be discouraged by first trials; for example, at Jackatalla, which is now called Wellington, when the troops were first sent up there, the Government were much disappointed at the result; bowel complaints prevailed to a very great extent; the sickness was considerable, and the mortality heavy, but the explanation of that, I believe to be this, that the troops were sent up before accommodation was sufficiently prepared for them, and there were upwards of 2,000 or 3,000 workmen, who were employed in the construction of public buildings there; they were under no sanitary control whatever, nor were any arrangements made with regard to them, to make them keep the ground clean, so that for miles about—and this is a matter of which I can speak confidently—the place was one immense privy, and the consequence was, that when the troops went there, bowel complaints prevailed to a very great extent, and it was long before the Government became reassured. But now that sanitary arrangements have been carried out, and that the buildings have been completed, there has been an astonishing change; in a letter lately received from Dr. Macpherson, he says, that the sickness is considerably under one per cent., that is to say, that there is a European regiment there very nearly 1,200 strong, and with only 10 men in hospital when he wrote.

2337. (*Sir R. Martin.*) Besides the local circumstances which you have stated, the regiment that went up was in a bad sanitary condition, when it went up there?—That might have been the case too; but I particularly mention this, because it is not an isolated case, for the same thing occurred at Trimulgherry; for many years I agitated to have the old Secunderabad barracks destroyed and abandoned; a subject upon which a very bitter controversy existed for many years, and at last the Court of Directors directed that those magnificent barracks at Trimulgherry should be erected, and the very same thing occurred there. There were thousands of workmen employed, under no control, and the whole place was in the same condition precisely as the other. I recollect, when those barracks were first occupied by troops, bowel complaints prevailed to a very great extent, and all those who had taken an active part in condemning the old barracks were very much jeered at in consequence.

2338. (*Dr. Farr.*) You have obtained extensive information about the stations in Southern India by your own observation, and from correspondence with Dr. Macpherson and others?—Yes.

2339. We have here the most recent returns, derived from the calculations of Indian officers, of the mortality at some of these stations; I will mention the rates of mortality, and then request you to state any circumstances which you may think will explain the differences. At Saugur, the rate of mortality is 29 in a thousand; at Kamptee, the mortality among the Queen's troops was 48 in a thousand, and in the Company's troops, 24 in a thousand; at Vizagapatam, 36 in a thousand, and at Secunderabad, in the Queen's troops, 60 in a thousand, and only 25 in

the Company's troops. Now, to what circumstances can you refer that very high rate of mortality at Secunderabad, in the Queen's troops particularly?—I should attribute that very high rate of mortality at Secunderabad to the prevalence of the most malignant form of dysentery; but that has been almost entirely confined to the old infantry barracks, which have had a bad reputation ever since they have been constructed. The artillery of the Indian army were never quartered there at all; they occupied barracks on the higher ground, to the north of the cantonments; the infantry barracks of Secunderabad were situated in a basin, and the ground on one side was deeply furrowed by nullahs; it was, in fact, the water shed of the neighbourhood, and these nullahs were generally resorted to by all the people in the bazaars and the neighbourhood, and the sanitary condition of the place was bad all along. The barracks themselves were of a very faulty construction, and they were always overcrowded. When I first went to those barracks with the Queen's 55th regiment, which was a regiment at that time of nearly 1,200 strong, they were crowded and stowed away in a barrack that was originally constructed for 700 men, and dysentery prevailed there all the year round, more or less, but more particularly after the rains, and when the ground began to dry. In certain years there were very frightful epidemics, which carried off a large number.

2340. Since the new barrack has been erected, what has been the result with regard to health?—I cannot tell you exactly the result, but I may particularly mention that the barracks at Trimulgherry have never yet had a fair trial; they were constructed upon an excellent plan, although rather costly; the intention was that the enclosed verandahs were never to be occupied by troops, but owing to the pressure at the time of the mutiny, there was an entire regiment of dragoons, and a considerable portion of a regiment of infantry, quartered in them, and the consequence was that the verandah, which ought never to have been used as a dormitory at all, was invariably occupied as such, and the soldiers who lived in the centre dormitories of the barracks suffered at night from the respirations of the men occupying the outer verandah, and thus, in my opinion, those barracks have never yet had a fair trial.

2341. But that will give us no idea of the mortality in the barrack if only occupied by the number of troops that it was intended for?—No, if there were only the number of troops that it was intended for.

2342. At what distance are the new barracks from the old barracks?—About a mile and a quarter.

2343. Is the situation superior?—Yes, infinitely superior, but we could have got a better situation if we had not been very much tied, but we were obliged to do as was done, for we could not have the barrack too far away from the arsenal, and the cantonment which the men were intended to protect. Sir Patrick Grant has urged upon Government the necessity of abandoning the cantonment of Secunderabad altogether, and moving it out between Trimulgherry and Bolarum upon the same ridge upon which the new barracks now stand.

2344. Were there native troops stationed in Secunderabad?—The cantonment there extends for three miles, running east and west, and some of the native troops are located in the centre, and others upon either flank to the east and west.

2345. Do they enjoy good health?—They do; there are particular ranges of barracks which are more healthy than others; for instance, the horse artillery barracks are on the western extremity of the line, and the men have always excellent health; they are upon comparatively high ground.

2346. The mortality of the 55th at Secunderabad was a remarkable example of the mortality caused by the bad selection of a station?—By local circumstances.

2347. At Bellary the mortality was 29 in a thousand; at Bangalore 28·20?—Yes.

2348. At Madras 31 per cent., St. Thomas's Mount 41 per cent., and at Palaveram 26?—Yes, Palaveram

is a station where European troops are never quartered at all.

2349. No, these were the Company's troops?—No European troops, either Company's or Queen's, have ever been stationed there.

2350. What are the chief diseases to which you can ascribe a rate of mortality so much exceeding that which you say is experienced now in the hill stations?—The chief mortality in all tropical stations is made up from dysentery, cholera, liver complaints, and fevers.

2351. Is liver complaint often connected with dysentery?—Very often, but not so often, I think, as observers in this country suppose. I do not think that clinical observations made in India show that dysentery and suppurative inflammation of the liver are so much connected as is supposed by Dr. Budd. There are no doubt examples of it to be seen, but it is not by any means so common as is supposed.

2352. To what causes do you ascribe those diseases in India among Europeans?—I think that the main cause of the sickness among Europeans has been the overcrowding, and bad ventilation in barracks. Speaking of remediable causes, I think those were the master sins of our old system, overcrowding and bad ventilation.

2353. And bad arrangements for preserving cleanliness?—Until very recently I may say that such arrangements did not exist at all, and I will particularly instance Madras. The fort of Madras is situated within a few yards of the sea, and the highest part of Black Town, immediately in the rear, is not above 20 feet above the sea, the whole of the drainage of Black Town passes in immediate contiguity to the fort; the place is so level, and the supply of water so bad, that the drainage there is, perhaps, worse than in any town, either in the tropics or in this country, and chiefly arising from the want of a good head of water to flush and clear the drains; and the consequence has been that both the residents living in the fort and the natives, have suffered severely; and it is a fact, that sometimes I have known officers and gentlemen employed in the public offices in the fort, almost made to vomit by the intense and abominable smells from the drains, and they have, no doubt, been a source of very great sickness in Fort St. George; but now that has been to some extent remedied. A few years ago there was a very high sea wall, which ran 500 feet along the sea face of the fort, with casemated batteries, but Sir Charles Trevelyan had it thrown down, and the sea face is defended now by a low wall, with heavy ordnance mounted en barbette, and that has had an immense effect in improving the health of the fort, for the sea breeze penetrates through every portion of it. The barracks are also greatly improved. Sir Charles Trevelyan had verandahs added, he had the officers' quarters moved, and the men, who were intensely crowded on the ground floor, were moved up into the upper story, and a great many sanitary improvements of a similar kind were carried out; and immediately, as if to test the benefit arising from these improvements, we had a very severe attack of epidemic cholera in the town, not a single case of cholera appeared in Her Majesty's 43rd regiment then quartered in the fort at the time. And it is consistent with my own knowledge, that no epidemic of cholera that has prevailed there for the last 20 years ever passed over Madras without taking its victims out of the fort barracks. The only part of the barracks where the accommodation was not improved was the patchery, where the married men live. There the married soldiers with their wives were undoubtedly crowded, and they suffered a little. There were one or two cases of cholera in the patchery, but not one in the improved barracks.

2354. (Sir R. Martin.) Speaking generally, would you attribute much influence to the habits of the European soldier in India?—I think that their habits of life are very unfavourable to health; for undoubtedly they are very intemperate, and they suffer much from *ennui* and from want of occupation. I do not

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think that half enough has been done to provide healthy occupations for them.

2355. Occupations and amusements?—Yes, those are points upon which there is great difference among officers. Some commanding officers pay much attention to matters of that kind, and I have never seen a regiment where those matters have been attended to, in which the results were not beneficial.

2356. (*Dr. Gibson.*) Do you think that the sanitary hill stations are sufficiently restorative for soldiers?—I think not; I think that there is a very large class of diseases that cannot be sent to the hill stations; for example, bowel complaints; and I wish to explain to the Commission that although I never did duty on the Neilgherry hills I was there on sick certificate, and in order to save the trouble of sending for another officer, I served on all the committees during the year of my stay, and, consequently, I saw almost every sick person that came there; we were obliged to send the majority of the sufferers from bowel complaints and hepatic affections to Europe, or to the sea coast.

2357. (*Sir R. Martin.*) I presume that you would recommend the climate of the mountain ranges not so much as places for the cure of disease as for the preservation of health?—Yes.

2358. (*Dr. Gibson.*) What has been the consequence of that state of things?—The want of facilities for the easy transport of invalids has always been a cause of mortality. I wish to add that of late more attention has been paid to this, and that invalids are now more sent to the coast than they were when first I went to India. They are now organizing bullock conveyances, and invalids are sent from the up-country stations by this transit system to the sea coast.

2359. Does much mortality occur from the want of means to remove men from India at an early period of disease?—Yes, unquestionably, and I think that that the station which I spoke of, Waltair, would be of immense benefit to the soldiers at Secunderabad; in a very few years it will become the established practice to send men who are convalescent after severe dysentery down to the sea coast.

2360. (*Sir R. Martin.*) Experience shows, does it not, in India, that certain points on the coasts have proved efficient as convalescent depôts?—Yes, undoubtedly.

2361. And therefore they have at all times been recommended by medical officers serving in India?—Yes, and they were used, as far as the officers were concerned.

2362. (*Dr. Gibson.*) Are they sufficient in your opinion for the restoration of the health of the soldier, and to enable him to return to his duty?—Yes, in some cases they would be; in the more severe cases you could not expect it, for you have still a high temperature to contend with.

2363. (*Sir R. Martin.*) And the severer cases must go further?—Yes; they must go to sea.

2364. (*Dr. Gibson.*) Are there not many cases of disease, the recovery from which is not supposed to need an English climate?—Yes.

2365. And which would require a visit to some intermediate place?—Yes.

2366. Can you suggest any place?—I have a very high opinion of the Cape of Good Hope as a sanitary station.

2367. (*Sir R. Martin.*) Have you heard anything of the west coast of Australia?—Yes; but I have not anything to say on this subject from my own observation; but I have no hesitation in saying, that many cases of disease would be cured in such a place, and such a place is required.

2368. (*Dr. Gibson.*) You think that many valuable lives would be saved?—Yes; in fact I may say, that in former days, when I did duty with the 55th regiment, it was lamentable to see the number of valuable lives that were lost for want of such a place.

2369. (*Sir R. Martin.*) There was nothing then for the soldier but this, that he must wait for death in the hospital?—Nothing; for only once a year the invalids were sent down, and it was never dreamt

of in those days that any chance was to be given to the soldier; the officers got away, but the unfortunate soldier was obliged to take his chance.

2370. (*Chairman.*) If a man was sent to Western Australia, or to the Cape of Good Hope, for the recovery of his health, you would assume, I presume, that he would be competent to do military duty there after a few weeks?—The probability is, that in a very large majority of cases, long before he reached the Cape, he would be an efficient man from the effects of the sea voyage; provided always, that a little care is taken to see that the transport vessels are properly fitted. I have seen great misery caused from want of attention to such details, and in my voyage home the other day overland, I saw officers and sick invalids from India suffering from bowel complaints, have their lives put in the greatest peril from such an apparent trifle as the mal-position of the water-closets, to which even sick officers could not get without getting wet; I speak of the mail steamers between Alexandria and Marseilles. All experiments of that kind must be conducted with a due regard to the necessary details, or disappointment is certain.

2371. (*Dr. Farr.*) Looking at the high temperature of India, and the peculiarities of its climate, I suppose we never can expect, however the troops may be placed, that the mortality will be as low as it is in England?—No; because the high temperature alone induces a condition that after a time tells upon us all; even those who take the best care of themselves, and who are placed in the most favourable circumstances, never can escape from that.

2372. By selecting hill stations, or stations which are ascertained to be salubrious, we may hope, I presume, to escape a part of the frightful mortality which our army has suffered from during its occupation of India?—That is my opinion; but I think there is one thing which is not regarded so much as it ought to be. On the Neilgherries now, I believe that the cost of the soldier's ration is very much greater than in the plains, and those who have to do with financial matters are very much opposed to hill stations on that account; but they forget the enormous saving of life that would be effected; they do not take into account the diminished hospital charges and expenses as a set-off against this additional outlay; they look simply to the fact that the feeding of the soldier on the Neilgherry hills is more expensive than the feeding of a soldier on the plains.

2373. (*Col. Durand.*) You were speaking of the old barracks at Secunderabad, and you referred to the married families, had they adopted the patchery system there?—Yes; it was in existence there.

2374. Comparing the men living in the patcheries, and the men in the old barracks, was there any great difference?—Undoubtedly; bad as the patcheries were, we never had the same mortality there that we had in the barracks, in neither their families nor themselves. The married men in the patcheries enjoyed better health than the single men in those bad barracks.

2375. With reference to the accommodation afforded to the married men in India, do you prefer the patchery system to any other accommodation that is usually given to married soldiers?—Yes, undoubtedly; but I have no doubt that it is susceptible of enormous improvement.

2376. I have seen it, and it has not been satisfactory?—No; because I think there has been very little attention paid to the patcheries, and they are not in the condition that they ought to be; but for all that the men had better health there than their comrades in the barracks, and it was because they were not poisoned by one another.

2377. I was asking you with reference to the accommodation afforded to married soldiers in India, do you prefer the patchery system to his being in a barrack?—I do.

2378. Have you seen the two systems elsewhere than in Secunderabad?—Yes; I have seen it in Fort St. George, and I think that the married soldier can

never be either happy or comfortable in a barrack. I think that where a man is married, and has his family about him, he likes to have a place for himself.

2379. (*Dr. Farr.*) Will you be good enough to explain what is the patchery system?—It is a number of detached huts under military discipline, and they are generally outside the barrack square.

2380. Are you generally in favour of isolation, and of putting the soldiers in separate dwellings, or in smaller barracks?—I am of opinion that they ought to be all in separate buildings. I think that the system which now prevails in India of erecting costly palaces for troops is one of the most unfortunate mistakes that was ever made, because in the first place, the barracks are so costly that the Government grudges the space required for the men, and I am quite sure that if such barracks were built as Colonel Durand knows were erected at Moulmein, detached bungalows, well raised from the ground, and well ventilated with roof ventilation, the health of the troops would be enormously increased, and the Government would save an immense sum of money.

2381. The officers live in detached dwellings, do they not?—Yes.

2382. And the mortality among them is not half so great?—No; the mortality at Secunderabad rarely exceeded two per cent. among the officers.

2383. Nearly all those diseases which are so fatal in India, and are contagious, are apt to run through barracks?—Yes, where they are in an epidemic form, dysentery, more particularly, and cholera.

2384. On all these grounds you would recommend isolated dwellings for the soldiers?—Yes.

2385. (*Col. Durand.*) You would prefer a barrack to contain not more than half a company to having a barrack consisting of one long building to contain a whole regiment?—Yes, if sufficient care is taken so that the one does not interfere with the other; they ought to be placed *en echelon*. A building in India which consists of two stories, can never be properly ventilated; there never can be roof-ventilation, and the soldiers living below will not have the same advantages as those who live above for this reason.

2386. (*Dr. Farr.*) Do the natives live together in large dwellings or have they isolated huts?—They never live together in large dwellings.

2387. Do the native troops live in detached dwellings or in barracks?—They live in huts.

2388. You are aware that the mortality among the native troops is not greater than among English troops in England?—Yes.

2389. (*Chairman.*) The native troops do not drink spirits?—No.

2390. (*Dr. Farr.*) Is spirit drinking sometimes caused by the bad sanitary condition in which the soldier is placed?—Yes, in bad circumstances he drinks, because he has nothing else to do, and when once the habit is contracted, it is difficult to cast it off; in some regiments the difference is enormous. I remember the 84th regiment, which was under the command of Colonel Russell, it was an Irish regiment, and it was very much under the influence of the Irish priests, who were promoting the temperance movement at Secunderabad, and there was scarcely a man in that regiment who drew the spirit ration, and, as might be expected, it was one of the healthiest regiments I ever saw at Secunderabad. Again I saw the 26th Cameronians under the command of Colonel Oglander; they were 900 strong when they joined us in the expedition to Chusan; when they landed at Chusan there was not a single man in the regiment, except the old soldiers, who drew his spirit ration.

2391. And was their health above the average?—Up to the time of their landing at Chusan, their health was admirable, but the regiment was completely destroyed at Chusan, not however from their abstinence from spirits, but because they were fed upon putrid meat which had been cured in Bengal, and because they were badly located and badly cared for after Colonel Oglander's death; the regiment was

completely destroyed in two months; they could not muster 20 men.

2392. (*Col. Durand.*) In fact, where officers like Colonel Russell, and Colonel Oglander, having great influence over their men, turn their attention to these matters, they produce most beneficial effects in their regiments?—Undoubtedly.

2393. (*Dr. Farr.*) Do you ascribe much of the sickness which prevails in India to debauchery?—Yes, and I am very anxious to impress upon the Commission the very great necessity which exists for some steps to be taken upon that subject; the loss of efficiency from syphilis in India is now becoming quite a State question. A short time before I went to India, there was at every station a lock hospital, but a prejudice got up against them. I suppose they were either thought expensive or inefficient. They were first so reduced as to be nearly inefficient, and then condemned because they did not answer the purpose, and they were abolished, and the consequence is now that the prostitutes at all the public stations where the troops are, are under no control whatever, and the troops suffer to an immense extent from syphilis. I know that it was brought to the attention of Lord Canning, by Dr. Macpherson when he was last in Calcutta, that in the last regiment, (a Queen's regiment,) which he inspected with the permission of the authorities at the place, it was ascertained that one woman had in the course of two nights utterly destroyed ten men; those men were so injured by her that they were no longer fit for duty; their efficiency was completely destroyed by a malignant form of syphilis. In the 1st Madras Fusiliers a few years ago, 368 cases of syphilis were admitted into hospital; this caused 8,456 days of total loss to the service, equal to the withdrawal from duty of one-fourth of a company daily.

2394. How do you think the lock hospitals would work?—I think if they were properly organized, they would work well; it would be quite possible, with the aid of the police magistrates at the stations, to bring all the prostitutes completely under control, and so nip an immense deal of disease in the bud.

2395. How would you place them under control?—The police magistrates in every station have immense authority, and every prostitute in a place could be summoned to appear on a certain day in every month, or a certain day in every week, and also, although it might be a very unpleasant process, these women could be subjected to proper examination.

2396. (*Chairman.*) As is done now in Paris?—Yes; I would adopt very much the same system as that which prevails in Paris, with certain modifications.

2397. (*Dr. Farr.*) Another plan was mentioned the other day, which was that of removing a woman who had communicated disease to the men, or of putting her in a lock hospital, without at all interfering with other women?—I think, if something like this was done once or twice a year, good would follow; if there were two or three examinations rigidly carried out, and if the women who were found to be in a diseased state were taken and confined in the lock hospitals, the very fact that they were liable to such inspection would of itself act as a preventive, and it would be a beneficial system in time.

2398. Have they any other means of obtaining their living besides prostitution?—Perhaps not; but it is better for you to maintain them while sick than to leave them at large; it would cost very little compared with the destruction that one infected woman is sure to work in a regiment.

2399. Is the amount of inefficiency amongst the men from syphilis very great?—It is very great directly and indirectly; the average daily number of sick in most regiments of Europeans is about 20, seldom less than 15. The ratio of venereal cases to be treated is about 27 per cent. nearly.

2400. If you have any information of that sort perhaps you will be good enough to furnish the Com-

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mittee with it?—Some very valuable information will be found in Dr. Macpherson's reports, who was so impressed with the frightful evil which existed that he went to Calcutta, at his own expense to have an interview with Lord Canning, in order to try to awaken his attention to the subject.

2401. Do you know whether syphilis is less prevalent in temperate regiments than in intemperate regiments?—I think it, to say the least, fully as prevalent in India as at home.

2402. (*Col. Durand.*) Would not the establishment of lock hospitals in India, in point of fact, be more easily carried out in military cantonments than in Europe?—Undoubtedly.

2403. From the habits of the people?—Yes; from the ready obedience which they yield to authority, which is very remarkable.

2404. (*Dr. Farr.*) Is syphilis as prevalent among the native troops as among the Europeans?—Decidedly not, because the native soldier, where I have seen, is always married, or with very few exceptions.

2405. And in consequence syphilis is not so prevalent among them as among European soldiers?—No.

2406. (*Sir P. Cautley.*) Would it not be a good plan with reference to venereal complaints, to have running water at the urinals, and if not a reservoir of water, at least sufficient to supply a trickle?—Yes; it would of course be useful in many ways; it would promote the cleanliness of the place, and diminish the unpleasant smells of the urinals which, at most of the barracks and hospitals that I have seen, are very bad.

2407. (*Dr. Farr.*) Do you think it would be desirable to encourage marriage among British soldiers in India?—With regard to their state of health, unquestionably it would; but there are other reasons which might perhaps render it not desirable. Looking at the life of a married soldier in India, I think if he is located in a good patchery, he is better off and better cared for in every way; his wife takes more care of him, and he does not indulge in debauchery, in the way the unmarried soldier does.

2408. Has he the means of maintaining a wife and children?—He is assisted in that by Government; he could not support his wife and children merely on his own pay. If you encourage marriage to a very great extent, of course there must be assistance given to a large amount by the Government, and then it becomes a financial question of considerable importance.

2409. Do you imagine that the English race could under any circumstances establish themselves in India so as to maintain themselves as a race?—Never.

2410. (*Sir R. Martin.*) Not on the plains?—No.

2411. (*Dr. Farr.*) On the mountain ranges do you think they could?—There would be a certain amount of degeneration in the race on the best hill ranges.

2412. How do the planters thrive in India?—On the whole they enjoy very good health indeed; they are as a class healthy.

2413. (*Sir R. Martin.*) If marriage were permitted in a larger proportion amongst the British soldiers, and if also a larger proportion of them was located upon the mountain ranges, would not the soldier be happier and better in every way than he is now?—I do not think that there can be two opinions upon that point.

2414. You would recommend both of those things, that a larger proportion of the men should be permitted to marry, and that a larger proportion of them should be located on the mountain ranges?—Yes, provided you did locate them there, for I would not encourage marriage among European soldiers if they are to be located on the plains.

2415. (*Chairman.*) Is there anything which you wish to add to the evidence you have already given?—There is one subject upon which I intended to say a few words, and that is on the subject of the marches of Europeans in India. A few years ago there was

a great want of attention to that, particularly on the side of India to which I belonged; the marches were very long, and particularly for the native troops. A regiment was frequently marched from an extreme point in the south up to the most northerly station in India at one stretch, which was a march of 800 or 900 miles, and the same was very often the case with European troops; and not only so, but when an epidemic of cholera broke out in a regiment marching, no alteration was made in the plan of the reliefs, and other regiments that were coming down were very often, I may say constantly, not occasionally, but as a rule, sent down right upon the footsteps of the infected regiment; and the moment they got to the place where the cholera first appeared they immediately picked it up, and a frightful mortality and great loss of life took place, and great suffering. I do not exaggerate when I say that between Hyderabad and the coast I have seen, having come through and over the ground where a native regiment had been marching scourged with cholera, the roads and camping places covered with the half buried remains of the dead, and the country stinking from the same. Of late years I am glad to say that the old state of things has been corrected to a great extent, but still I do not think that the authorities in India are sufficiently impressed with the necessity of arranging the marches, and so regulating the reliefs as to give the shortest possible journeys, for it has been found that the longer the march the greater the sickness has been.

2416. (*Colonel Durand.*) To what do you attribute this, which is a remarkable fact, that the marches in the Madras army, and the reliefs of their troops, are much more accompanied by outbreaks of cholera than the marches in the other presidencies?—I attribute it very much to two causes, first of all, the extreme length of the march, when the soldiers become fatigued; they are in that state more prone to fall ready victims to any epidemic, and also, I may add, that they carry their families with them, and in marching their means are hardly sufficient to enable them to pay the charges for the carts in which their families are carried, and to feed both themselves and their families. Both sepoys and followers are thus half starved, the more followers you have in camp the greater is the risk of disease, particularly cholera. I have brought with me a paper for the express purpose of showing to the Committee the bad effects of very long marches; it is an article on *Insolatio*, by Dr. Barclay, of Her Majesty's 43rd Regiment, and with the permission of the Committee I will read one or two very short extracts to show the effect of long marches. He says, "It is not my intention to give here any detailed account of the long and weary march northwards which we commenced, as above stated, on the 24th of December 1857; or of the sanitary precautions to which, I believe, we owed in part our extraordinary immunity from sickness during the greater part of it. We proceeded by the usual stages and with the usual halts, *via* Gooty and Kurnool, to Secunderabad, where we arrived on the 8th of February 1858, and were detained for eight days. Marching again on the 17th, we proceeded through the Neermull jungle to Kamptee, where we arrived on the 27th of March. On the 1st of April we marched again for Jubbulpore, and we arrived there on the 17th of the same month, having crossed the Nerbudda the day before. During the first part of this long march throughout the greater part of the length of the Madras presidency, viz., while we continued in the Mysore territory, we had cool and bracing weather. When we descended into the ceded districts, however, the weather became sensibly hotter; and by the time that we arrived at Secunderabad, the residents at that station were already complaining of the severity of the heat. On the march from Secunderabad to Kamptee, and on that from Kamptee to Jubbulpore, the weather was for the most part very oppressive, the thermometer frequently exceeding 100° in the tents during the

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"day; but the nights were still generally comparatively cool. During this long march we had singular good fortune. We did not lose a man from sickness; we only left two sick men behind us. We had no epidemic diseases, and very little serious sickness of any kind. The march, however, had told seriously upon the men in general. They had lost their condition, and in a great measure their robust appearance, and they were obviously in urgent need of rest. This, however, they were not destined to obtain." This was a case of absolute necessity; it was a regiment moving during the mutiny, and they were obliged to pass on. "At Jubbulpore we received orders to proceed at once to division head-quarters at Nowgong, *via* Dumoh and Saugor, leaving a detachment of 250 men at the latter station, and another of 50 men at Jubbulpore. We marched again accordingly on the 22nd April, 50 of the men most urgently requiring rest having been selected and left to form the detachment ordered, and on the 27th we arrived at Dumoh. While there we received orders from the Governor-General to alter our route to Nagode, and, in compliance with these orders, we arrived at that station on the 8th of May, having marched 163 miles since leaving Jubbulpore. The heat in this march was excessive, and it told very much on the health of the men, already exhausted as they were, by a march of almost unexampled length. Our first casualty took place on the 5th of May, at which date we had been four months and thirteen days in the field, and had marched, according to my journal, 969 miles. The cause of death in this case was paralysis, the first symptoms of which occurred suddenly on the line of march on the 27th April. They were not attended with any degree of loss of consciousness until within a short time of the fatal termination. Next day a fatal case of insolation occurred, and from that date cases of that disease gradually increased in frequency." That was in Her Majesty's 43rd Regiment, a European regiment.

2417. (*Dr. Farr.*) What was the degree of mortality in the regiment?—It was very great. In this article that was written on insolation, the mortality tables have reference to that; but the mortality was very great. "On the evening of the 27th we arrived at Banda, where the remainder of the division had been resting and under cover for the previous six weeks. On the march from Nagode to that station, a distance of about 100 miles, by the route that we followed, we had lost two officers and 19 men;" and so on it goes, in proportion as the march was prolonged beyond a certain time. "On the march from Humeerpore to Calpee, however, the weather was again excessively hot, and the men suffered very severely. They were by this time completely worn out and prostrated. There was scarcely a man in the regiment whose strength was not reduced to a level with that of a child; and the officers were not in a very much better plight. Many men broke down altogether, and had to be carried as it could best be managed, in doolies and sick carts, and after they had been filled on baggage or commissariat carts. It was painful to see many others who, a few months

"before, had been in robust health and full of vigour, staggering from weakness as they endeavoured to keep up with the column, throwing themselves down completely exhausted at every halt, and scarcely able to rise from the ground when the assembly sounded."

2418. (*Sir R. Martin.*) So that it would appear that excessive fatigue predisposed the men to endemic and epidemic disease?—Yes.

2419. (*Dr. Farr.*) The great prevalence of mortality from insolation in all stations, you think, is referrible to the long marches?—No, not exactly; it is referrible to heat mainly, but long marches, to say the least, predispose men to such attacks.

2420. (*Col. Durand.*) You have mentioned that the circumstance of the families of the native troops accompanying them increases the chance of cholera; are you aware whether on the march when native troops are accompanied by their families, and with a large number of carts, any sanitary measures are resorted to?—With a good and intelligent commanding officer a good deal of attention is paid, and always with good effect. The native soldier keeps his family shut up in those carts, and in those cases many commanding officers have been at great pains to cause the whole of those carts to be uncovered, and everything in them taken out to be well aired, and that invariably has been attended with good effects. There is one other subject that I should like to mention, and that is the introduction of an ambulance system into India. At present the people of the bearer class, who were formerly to be had in great numbers, are gone; they are absorbed into the class of labourers, and as the improvement of the country advances they are taken up for the public works; they go to the coffee estates or are employed on railways, and they are no longer available. The consequence is, that something in the shape of an organized system for the transport of the sick and wounded has become absolutely necessary; this very regiment, the 43rd, that marched from Bangalore was so badly supplied with bearers, that the medical officers were obliged to be content with most ill contrived vans, or sick carts, from which the men suffered very much indeed. The Inspector-General at Madras has lately submitted to the Government a plan for the introduction of an ambulance system, consisting of light carts for bullock draught, each of those carts being capable of holding a certain number of sick—spring carts. I think that this is a subject well worthy of the attention of the Government, and to organize it into a regular system. I am sure that by-and-bye, if any military operations should be required in Southern India, the troops would be very much crippled for want of means of transporting their sick and wounded. I brought home models of those carts with me, and deposited them in the museum at Fort Pitt, and some of them have been sent to Calcutta, and have been very much approved; they possess this advantage over the bearer system, they greatly diminish the number of followers in an Indian camp; you must have six bearers for the transport of every sick or wounded man, while on the other hand, with a well organized ambulance, a cart with a pair of bullocks would require only one man.

The witness withdrew.

Saturday, 13th April 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.
Sir RANALD MARTIN, C.B., F.R.S.
J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.
Colonel GREATHED, C.B.

Colonel DURAND, C.B.
WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

Dr. J. McCosh.

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Dr. JOHN MCCOSH, Staff Surgeon, Bengal Army, Retired, examined.

2421. (*Chairman.*) Will you state how long you have served in India?—I have served for about 25 years from first to last; 21 years of actual service.

2422. Have you served with Queen's troops?—I have never served with Queen's troops, unless with recruits on board ship. I have served much with the Company's European troops.

2423. In what Presidency have you served?—In Bengal.

2424. At what stations have you served?—I have been in most stations—from Rangoon to Peshawur.

2425. Will you enumerate some of the various stations at which you have been?—To begin with the south. I served throughout the Cole campaign, the Mahratta, the Punjab, and the Burmese wars. I have been stationed at Rangoon and Prome, and visited almost all the other stations in Burmah on various expeditions during the late war.

2426. Are there any of the stations which appear to you to require special notice on account of their unhealthiness, or their liability to malaria?—I think Prome particularly.

2427. (*Sir Proby Cautley.*) I believe that you published a work on Assam?—I did publish a topography of Assam.

2428. You were resident, I believe, there for some time?—I was resident for several years in Assam.

2429. (*Chairman.*) To revert to Prome, will you be good enough to state to the Commission what the peculiarities of Prome are which render that station, in your opinion, especially unhealthy?—In the first place it is completely shut out from the prevailing current of wind by a range of hills. It is also completely inundated to a very large extent, with very few exceptions. There are few parts not raised by artificial means, which are above the water during the rainy season.

2430. What is the prevailing wind?—Generally the south-west and north-east monsoons.

2431. Do you say that the station is shut out from both of those winds?—Chiefly from the south-west, the prevailing wind of the hot season.

2432. You say that in the wet season it is inundated to a considerable extent; for what period of time does that inundation generally last?—For three or four months.

2433. During that time I suppose it is impossible for the men to go about?—It is, only on the artificial embankments and by boats.

2434. At what time were you acquainted with the station at Prome?—I went with the first expedition to Prome in September, I think, of 1852, and before the inundation had subsided.

2435. Do you know what steps have been taken to secure the station itself from the unhealthy effects of the inundation?—I believe the intention once was, to abandon it altogether, and it was proposed before I left Burmah, to have a new cantonment about six miles lower down, upon a spur of the hills that run into the Irrawaddy. They attempted to make a cantonment at Namean.

2436. (*Sir R. Martin.*) That proved as unhealthy as Prome, did it not?—Yes, and perhaps more so. The station at Namean was selected on a beautiful slope, well raised above all inundation; but it was in a forest. The site was selected in a forest, and the trees were obliged to be cut down, and in fact the ground had to be cleared as if it had been an impen-

trable jungle. It was taken possession of almost immediately, and it turned out to be very unhealthy. Nevertheless, I think Namean with proper clearance and drainage might be made as healthy as any station in the interior of Burmah.

2437. (*Chairman.*) When was the station at Prome first occupied?—In the month of September, and the troops never entirely left it after they took possession of it.

2438. Were you there at the time that its occupation was decided upon?—Yes, I was.

2439. Was it selected with any reference to sanitary conditions, or was it selected exclusively for military purposes?—I believe it was selected without any reference to sanitary considerations, but merely because it was an important town of the Burmese empire.

2440. Do you think that in a sanitary point of view the abandonment of the station at Prome would be desirable?—I should think it would be desirable, because it has been very unhealthy, and I do not see how it can be made healthy.

2441. The unhealthiness arises, I presume, from the physical peculiarities of the site, and not from any faulty construction in the buildings, or the general arrangement?—When I was there, we had nothing but the most temporary accommodation.

2442. It is not a station which you think can ever be made a healthy station for occupation by European troops?—I do not think it is.

2443. Is there any high ground, or any mountain range within a convenient distance of Prome, to which the troops could be removed when necessary?—There is a small range of hills overlooking Prome, but the height of the hills is not above 500 feet.

2444. Therefore no material improvement probably would be gained by removing the troops to those hills?—No; we built cantonments, and barracks, and houses upon those hills, but I do not think that we improved our position much by that.

2445. Will you be good enough to state which is the nearest range of hills to Prome, giving in round numbers the height, 1,500 or 2,000 feet?—There is a range of hills running parallel to the coast not more than 50 or 60 miles from Prome, between Prome and the Aracan coast about that elevation.

2446. What means of communication are there between that range of hills and Rangoon?—There are no direct roads. There was a survey made of a road across while I was at Prome. Major Yule, of the Bengal Engineers, made a survey from the Aracan coast to Prome, and a practical road has since been made over the chain of mountains.

2447. (*Sir R. Martin.*) Along the former Burmese road?—That I am not aware of; but at any rate across the mountains.

2448. (*Sir P. Cautley.*) Over the Aeng pass?—Probably.

2449. (*Sir R. Martin.*) The road pursued by Capt. Trant after the first Burmese war?—I do not know whether Major Yule selected that identical road, but that a new road was constructed I know.

2450. (*Chairman.*) Are you acquainted with the navigation of the river up to Prome?—Yes, I have gone up and down it a good many times.

2451. In the event of Prome being abandoned as a station, can you state whether at all times of the year there would be an easy mode of communication

for troops up the river from Rangoon?—Perfectly easy. The steamers run from Rangoon to Prome, and very much higher up the river at all seasons of the year. The navigation of the Irrawaddy is very easy; indeed, more easy than that of the Ganges.

2452. (*Sir R. Martin.*) Owing to its comparatively straight course?—Yes; and to there being plenty of water.

2453. (*Chairman.*) Is there a station at Tongoo?—Yes, there is; but I have never been there.

2454. Coming down to Rangoon, can you give the Commission any information as to the characteristics, in a sanitary point of view, of that station?—Rangoon is situated upon red primitive soil, and is liable to be inundated all round; but the cantonments stand upon the primitive clay soil well raised.

2455. And it is liable to be inundated all round?—Yes, and particularly the city is liable to be inundated, but most of the inundation is tidal.

2456. (*Dr. Sutherland.*) Is there not a saying that the Burman Hills are unhealthy, but that the Burman mud is healthy?—I am not aware of that. I know that we were all very careful not to enter those hills in the hot and rainy season of the year.

2457. (*Chairman.*) How long were you stationed at Rangoon?—I was stationed there two, or three, or four months on several occasions, as the emergencies of the service required.

2458. Were you there long enough to be enabled to judge as to its general healthiness?—Yes, certainly.

2459. Except with regard to the annual inundations, do you consider it an unhealthy post?—No, I do not; I think that Rangoon is a very healthy place for the tropics.

2460. I believe it has the benefit of the sea breeze?—Yes; and in that respect it is preferable to Calcutta.

2461. (*Col. Durand.*) Is it well open to the south-west monsoon?—Very much so; the monsoon blows very fresh at Rangoon.

2462. (*Dr. Farr.*) Do you think that Rangoon is not much better than Calcutta?—It is very much better; and if it had the advantages of Calcutta, with respect to drainage, it would surpass it still more in point of health.

2463. (*Sir R. Martin.*) And you would, I presume, say the same of Pegu generally, as compared with Bengal proper?—Yes.

2464. (*Col. Durand.*) In what sort of barracks were the European troops in Rangoon?—After the capture of Rangoon the troops were quartered in ruined houses and pagodas, and the covered staircases leading up to the great pagoda. Officers were content to have a corner of a room 20 feet square, and some built huts. I built my own hut in eight days, and thought myself well housed for the season. Afterwards there were good barracks; they were all built of teak; stout timbers were sunk three or four feet into the ground six or eight feet apart as a foundation; the floors were planked and raised about three feet above the ground, and the barracks were mounted by a ladder, about as high as this table. The walls were built with planks overlapping one another, and the roofs were made of thatch.

2465. And you found those barracks very healthy?—Very much so, considering all things.

2466. (*Sir P. Cautley.*) Were the floors hollow underneath?—Yes, about three feet above ground.

2467. And pervious to the wind?—Yes.

2468. (*Col. Durand.*) Were there similar barracks for the men at Prome?—Yes, exactly; that is, eventually; not at first starting; for we were glad at first to get under cover anywhere.

2469. In Burmah, I suppose, the hospitals were constructed exactly in the same way?—Not at first, but eventually they were. On first landing and for months afterwards ruined houses were converted into hospitals.

2470. (*Chairman.*) It is some time since you left those stations?—Yes, it is seven years since I left Burmah.

2471. Since then there has been a good deal done, I believe, in the way of improving the internal arrangements?—I have no doubt that there has.

2472. Is there any range of hills suitable for a station within a moderate distance of Rangoon, to which part of the garrison of Rangoon could be sent? There is none within perhaps 100 miles; there is the great Aracan chain, ending in Cape Negrais.

2473. But there are no moderate elevations of 1,500 or 2,000 feet nearer than that?—Not nearer than that range.

2474. The whole of the country round is a low alluvial plain, is it not?—Yes, it is all inundated, with a few exceptions, but the soil is of hard red clay generally.

2475. Therefore, if Rangoon is to be occupied as a strategical point, and it becomes absolutely necessary that troops shall be stationed there, is there any place in the neighbourhood to which they could be sent with great sanitary advantage?—No hills nearer than that range. There was a sanitarium erected on the island of Amherst during the late war, and I thought favourably of it.

2476. Are there any peculiar precautions taken against any unhealthiness which may be produced by these annual floods of which you have spoken?—I do not see what can be done. The country will be inundated, and there is no means of protecting it from the inundation. The chief precaution to be taken is to have a rapid drainage when the river subsides, and that, I think, is generally neglected.

2477. I presume that the time at which these inundations are most unhealthy is not at the time when the water has reached its maximum height, but rather when it is retiring, and leaving an expanse of mud?—Yes; in September, when the river has fallen down low, and the great mass of the water has run out, there are thousands of miles of stagnant water all over the country, which are allowed to dry by evaporation; and they might all be drained after the rains.

2478. But to do that to such an extent as to affect the salubrity of the station would involve, would it not, an immense amount of labour and expense?—I do not think that it would.

2479. What kind of drainage do you mean? Do you mean cutting main channels?—I mean open ditches. The river after the rains may fall 30 or 40 feet, giving any amount of fall that may be required for the drainage.

2480. But the water which has been spread over the country has no means of escape?—No, only by evaporation.

2481. (*Col. Durand.*) Is not the alluvial land of the Irrawaddy almost everywhere intersected by a great many nullahs, which form the natural drainage of the country?—It is; but there is still an immense expanse of water which is not benefited by that drainage, on the flat ground between the nullahs.

2482. Have you ever had an opportunity of forming an opinion by actual comparison and experience of the relative advantages and healthiness of barracks constructed as those were which you have described to us, and of masonry buildings, for troops in that country?—I have not seen what they call Puckah barracks in Burmah.

2483. Nor have you seen the men lodged in masonry buildings?—Not in Burmah.

2484. Were you ever in the provinces south of Burmah?—I was never settled there. I have been at Moulmein, Martaban, and Amherst on one occasion, but I was never cantoned there.

2485. (*Sir R. Martin.*) Have you served at Meaday?—Yes; I was at the occupation of it.

2486. Do you consider that place preferable?—It promised to be an exceedingly good cantonment, but a finer site was found a little lower down on the opposite side of the river at Thayetmyo, and that is now the great frontier station, the advanced post in Burmah on the right bank of the river.

2487. (*Chairman.*) I think you have stated that the construction and the internal arrangements of the

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Dr. J. McCosh. stations have been considerably altered since you left India?—I have no doubt that they have been.

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2488. Therefore it would be useless to question you as to their present condition in that respect?—Yes; I may mention that I have been cantoned for three years in the Himalaya mountains.

2489. In what part?—In Kumaon at Almorah.

2490. Had you any considerable number of men under your charge at Almorah?—I had a regiment of native infantry, the civil station, and the invalid officers from the plains.

2491. Was that station used as a sanitarium for European troops?—No, not for European troops, but for European officers.

2492. The height above the sea is considerable, is it not?—5,600 feet.

2493. What accommodation is there in Kumaon for European troops upon a large scale?—There are means of cantoning any amount of European troops in those hills.

2494. Is there a considerable expanse of level, or nearly level ground?—Yes, between Almorah and Lohoghaut I believe that 10,000 troops might be comfortably cantoned along those hills. Very perfect sites for cantonments could be found on the Deo-Dhoora range, near the halting places of Dee and Furkah, 6,000 to 7,000 feet above the sea. There is a small station at Lohoghaut, and a very good cantonment could be made there for a European regiment; its elevation is 5,500 feet. I think that the best elevation; to go higher is to get more fog and more rain, and a rigorous winter. I think most of the hill stations are 1,000 to 1,500 feet too high. I would prefer the northern slope of the range to the summit. At a point 1,500 feet below the level of the ridge the mist and rain are but little felt, owing to the clouds being blown over it, a fact well established. Troops might have a camp for exercise in the Terrai during the cold weather, and they might be then employed in clearing the jungle. From 15th November to 15th February the Terrai is as healthy as Upper India.

2495. What means of access would they have to the plains?—The roads are not very good, but still they are passable for troops.

2496. How many days' march would bring them down to the plains?—They might leave the hills; take, for example, Lohoghaut, and two days' march would bring them into the plains, perhaps one forced march would.

2497. Is any part of the country through which the troops would have to pass, in moving down upon the plains, unhealthy?—Very much so during the rainy season; in fact it is not passable for troops at that season.

2498. Therefore one must consider that troops who were sent up to Kumaon would be locked up there during a part of the year?—There are means of clearing enough to make a passage quite safe; the Terrai might be cleared so as to admit of troops passing at all seasons of the year.

2499. (*Dr. Farr.*) To what do you ascribe the insalubrity of that particular spot?—It is difficult to say; for it is not a marsh, generally speaking; it is perhaps from excessive jungle and forest.

2500. It may be unsafe to remain in it for two or three days, but would it be unsafe to pass through it?—It would be if not cleared; people pass through the Terrai going to Mussourie at all seasons of the year, and they do not apprehend anything from it.

2501. Do you think that the water is bad, and that they take disease from the water which they obtain in that district?—I should not blame the water very much. We are in the habit of using the vague word malaria to account for fever, and just form an impression that there is something generated by that excessive vegetation and excessive forest growth that is injurious to health.

2502. Do you think that such arrangements could be made as to enable troops to pass with comparative safety through it?—Yes; perfectly. If there was a

railway driven up to the foot of the hills from Kanouge, the troops might leave the cantonment in the morning, be on the railway by the evening, and by the next morning be on the banks of the Ganges. The country between the hills and the Ganges is as level as a bowling green, with no heavy rivers to pass, no cuttings or embankments necessary, and the distance from Burrum-deo to Kanouge is about 150 miles only. By fixing on Kanouge as the station the hills would be reached without having any heavy rivers to cross, and the line would be north and south.

2503. There is no railway at the present time?—No.

2504. Is any railway in contemplation?—I do not think so. In a mercantile point of view there is no inducement.

2505. It would not pay as a commercial enterprise?—No.

2506. Independently of a railway, do you think that such arrangements could be made on the road as would very much lessen the danger of passing the Terrai?—Yes.

2507. (*Sir P. Cautley.*) You make a great distinction, do you not, between the Terrai at the foot of the Almorah hills, and the country at the foot of the Mussourie hills?—Yes; there is a certain difference, as there the Dhera-dhoon intervenes and occupies the position in place of the Terrai, and the Dhoon is very healthy.

2508. As far back as 1854 the whole of the jungle, up to the foot of the hills, was cleared, and which I recollect to have been 10 or 12 miles wide, but people used to pass up at all seasons of the year, without any risk of sickness or malaria, whereas they would not have done the same thing on the other side of the Ganges in going to Almorah?—I should not apprehend any danger, with a proper amount of clearing, from Bareilly right up to Almorah.

2509. (*Chairman.*) Have you considered generally the question of the climate of the hill stations in the Himalayas?—Yes; it has been my study for years.

2510. Will you say whether, generally, you consider it advisable that a large proportion of the European troops should be quartered there, assuming the possibility of so quartering them, in a financial point of view?—I think it is very desirable, and that it would be very conducive to the effective strength of regiments.

2511. In a sanitary point of view, you would desire to see as large a proportion as possible of the European force stationed on the hills, rather than on the plains?—Yes; I would.

2512. Do you consider that troops suddenly taken from the hill stations in the hot season, and marched down upon the plains, would bear the heat as well as or better than troops that had been previously stationed in the plains?—That admits of many views. The troops that had been stationed at Kussowlie, Dugshai, and Subathoo, were marched down to Delhi at the beginning of the mutiny, went through the whole of their exposure well, and were perhaps more healthy than if they had been in a quiet cantonment.

2513. I will put the question to you in the most general form. Is a man better prepared to endure extreme heat after having been exposed to it for a considerable time previously, or when he is brought into it from a temperate climate?—I should think that a man leaving a temperate climate could endure the heat better. New-comers do not feel the heat so much as old Indians do.

2514. So that in fact you are of opinion that continued exposure to heat, instead of creating a greater power of endurance of heat, diminishes the power?—I think it produces more debility, which increases with the time of exposure.

2515. (*Sir R. Martin.*) You are aware probably that the troops, who had been recruited from the southern provinces of France, bore exposure in Egypt, and also those, on the retreat from Moscow, better than even the natives of Holland and Germany, showing that a temperate region qualifies men for service

in a certain degree?—Yes; but there are many co-operative circumstances that I think would neutralize any such advantages.

2516. But you are aware of the fact I have stated?—Yes; I believe it is a fact, but I quote the case of the European troops who left the hill stations for Delhi, and who suffered comparatively little from the extreme change.

2517. (*Col. Greathed.*) As compared with troops that came from hot stations?—Yes.

2518. The 8th and the 61st regiments?—Yes.

2519. They did not get so much cholera?—That again is an accidental circumstance; for cholera may seize on the healthiest regiment, and pass over the most sickly.

2520. (*Sir R. Martin.*) Cholera, in the instance referred to, was almost the only disease I believe that visited the troops on that march?—Perhaps it was.

2521. (*Col. Durand.*) You have, of course, paid attention to the force of the sun's rays upon the hills?—Yes, I have, but not particularly as to figures.

2522. You are aware that the men are constantly out, and exposed to it?—Yes; in the hills we thought nothing of being out all day in the sun. The thermometer in the shade rarely rises to 80° in the hottest days; frost lies white every morning during most of the winter, and once or twice a year a heavy fall of snow takes place. At 5,000 feet of elevation the snow melts in one day, but at 7,000 it lies for months.

2523. And you went out without suffering at all?—Yes; we never thought of it more than we do in England.

2524. Do you think that that has any effect in preparing the men for exposure in the plains, bearing in mind the force of the sun's rays at those altitudes?—It might, or it might not; we apprehend nothing from the rays of the sun up in the hills at an altitude of 7,000 feet.

2525. I was speaking with reference to the force of the rays of the sun, or the heat of the sun, on the hills at those altitudes, when, as they very often are in valleys and sheltered places, the men are not exposed to the winds which very much temper the climate of those altitudes. Have you ever experimented upon the temperature to which the men expose themselves for hours?—No, not particularly, farther than judging by my own feelings.

2526. (*Sir P. Cautley.*) Instances of coup-de-soleil have occurred at Simla and Mussourie?—Yes; but we have had instances of coup-de-soleil in even more temperate climates than that.

2527. (*Dr. Farr.*) Can you give any other instances showing that troops moving from the high grounds endure the climate of the plains better than troops residing upon the plains?—No, I cannot. I merely gave the instance to which I have referred, of the troops leaving the hill stations and going down to Delhi, as a historical fact, which is well known.

2528. (*Sir R. Martin.*) Exemption from the diseases of the plains would go a considerable way, would it not, to account for the healthiness of the men descending from the mountain ranges?—Yes; but I should attribute a great part of it to the excitement of the time, which carried them through, when perhaps, under ordinary circumstances, they would have broken down.

2529. (*Dr. Farr.*) I believe you are the author of a systematic work on diseases of India?—Yes; I have written a general sort of text book on the health of troops in India.

2530. And of the means of protecting the soldier against the climate of that country?—Yes; I have written a text book on that subject, more particularly for officers.

2531. To what do you refer the advantages of residing in hill stations chiefly?—To the cool temperature, which is the principal thing; to the absence of malaria, which is another; and to the absence of

epidemics, cholera, small-pox, and fevers, generally speaking. *Dr. J. McCosh.*

2532. What should you say about dysentery?—That is just the weak point of the hill stations, because in all the hill stations I believe, without exception, there is a disposition to diarrhoea, which, in extreme cases, runs into dysentery.

2533. Does that attach inevitably to the hill stations?—It is so common that very few officers, with all the comforts of a good house and good living, escape an attack of diarrhoea during their first year upon the hills.

2534. (*Sir R. Martin.*) Is that the case at Missourie?—I believe it is a little better generally than some of the other stations, but I think that that is the prevailing character of almost all the Himalayan hills.

2535. (*Dr. Farr.*) Is it a fatal diarrhoea to which you refer?—No; we rather laugh at it; we call it the trot. A man has the diarrhoea perhaps for a few days, or a few weeks, and if he is a stout hale man, he becomes perhaps all the better for it.

2536. It is not of so serious a nature as to make the hill stations anything like so injurious to the men as the diseases to which they are liable on the plains?—Not if a man is otherwise healthy; but I can give you instances of this kind. There was my old regiment, the 2nd European Fusiliers, that I had charge of for about two years. That regiment had gone through a great deal of service in Sind, and had contracted scurvy to a very large extent, from want of vegetable diet; they were sent to Subathoo, where there is a predisposition to diarrhoea, and the mortality there was very great indeed. There was also Her Majesty's 29th regiment; they had gone through a similar routine of service; they were sent to Kussowlie, and scurvy was epidemic amongst them; they suffered excessively from diarrhoea.

2537. (*Sir R. Martin.*) But in both those instances I believe that each regiment was in a most unfavourable sanitary condition previously to being sent to those places?—Yes; they were in a scorbutic state.

2538. And fever and dysentery prevailed?—Yes; my own regiment, after it came down to the plains, went through the Punjab campaign, and when I took charge of it after the battle of Goojerat, I found nearly one half of the regiment suffering from scurvy. After returning to Lahore I did my best for the men, and made an urgent statement to the Commander-in-Chief, Sir Charles Napier, and got a special allowance of half a pound of vegetables daily for each man; but with all that, diarrhoea was very prevalent in the regiment, and was very fatal at Lahore.

2539. (*Dr. Farr.*) Is scurvy a common affection in India?—Yes; in Upper India, along the banks of Sutlej and the Indus, and especially in Sind, I believe what is called Sind boil to be one of the symptoms of scurvy.

2540. To what do you ascribe that?—I believe generally to the absence of vegetable diet suitable for the European soldier.

2541. In those hill stations do they obtain access to antiscorbutic food, such as you think they ought to have?—Vegetable diet is very abundant in the hills.

2542. (*Sir R. Martin.*) And fruit?—Yes. All European fruits and vegetables grow to perfection here.

2543. (*Dr. Farr.*) There is no difficulty in supplying them with antiscorbutic vegetables?—None, provided arrangements are made to furnish them. I may mention that since the time when the special concession was made to the second European Fusiliers, the allowance of vegetables has been doubled, and a pound of vegetables is now allowed to each man. Throughout India each soldier now receives a pound of fresh vegetables daily.

2544. Since what date has that been?—Probably since 1856.

2545. Is the diarrhoea of the hills at all of a scorbutic character?—Not necessarily so.

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2546. (*Sir R. Martin.*) But it was so in the instances you have stated?—Yes, the diarrhoea acted upon a scorbutic constitution.

2547. (*Col. Durand.*) Generally speaking to what do you ascribe the diarrhoea which prevails in the hills?—That is a difficult matter to answer. I puzzled myself a good deal to come to any decided conclusion about it, and the utmost that I can do is to attribute it to two or three causes combining.

2548. What were those combining causes?—I think, in the first place, the greatly reduced pressure of the atmosphere has a very important effect; for instance, at 20,000 feet of elevation the atmospheric pressure is reduced to nearly one half of its normal condition, and the barometer falls to 15 or 16 inches. At 5,000 and 6,000 feet it may stand at 23 inches. The internal pressure upon the bowels is consequently reduced, and there is a greater disposition to serous effusion in the intestinal canal than when the pressure is greater, as in the plains. Then there is another cause. The liver in almost all cases of diarrhoea is more or less affected, the secretion of bile is much reduced, and an effort is made by nature to lubricate the bowels by diarrhoea.

2549. (*Sir R. Martin.*) Do not the damp and the cold act injuriously upon the frames of the soldiers who have been habituated to the heat of the plains?—No doubt they do to a certain extent.

2550. (*Sir P. Cautley.*) The natives, I believe, all attribute it to the water?—Yes, to the air and the water.

2551. Then the question arises whether the water may not be the cause?—Yes; but I can give you an instance where the water was not concerned. I remember that the bishop of Calcutta made a visit to Almorah; he was aware that diarrhoea was very prevalent in those hills, and he brought up his own water, bottled at the hot spring near Mongyr, and had it carried up in chests to Almorah, but he had not been ten days in the station before he had the diarrhoea; yet he used only the water of the plains.

2552. (*Col. Durand.*) Do you not think that great alternations of temperature have something to do with it?—Yes; the perspiration is immensely reduced after leaving the plains, and going up to the hills; consequently the effusion by the skin is perhaps made up for by an extra secretion from the bowels; and that is another important cause.

2553. (*Chairman.*) I gather from what you have stated that it is your opinion that although the hill stations are excellent for the health of European troops who had not been previously quartered in the plains, yet there is some doubt how far they are suitable for men who have been exposed to great heat in the plains?—It depends upon what they suffer from; if there is a predisposition to consumption, or dysentery, or diarrhoea, or inflammation of the liver, or rheumatism; such men should not be sent to the hills.

2554. (*Sir R. Martin.*) Generally speaking, you would regard the mountain stations as more valuable for the prevention of disease, than for its cure?—Generally speaking, I would; but with regard to the majority of diseases that the troops suffer from, I should say that they benefit largely by the hills.

2555. All diseases of the fever class?—Yes; and a more important class than any that the men suffer from, namely, from having nothing to do, from ennui, and being confined in some remote part of the country; those men that would be good for nothing in the plains, even if they were going upon service, if sent to the hills, would return from the hills hale and active men. I know that the men do not like the hills, but that officers do, and consider it a great boon to be allowed six months' leave to visit them during the hot season.

2556. (*Chairman.*) It is one advantage of a hill station, is it not, that the men are able to take exercise and amuse themselves in the open air?—Yes; and exercise I considered the greatest enjoyment that I had in the hills, walking 10 or 15 miles at a stretch.

2557. (*Dr. Farr.*) Are the natives healthy in

those hill stations?—They generally are, but they have also their epidemics, and strange epidemics too. In Kumaon there is a disease that bears a close resemblance to the plague, and now and then this breaks out amongst the natives, at elevations of 7,000, 8,000, and 9,000 feet, and the mortality is awful. It is called mahamurry, or the great murrain. Goitre is very common on limestone formations, and sometimes small-pox, but cholera is very seldom known in the hills.

2558. (*Dr. Farr.*) Are the native troops healthy on the hills?—They enjoy a very fair amount of health.

2559. Do they suffer from diarrhoea?—Yes; they do.

2560. (*Col. Durand.*) Have you ever known Europeans, either officers or privates, taken with that peculiar hill disease?—No; I have never known an instance of mahamurry in Europeans.

2561. (*Col. Greathed.*) The natives are a very dirty race are they not?—Yes; and one of their most objectionable habits is this; they have the cattle under the same roof with themselves, their houses are generally built upon a hill, and the lower apartment is used for the cattle, they themselves living above it, and all the dung, and all the offal, and offensive matter of the cow-shed is immediately below them. The clothing of the natives is made either of coarse wool or hemp, and is very seldom washed.

2562. (*Sir R. Martin.*) The fever of which you speak has been, has it not, referred to sanitary neglects?—Yes; it has been, and a great deal has been done by the civil authorities to introduce more cleanly habits.

2563. (*Chairman.*) Is there always at the hill stations with which you are acquainted, a sufficient supply of water for all purposes of cleanliness?—In Kumaon there is, and always has been, but in some of the stations there is not; for instance, at Landour they are obliged to bring the water up from a descent perhaps of 1,000 or 1,500 feet.

2564. (*Sir P. Cautley.*) But not all the year round I think?—I think that there are no springs upon the hill of Landour; I am not aware of any, and the only supply of water is got from a spring, perhaps 500 feet below the level of Mussourie.

2565. There is a great difference in the height of the springs in different parts of the year, that is to say, in June the springs get very low?—Yes, very; perhaps the highest spring may be 1,000 or 1,500 feet below the level of the ridge.

2566. (*Chairman.*) If the practice were adopted upon a large scale of quartering European troops in the hill stations instead of upon the plains, would there not be considerable difficulty in finding stations with a sufficient supply of water?—I do not think so, I think that upon any range in the Himalayas, if there is no water upon the summit of a range, you will find water at 1,000 or 1,200 feet lower down, and this site may be preferable to a station on a ridge.

2567. (*Dr. Sutherland.*) Have you ever observed any difference in the various stations in the healthiness of the British troops, infantry, cavalry and artillery?—Decidedly, a very great difference.

2568. Which arm of the service have you found to be the most healthy?—I think the European artillery decidedly were the most healthy.

2569. To what do you attribute their superior healthiness?—Because they are a superior class of men altogether to any other troops in India.

2570. Is there anything in their habits distinguishing them from the other arms of the service, which in your opinion leads to higher efficiency?—Yes; They are men of more intellect, men who know the value of their own lives, and who take more care of themselves. They generally look to staff appointments as their rewards, to be commissariat conductors, garrison sergeants, and staff sergeants in native corps, and many aspire to commissions. Most of them are well educated, and students of law,

physic, and divinity are not unusual in a battalion or troop of artillery.

2571. Are they confined to barracks, like the infantry generally?—Much the same.

2572. At some stations are they not allowed to go out at all times of the day?—They take it upon themselves to do it, although there may be standing orders that they are to remain in barracks, but European troops generally will straggle out.

2573. Are these men generally speaking more temperate?—Generally they are; and not only that, but they are a very superior class of men compared with the soldiers of the line.

2574. (*Sir R. Martin.*) Was that in consequence of there having been a more careful selection in recruiting the men, or do you think that the training of the men in the artillery is the cause?—I think no doubt it is attributable to more careful selection in recruiting; but there is a higher moral standard amongst artillerymen.

2575. (*Dr. Sutherland.*) Do you think that any part of the superior health which they enjoy is due to taking greater exercise?—No doubt exercise must be very conducive to health.

2576. And they have more exercise have they not?—They have.

2577. They work more with their arms?—Yes.

2578. (*Col. Greathed.*) Do you think that they are more healthy than the dragoons?—Yes; I should think they were.

2579. (*Sir R. Martin.*) The dragoons have an advantage over the infantry, that they are confined to the plains of India, and are never brought into the countries of the great waters?—Yes; their range of service is very local, and they have the best stations.

2580. (*Dr. Farr.*) You were I believe attached to the artillery yourself?—Yes; I served through the Burmese war with the artillery.

2581. (*Col. Durand.*) The horse artillery or foot artillery?—A horse battery.

2582. (*Chairman.*) With regard to the rations that are served to the men, do you consider that sufficient care is exercised to supply them with a proper variety of food?—Yes; I think that every care is taken as to the rations of the soldier.

2583. Were proper rations supplied to them in your time?—In Burmah we had salt provisions twice a week, but generally speaking in the cantonments in India fresh provisions are served out every day.

2584. Was there any variety in the meat?—Beef was served out on certain days, and mutton and pork so many days each.

2585. I think it has been stated in evidence that except on the march no ration of spirits is given out, but the soldier obtains his spirits at the canteen?—Yes; I think it is generally the case that he gets his drams, two tots a day in the canteen. In camp he goes by beat of drum, and gets his dram.

2586. In camp you say that he receives his dram regularly?—Yes.

2587. Has he the option of substituting beer for spirits?—He has; but not upon the line of march.

2588. If he prefers not to consume either spirits or beer, does he get the value of his dram in money?—Yes; that is, he does not pay for it.

2589. (*Col. Greathed.*) But it is not considered a part of the soldier's ration is it?—Not necessarily.

2590. Is it at all considered a part of his ration?—The soldier has the option of taking his two drams a day if he wishes, or not; if he does not drink it he does not pay for it.

2591. He pays for the rest of his rations?—Yes.

2592. And he does not get the money back under any circumstances?—No; but if he does not drink his dram he is not debited for it.

2593. Is the spirit a part of the soldier's ration or not?—No; I should not call it a part of the ration, for it is an entirely optional thing; a great many of the men will not take it at all. I think that ale might be more generally introduced in European regiments than it is. Good Bass and Allsop's ale is served out

by the commissariat to the soldiers at three anas a quart. This is, perhaps, only half, or one-third its cost price, and the Government bear the remainder. Very good ale is brewed at Simla, Kussowlie, and Mussourie by European brewers, and on a very considerable scale, and sold at three or four anas a quart. I believe that the hill stations could be made to supply the whole army with good wholesome ale. Barley grows to perfection on the hills, and though hops will not ripen before the rains set in, and the crops are thus lost, yet they would grow well in the valley of Kunawur, and if required any quantity could be got from it. The cold weather of the hills is most favourable for brewing, and contractors would readily come forward if a heavy contract were ensured them. Government might thus save a quarter of a million annually upon ale alone.

2594. (*Col. Durand.*) Did you ever pay any attention in India to the cooking of the ration of the soldier?—Yes, I have; I made a point of frequently visiting the place where the soldier's cooking was going on, and of inspecting their mode of cooking; I have entered into all those particulars.

2595. What is your opinion of the mode which is followed with reference to feeding the soldier?—The mode is very satisfactory. The men are told off into messes; each mess has its own cook or cooks, and generally speaking, their rations are cooked according to their own taste.

2596. Do you think that the cooking is pretty good?—It satisfies them generally; if a man is very particular he can cook his own dinner, or superintend the cooking of it after his own taste.

2597. (*Dr. Sutherland.*) You have stated that the better health enjoyed by the artillery depends upon their being better men in the first instance; do you think it would be possible to secure to the other arms of the service the same advantage, that of enjoying better health by supplying the recruits with some printed instructions as to how they should conduct themselves, and what precautions they should take on going from England to India, and after they get to India?—Yes, no doubt, I think that the greatest field for the improvement of the soldier lies there.

2598. If some simple instructions were drawn up, and handed to every recruit, do you think that they have sufficient intelligence to comprehend and act upon such instructions?—I am not sure that they would generally attend to them.

2599. But do you think that such a proceeding would be followed generally by a good result?—Yes, there might be a good result.

2600. (*Sir R. Martin.*) In the old battalions of the company, but especially in the artillery regiments, there were traditional habits and customs which the men imparted to the young recruits on their arrival, and which were found useful, were they not?—Yes; both useful and the contrary. The traditions in those respects are very strong in regiments whether for good or for bad.

2601. (*Col. Greathed.*) Are you aware that special instructions are given to every detachment when they land in India now, for the preservation of the health of the troops that go out?—Yes.

2602. Special printed instructions issued under authority?—Yes, I believe they are; still it has not come within my experience.

2603. (*Dr. Farr.*) In speaking of the artillery you refer, I presume, only to the artillery of the East India Company?—Yes.

2604. Are you sure that the mortality among the artillery is lower than the mortality among other arms of the service?—I should say generally in India that it is.

2605. But you have not examined the returns upon that point?—No, not as to the figures.

2606. Your book, I believe, is chiefly addressed to officers?—Yes, but to the men too.

2607. Do you think that the suggestion of Dr. Sutherland might not be carried out, and that a small tract on the basis of your book might be drawn up,

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addressed to the men, and placed in their hands?—Yes, I think it might be. I wish to state that it seems to me that the European soldier has not inducement enough to live. I think that in order to improve the health of the soldier, he ought to have some more inducement to live, and to have the means of living when he is discharged.

2608. (*Sir R. Martin.*) The ennui of barrack life on the plains deprives him of the right motive for existence?—Yes, he has no motive for existence beyond his period of service.

2609. (*Chairman.*) You believe that a powerful agency for the prevention of sickness is to be found in the will of the individual?—Yes, in something in prospect—something to hope for when he has completed his term of service.

2610. You think that the European soldier in India becomes absolutely indifferent to life?—Yes, and no one who has not witnessed it would believe how little they regard life.

2611. (*Col. Durand.*) And which indifference you attribute, as I understand you, to the want of some future prospect?—Yes, an inducement to live. I think that this is wanted more than any other object I can suggest, *the means of living when discharged.*

2612. (*Sir R. Martin.*) Have you observed the influence of ennui on the discipline of the European soldier?—Yes, it is the greatest evil that the soldier has to suffer from, and the greatest difficulty that a surgeon has to encounter is that ennui, which is induced by perfect idleness. There is a constant struggle between the men and the medical officers, the men rushing to their graves, the surgeons trying to prevent them.

2613. Has it come within your observation that that ennui, which makes a soldier regardless of his own life, has made him mutinous, or disrespectful, or neglectful of his duties in any way?—I cannot speak as to mutiny or bad feeling amongst soldiers. I have seen little or none of that; but I have seen a total disregard of life. A man will say, "What object have I in living? Suppose I serve out my period of service, and am discharged, what then am I to live upon," perhaps 6*d.* or 8*d.* a day. On referring to the army estimates for 1861–2, I find the number of pensioners amounts to 57,000, and that the average pension of 29,122 men is only 8½*d.* I think more might be done at home in employing steady good men as door-keepers of public offices and museums, of public parks and gardens, of the Horse Guards, the War Office, the India Office, the Houses of Parliament, the Royal Palaces, &c. The private institution of commissionaires is a good example of what might be done in a public capacity. I learn that there are about 200 disabled pensioners belonging to this institution eking out their pensions in London. The man who waits at the Junior United Service Club lost his arm at Lucknow, and his pension is only a shilling a day. The man who waits at Claudet's door lost his leg at Ferozshah, and he gets no more, and the cases of these two men are good examples of the provision made for disabled soldiers.

2614. (*Dr. Farr.*) What motive could you supply him with?—I would give him a higher rate of pension, and give him a prospect of being able to live upon it.

2615. (*Chairman.*) Soldiers, I believe, are in general selected from the labouring classes?—Yes, or the manufacturing classes.

2616. Do you think as a rule that the prospects of a soldier in his old age are worse than those of ordinary labourers in this country?—Yes, I should say so. A soldier, after having served 10, 15, or 20 years in India is a broken down man; he is incapacitated for almost all other service when he is discharged, and he has little therefore to look to, but his pittance of a pension.

2617. (*Dr. Farr.*) Generally speaking, he has no family and no ties?—Those men who have family

ties never leave India, or very few of them do, because they are almost natives in their habits; they associate with natives and live with natives.

2618. Do many pensioners remain in India?—A great many. There are 2,000 or 3,000 in India now.

2619. And marry?—Yes; generally they have some attachment or are married, and they have generally families.

2620. With what other motive do you think the soldier might be supplied besides that of a more liberal pension to remove this feeling of ennui?—I think that more might be done for him in the way of occupying his time. I think that the soldier might be well occupied in manual labour on the public works to a very large extent, if they had a certain amount of pay for what they did. They do so at home, and I lately saw squads of soldiers working cheerfully at the fortifications of Dover, and earning eightpence a day. The wages for such extra work might be deposited in a regimental savings bank for the soldier's benefit when discharged, or his next of kin in event of his death.

2621. (*Sir R. Martin.*) To be employed in their respective trades?—Yes.

2622. (*Dr. Farr.*) You think that this ennui results a good deal from idleness?—From idleness, and from the want of some inducement to work.

2623. (*Chairman.*) You do not think that the feeling of monotony and vacancy of which you speak would be materially removed by an addition to the pension to which the soldier looks forward?—No, certainly not; but it would be one important item in his improvement.

2624. Is it not rather a means of filling up his day with some occupation that he requires?—That is of course the difficulty.

2625. (*Sir R. Martin.*) But which state of things you consider would be very much improved by placing the soldiers on the elevated hill ranges?—Yes, undoubtedly; for there they would have an inducement to take active exercise. Instead of moping on their beds all day, they would then be out on the hill tops walking about.

2626. And practising athletic games?—Yes; I think that they might be usefully employed in public works, in the construction of roads, the improvement of their own barracks, in digging wells, in making their gardens and growing vegetables; and there are a thousand ways in which they might be usefully and advantageously employed.

2627. (*Dr. Farr.*) Would you allow them to work on the plains?—No, not at all seasons; but in almost all parts of India there are four or five months in the year when the men might do a great amount of work in the open air, and benefit by it.

2628. I think the recommendations which you have made come mainly to this. You think it desirable that a larger number of European troops should be quartered in the hills, and being there, that a greater amount of daily employment should be provided for them?—Undoubtedly.

2629. With regard to the rations, you do not think that there is anything of which to complain?—No; I think that it is their officers' fault if there is anything to complain of as to their rations.

2630. With regard to barrack arrangements, I think you said that they have been considerably altered since you were in India?—Yes, they have; the bad ones were burned during the mutiny. I may mention that I have drawn out a plan of barracks with circular roofs. I propose that they should be built of conical pots pervious to the air; in fact, like a honeycomb. There is a plan with a circular roof all over, and there is another with a roof of three separate arches. But the chief object to be kept in view is that these arches be built of conical earthen pots instead of solid brick and mortar.

2631. (*Sir P. Cautley.*) Are you aware that these have been tried at Delhi?—I have not seen conical pots tried.

2632. Cylindrical pots?—I mean like the Syrian roofs.

2633. They were found in India so intolerably hot that they were not adopted?—Every roof in Syria is built of these cylindrical pots, and I have found no roof so cool in a hot climate as those in Palestine, and there the idea first struck me.

2634. (*Chairman.*) Of what material do you propose that the roofs constructed of this form should be?—Of common earthen pots, about nine inches long, something like a flower pot, but a little longer. They might be used for springing the arch, so that the roof would be a series of air cells, like a honeycomb. No timber would be required for such barracks beyond the doors and windows; the cost would be about half the cost of the ordinary flat-roofed ones; the annual repairs would be trifling; they would be fire-proof and ant-proof, and would last for a century or two.

2635. Have you any suggestion to make as to particular localities in the Himalayas or in northern India generally, where hill stations might be established?—The particular place in Kumaon is the Deo-Dhoora range, between Almorah and Rikessur or Lohooqhaut, which I should think most desirable for European cantonments.

2636. In what neighbourhood is that?—All along the ridge.

2637. To the south of Almorah?—To the south-east; and upon that ridge alone 10,000 troops might be cantoned; at least any amount of European troops that were required for service in Upper India.

2638. What facilities for communication with the plains would there be?—Already there is a very passable road from Lohooqhaut down to the plains.

2639. (*Dr. Farr.*) Down to Meerut and Delhi?—Yes, in their direction.

2640. (*Sir P. Cautley.*) Do you know the Tanna-angra range?—I have not been on it.

2641. The difficulty is rather at the foot of the hills in getting up, is it not?—Yes.

2642. (*Dr. Farr.*) There are no troops stationed in Kumaon now?—No European troops; there is a small dépôt for European invalids at Banskate, near Nynsee Täl, but no effective troops are regularly stationed there.

2643. (*Chairman.*) With regard to the ventilation of the barracks, do you think that that is a matter which is sufficiently attended to, or do you think that any improvement is desirable in that respect?—No; the chief difficulty is to carry out the intention of the engineering officer as to ventilation, for soldiers will stop the ventilation, and will obstruct it if they can, especially in the cold weather. In the hot weather they will not remain in the barracks, but sleep in the verandahs, or they sleep outside altogether under the naked sky; that is during the hot wind.

2644. As a general rule I believe that overcrowding of European soldiers has not been common?—Not common; but sometimes force of circumstances will lead to it. I remember when my regiment came to Lahore after the Punjab campaign we were obliged to share the hospital with another regiment, the 14th Dragoons, though built to accommodate only one regiment. I attribute much of the mortality that ensued to this overcrowding in hospital.

2645. (*Dr. Farr.*) Lahore is in a bad sanitary condition altogether, is it not?—At that time it was, and they were obliged to make cantonments under the pressure of circumstances: but now things are all altered there. Those old cantonments are all knocked down, and a very desirable new cantonment has been built several miles from Lahore at Meanmeer.

2646. Lahore might be, I presume, at a moderate expense, rendered comparatively healthy?—It might be, for the situation is favourable.

2647. (*Chairman.*) Generally speaking are there any suggestions which occur to you, bearing upon the subject of this inquiry that have not been included in the questions already put to you?—Yes; as far as the medical service is concerned I think that it might be improved in several material points.

2648. Will you be good enough to state to the Commission what the points are to which you allude?—In the first place the time of service in the grade of assistant-surgeon is something very dreadful. In Bengal an officer is generally 13 or 14 years an assistant-surgeon, I myself served 16 years and some odd months before I was promoted to surgeon, but that has been improved of late years in Bengal; there they now get their promotion in about 14 years. But in Madras and Bombay there are assistant-surgeons now after 17 and 18 years' service. In the Royal army assistants are promoted in 7, 8, or 9 years after entering the service.

2649. What is the remedy that you would propose for this state of things?—By giving them promotion much earlier. When the great mass of the Indian army was increased, doubled and trebled, and perhaps quadrupled, few surgeons were added to the list; but the great additions were made in the grade of assistant-surgeon. The consequence of so few surgeons being added to the list is, that there are now officers of 17 and 18 years' service in the rank of assistant-surgeon.

2650. (*Dr. Farr.*) There is not a due proportion of surgeons?—No.

2651. And the rapidity of promotion depends upon the relative numbers of the two classes?—Yes; the relative numbers of the higher classes were not kept *in pari passu* with the increase of the whole body of the army.

2652. What is the number of surgeons in India?—The number of medical officers is perhaps 900 in the three Presidencies.

2653. And what is the number of the assistant-surgeons?—You may take two-thirds at any rate of that number.

2654. (*Sir R. Martin.*) I believe there are altogether between 900 and 1,000?—There may be.

2655. (*Dr. Farr.*) What is the number of the surgeons?—I cannot say from memory.

2656. But relatively you think that the proportion is so small that the assistant surgeons are necessarily many years before they obtain the grade of surgeon?—Yes; In every other branch of the public service there has been a comparative increase of the higher grades of the service, compared with the increase of the army generally, but in the medical service it has been, as I have described, increased at the bottom of the list, *a vis a tergo*. Another great grievance is, that when a surgeon is promoted to the grade of surgeon-major, his pay is not increased, but remains as before, and as all promotion beyond the rank of surgeon-major is by selection, it may never rise higher than the rate of surgeon.

2657. (*Col. Durand.*) You mean in fact that the rewards held out to the medical profession have not been proportionate with respect to the service generally?—Yes.

2658. (*Sir R. Martin.*) The absence of the superior grades in due proportion has necessarily interfered with the rewards?—I believe it has, and I believe that in no service in the world does an officer remain for 17 or 18 years in the first grade in which he entered it. The average time in the line is 7 or 8 years.

2659. That being the subaltern grade?—Yes.

2660. All the circumstances which you have mentioned have produced chronic discontent, and a dispiriting effect upon the whole medical corps, have they not?—Yes; they have.

2661. (*Chairman.*) There is, in effect, at the present time no great eagerness shewn by the members of the medical profession to enter the medical service of the army?—No; another great grievance is the rate of pension. No assistant surgeon can obtain a regular pension under 17 years' service; I can quote a case which occurred only the other day with an assistant surgeon in Madras, and I could many more in the other Presidencies. He had served for about 12 years; he was still an assistant surgeon, and his health broke down; he was declared incapable of

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returning to India, and he was obliged to retire, on a pension of 73*l.* per annum, or only four shillings a day. Had he been in the royal army his pension would have been fifteen shillings a day. That is one of the very great hardships which men have to suffer who have rendered active and good service, and who are so broken down that they are obliged to retire before they are entitled to a regular pension.

2662. You complain in the first place that there is not sufficiently rapid promotion, and next that there is an inadequate amount of retiring pension?—Yes; in general the rates of pension are far below the rates of the Royal army, according to length of service.

2663. (*Col. Durand.*) Have you any observations to make as to the subordinate branch of the medical department, upon which the efficiency of the medical service so much depends?—I think that upon the whole it is satisfactory enough; I cannot find fault, generally speaking, with them; I think that they perform their duty, upon the whole, very satisfactorily. I have known some men object to write the numerous reports of the hospital, and expect a separate native writer for that purpose, but I thought the objection unreasonable.

2664. Do you think that the organization of that department is sufficient for the requirements of the service?—I think that it has worked well, and I have had a good deal to do with that department. I think that in many positions it works well enough. I was at one time professor in the Medical College, Calcutta, where such men are educated, and found them eager to improve themselves.

2665. Have you been in the field with it?—Yes, I have a great deal. I served through part of the Punjab campaign with the Europeans, and I had the subordinate branch of the medical department under me in Burmah, and in the general hospital in Calcutta; and, taking them altogether, I think that they performed their duty very well.

2666. (*Sir R. Martin.*) They are indispensable, are they not?—Yes, they are.

2667. (*Chairman.*) Do you think that a medical officer has sufficient means in his hands to make sure that his recommendation will be attended to on sanitary matters; for instance, if he sees any nuisance in the neighbourhood of a barrack, calculated to injure the health of the men, has he sufficient power to get it removed?—No; and I will give the Commission an instance in point. After getting possession of Rangoon, the artillery were quartered on the Upper Terrace there; I was surgeon of the Bengal division of artillery, and the commanding officer built an open public privy within 20 yards of one of his own barracks, in defiance of all the remonstrances I could make.

2668. In such a case as that is there any power of appeal, or means of making a complaint to any higher authority?—There is; but it is a very tedious process. Of course I could have gone direct to the General, and then to the Commander-in-Chief; but I found it such a dreary prospect to wade through all those details, that I left it alone; in fact, I was snubbed; and a disgusting and unwholesome nuisance was the consequence.

2669. How often, and to whom are reports of the sanitary state of a regiment made in a station?—They are made daily to the commanding officer; but that is mere general routine. Monthly reports of sick in hospital, half-yearly returns of medicines and instruments, and indents for fresh supplies are made to the deputy inspector-general, also a medical history of the regiment and cantonment, its climate and diseases is made annually.

2670. (*Dr. Farr.*) And in that, I presume, you can set forth any sanitary evils which may affect the health of the men?—Yes, you may state what you

please; the whole routine is before you. You are allowed to draw up a medical history of your regiment.

2671. Is any action usually taken upon that report being made?—It may be, or it may not.

2672. Under whose notice does it fall?—It may be sent on to the Commander-in-Chief.

2673. But is it so sent on?—Generally, I believe, it is not. The most important concession that I ever got in that way was the concession of half a pound of vegetables to each soldier in my regiment; but that had to go to the Commander-in-Chief, Sir Charles Napier, before I got it, and eventually to the Governor-General.

2674. Would it, in your opinion, be an advantage, if more frequent sanitary reports were made?—No; I do not think so. Every medical officer can make a special report when he deems it necessary.

2675. (*Col. Durand.*) Is it not his duty to make such a report to the commanding officer?—Yes.

2676. And is it not the duty of the commanding officer to bring it to the notice of the brigadier, or to the general?—He may do it, or he may not; it is not always done.

2677. (*Dr. Farr.*) It now rests, does it not, mainly with the commanding officer of the regiment?—Very much so.

2678. And when he is an intelligent officer, understanding sanitary principles, he will carry out the recommendations of the medical officer?—Yes, and if not he looks upon the medical officer as a troublesome man.

2679. (*Col. Durand.*) Is there not a report made to the superintending surgeon?—Yes. A surgeon may at any time make a special report to the deputy inspector-general.

2680. Will not that draw attention to the subject of the complaint?—It may. The surgeon may pass by his commanding officer and go direct to the inspector-general, and make his wishes known through that channel.

2681. Is not that the regulation?—That is one channel; but the commanding officer is also another.

2682. (*Col. Greathed.*) Would you not call the refusal to attend to the suggestion of the medical officer the exception and not the rule?—Yes; I should call it the exception.

2683. (*Chairman.*) Is there any other suggestion which you wish to make?—There is one only, and that is with regard to a European regiment, although it will be all altered now; but I believe a difficulty in Company's European regiments formerly was that the surgeon was the only permanent medical officer, but that has all passed away now, and I therefore need not dwell upon it.

2684. (*Col. Durand.*) But with regard to the main point affecting the soldier in India, to which you referred, namely, his having no encouraging prospect—nothing to hope for in the future—have you any positive recommendation or suggestion to make in order to ameliorate his condition?—The most important one that I could make would be to give him an object to live, and increase his pension.

2685. Is there no other suggestion that occurs to you?—Another would be to occupy the immense amount of idle time which he has on his hands, and which he does not know how to spend; to give him some means of spending it profitably and pleasantly.

2686. (*Sir R. Martin.*) You think that he should be encouraged to do for himself whatever he can do without injury to his health or discipline?—I think soldiers in India do a great deal too little for themselves, and anything that would keep them out of idleness and out of the grog shops would be conferring a benefit upon them. They are never so healthy as when undergoing the fatigues of a long march.

The witness withdrew.

Dr. R. ANGUS SMITH, F.R.S., Professional Chemist, examined.

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2687. (*Chairman.*) I believe you have paid a good deal of attention to sanitary subjects for a number of years past?—I have done so.

2688. Have you ever been led to turn your attention especially to the subject of the sanitary condition of European troops in India?—Not with special reference to India, but to points which are of universal interest, and which will be of interest in India as well as elsewhere. I will endeavour to give the Commission my ideas concerning the subject about which I came here, namely, disinfectants.

2689. You are prepared to give evidence upon the subject of disinfectants?—Yes, I came for that purpose, but there are two or three other points connected with sanitary matters which I may speak of at the same time. I may say that I am not prepared with any papers on the subject; when I came up to London I had no intention of giving evidence before this Commission, therefore I can only give a rapid sketch of my views; but I think I shall be able to state some things that will be of interest to the Commission, especially as my latest investigation has had relation to the state of the soil, and to the treatment of malarious districts, a point that will be interesting with respect to the army in India. In speaking of disinfectants I am disposed to say that there is not very much information upon the subject, for the subject has not until very lately been taken up with any enlarged views, but only for trifling purposes, and in very narrow ranges. I would divide the class of bodies used for disinfection into two kinds, first, disinfectants and next antiseptics. There are many bodies which destroy the putrefactive condition of the organic matter, but which do not prevent putrefaction from continuing—they destroy it only for a moment, or in other words they destroy the products formed and leave the substance to form more. Antiseptics may or may not destroy the products, but they prevent their recurrence. I think therefore that whenever we use disinfectants it is important that we should use antiseptic bodies that will prevent decomposition from going on. So far as we know, all the noxious emanations from organic matter arise during the decomposition of the organic matter. Whenever the organic matter begins to decompose, the parts of which it is composed are separated and come out in forms which are hurtful to health, but we can prevent this decomposition going forward. We can prevent the formation of those gases or vapours which are injurious to health; we know for a fact that this can be done to an enormous extent, and in reality the mummies from Egypt show that organic matter of the most dangerous kind can be preserved for 3,000 years without any injurious influence to health: for the same reason we may conclude that all organic matter in the soil where malaria exists may be preserved in a state in which no gas whatever can be given out, and the vapours or air around it will be entirely freed from injurious substances arising from this decomposition. If we were to put this in practice we could imitate what the Egyptians have done with the greatest ease, and there are many substances which might be used. We can preserve pieces of flesh for any length of time in many disinfectants; there are probably a dozen substances, and some writers mention many scores, but at least there are several substances which will preserve flesh from decomposition for a long time. I myself have put animals in disinfecting materials, and have preserved them in a perfectly sweet condition for something like a year, and in the same way dead bodies have been preserved and exported from this country to America, in cases where the friends have wished to have them buried in America, without any perceptible change in their condition.

There are some organic matters which are to a very great extent decomposed before they can be obtained for treatment, for example fæces of all kinds, both of men and of animals, and those require of course

to be treated first by the removal of the smell, and next by antiseptic treatment to prevent the recurrence of the smell. I have had considerable experience with regard to the sewage of towns, and as to preserving those matters in such a condition that they shall not be offensive by giving off emanations into the atmosphere, and that they shall be so preserved that their value as manures will not be diminished, and I find that these two important results may be obtained simply by the use of antiseptics. They are becoming for this reason very much used in farm yards, in stables, and cowhouses by farmers generally. It is found that the great loss which is caused by the decomposition of the manures is thus obviated. The manure can be preserved for many months in a condition as sound as it was at the beginning, and at the same time it is found that a manure so treated does not give out any offensive smell; the animals, therefore, which are otherwise continually exposed to foul emanations, are preserved in very much better health. I could give many instances proving that animals are preserved, by this means, from disease, but it would probably be tedious to give them. The country generally is scarcely aware how much this subject has been cultivated in some parts of it, and how largely farmers and keepers of horses are becoming acquainted with the value of disinfectants for the preservation of manures, and for the preservation of the health of animals, nor is it aware, that whilst the health of the valuable animals is preserved, the destruction of the lower forms, such as insects, grubs, &c., is at the same time secured.

It was in pursuit of this inquiry that Mr. McDougall and I performed some experiments at the desire of the Board of Works upon the treatment of sewage in the same manner, in order to prevent decomposition in the sewers, and mainly, perhaps, also to preserve the manure matter untouched. We took specimens of the sewer water disinfected and not disinfected, and kept it for various periods of time, one, two, three, and four days, weeks, and months, and we found invariably that if enough were added of disinfecting matter there was no emanation of gaseous matter from the sewer water, and that, in fact, the sewer water could be completely prevented from decomposition by the use of a very small quantity of the disinfectants. It was proposed by me, although it did not receive any attention, that these disinfectants should be applied to the sewers themselves, instead of allowing the putrid matter to flow through cities in many of the streets, and that we should pour the disinfecting materials into the sewers, and prevent the formation of those gases at once, instead of allowing them first to form, and then endeavour to put them away; the strange notion of driving the vile gases of sewers into the air, by ventilation will then be seen still more clearly to be a mistake, and one mischievous as well as absurd. I believe that the value of the proposal will be found great; but there were some difficulties raised as to the mode of application, although I think that all of these might be obviated. The whole of our streets are covered with putrid matter from cattle going continually over them, and this matter gives off very offensive vapours. When the refuse of the streets is allowed to stand we find that much impure gas arises, as Dr. Bernays proved, and as we know from the nature of the materials. It was proposed at the time that the streets should be watered with disinfecting material, which would purify them, whilst, the material being carried by the rain into the sewers, the sewers would be supplied with it in every street. This being done, the Thames would finally receive the purifying ingredients, and the whole city would be treated with antiseptics, much to its benefit. These are illustrations of what might be done here, although perhaps not very valuable in India.

The plan was on trial for a very short time in London, and a very curious circumstance occurred

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at the time, which will illustrate the value of such a mode of procedure. The sewer in which the experiment was tried flowed from Tottenham Court road down to Charing Cross, and it was found that the disinfectant which had some smell when it was used in large quantities created a smell in the sewer. The people all along the line of the sewer observed something peculiar in their houses on those days in which we tried an excess, and this was a remarkable proof of the fact which had been very often denied, even by sanitary reformers, that the atmosphere of the sewers of our cities actually finds its way directly into our houses in very many cases if not in all. We have had many clear proofs of it since that time.

If this plan in all its fulness were adopted, expensive covered conduits reaching far beyond the boundaries of a town might be avoided, cheap open canals being sufficient.

2690. (*Sir R. Martin.*) Even when the trapping has been good?—I believe that when the trapping of gulley holes is very good the foul air goes more directly into the house, because it has no exit into the external air.

2691. (*Dr. Farr.*) You mean the external trapping?—Yes.

2692. But when the internal trapping is good, does not that exclude the gases?—No. I do not think it comes through the grating, but it comes through imperfect brickwork. I had an instance in my own house in Manchester. Behind a bookcase before which I sit there had been an emanation of sewer matter for a long time, and I was determined to find out the cause; last week I had the skirting board and the floor taken up, and I found that the air came through the brickwork, I think it probable that the same method will introduce it into most of the houses here. If it came through the grating, it would be very easily perceived, and the nose could trace it exactly to one spot; but it comes through holes in the brickwork smaller than any animals can make use of. In the cases that I have seen, it has come through the brickwork.

I have given instances of the value of disinfectants in our own country; I suppose that if disinfectants can be made so valuable in cowhouses and stables, and farm yards, they would be of extreme value in camps, and in all places, especially where there are only temporary habitations. We find here, in the most advanced state of civilization, that our work can with difficulty be done, even when supplied with the best of workmen; we find it very difficult to have our towns and streets and houses made pure, because we find that the sewers are difficult to make, and it takes a long time to make them; on the other hand, if they are not made, we are compelled to resort to middens, as they do especially in the north of England; and in camps, of course, they must have recourse to the same method, middens or cesspools. Middens are manifestly and prominently pernicious; cesspools have long ago been shown to be the most dangerous generators of disease; both could be rendered inactive by antiseptics. I believe that the evil arising from these was very much felt in the Crimea—to an extent which it is revolting to think of, according to the accounts given by those who have treated upon the subject, Mr. Rawlinson, and, I think, Dr. Sutherland, and others; the use of disinfectants there might have been resorted to with the greatest ease, without any trouble, and almost without any expense, whilst they would have put a complete stop to all the evils arising upon that head. I make that assertion, because I have seen the operation performed so very frequently; and to bring instances forward would be merely accumulating facts so like each other that it would be tedious to repeat them and tedious to listen to them. But decomposition of animal matter is completely put a stop to by antiseptics, and of course the injurious gases or vapours are not evolved.

Upon this subject I may say that there have been only two or three experiments which may be called public ones, but which, I think, are perhaps the most striking that have been made in the country

upon the subject of disinfection. One of them is being carried out now at Carlisle; I can scarcely call it an experiment, as it has been going on for two seasons and is, in fact, a success. I suppose that by it alone the sewage question, at least in a sanitary point of view, is entirely settled. Mr. McDougall raises the sewage water of Carlisle about 15 feet, and passes it over a meadow of about 100 acres; but before passing it over the meadow he mixes it with the disinfecting material, and it is impossible for the finest nose to detect anything disagreeable upon those meadows. I have taken people there who considered that they had a very fine sense of smell, and they have not been able to detect the slightest offensive smell in those fields. On the other side of the river there are fields exactly of the same kind, there is the same soil, and the fields were exactly in the same condition about two years ago. These fields are exceedingly bare from not being manured; but on the manured side of the river the grass is exceedingly rich, and many crops are taken off during the year. Mr. McDougall, I consider, has settled this point: that, by means of disinfectants, the sewage of towns may be used as manure, and it may also be used economically; it may also be used in a manner which would entirely remove any offence to the inhabitants. I may mention that another very important thing has arisen from these experiments at Carlisle; it is a curious fact that no water whatever from the city of Carlisle flows into the river. There is no flow of water or of sewage into the river during the day; for it is entirely absorbed by the land; no doubt it ultimately flows in, but at a very low level, and after filtering through a considerable depth of soil. The consequence of this is that the river has ceased to be affected in the smallest degree by the sewage. The result has proved to be a very beautiful experiment, and very well worth the attention of the whole nation. The fishermen find the fishing to be very much improved, as a necessary consequence. It is the only instance I know where absolutely not one drop of impure water is allowed to go into the river from the sewers of a large town, unless we except the night, when the sewage is nearly pure water in Carlisle, and the time of great floods. Now if such can be done there, and with such a small expenditure of money, I have no doubt that it can be done elsewhere. The whole cost of the irrigation works at Carlisle was under 400*l.*, which is a mere nothing in such a large place. This, I fear, will condemn the plan, as engineers will have little to spend on the works.

2693. (*Sir P. Cautley.*) Is it the fact that this disinfecting fluid does not at all deteriorate the value of the sewage matter as manure?—On the contrary. I am endeavouring to show that it preserves its value and prevents decomposition.

2694. Then it is equally good as manure after the mixture has taken place with the disinfecting fluid as it was before it?—Yes, decidedly so. It is a very curious point, that upon the Edinburgh meadows, which have been irrigated by sewer water for many years, the grass is rank, and it has been said, I believe, on good authority, that the cattle which eat that grass are not in a healthy condition. Several other reasons have been given for the want of health in the cattle, but I believe there is no doubt that the cattle are not in a healthy condition; they do not like the grass as well as other grass, but when the smell has been removed from the sewage water the cattle have no distaste for it, on the contrary, they like it exceedingly well.

Objections have been made to disinfectants altogether by some truly wise sanitary reformers, and amongst others, Mr. Chadwick has often told me that he objected to their use, because he believed that water ought to be used to carry away all impurities, and that it was unwise to keep impure matter in any place, instead of instantly dispersing it into the fields. I believe he is quite right to remove it by water, but I object even to that stream of mixed water and sewage

which he admires. I would first render it harmless. It also frequently happens that offensive matter accumulates because the removal cannot take place at the moment when it is desired. I believe that camps and places not used as a very permanent residence would be exactly in that condition, and that the accumulating matter could not be removed very rapidly. A great portion of the suffering, and I may say mental and bodily degradation of our Crimean army was caused by filth, which could readily have been made innocent, whilst waiting for removal or being removed.

Whilst pursuing these inquiries I came upon another subject, with regard to which I am now publishing a paper; it is upon the effects of disinfectants upon malaria. I will give a portion as part of my evidence.

McCulloch says: "I trust to prove that the causes of malaria exist under numerous circumstances not at all suspected in our country, and in thousands, tens of thousands of places, even at our very doors" (p. 11, Ed. 1827.) Again: "Malaria produces in itself a far wider mass of human misery than any other cause of disease; as, for the world at large, it is also the cause of far more than half the mortality of mankind" (p. 31).

In the examination of different districts for organic matter in the air I have invariably found that low grounds well cultivated have shown more than high grounds or hills, and more than the open sea. I cannot, therefore, doubt that the remarks of Dr. McCulloch are correct as to the very general occurrence of unwholesome influences caused by the state of the ground. I am inclined to go further, and to say that even in places where we cannot find that health is in any way injured emanations arise.

The cause of malaria has been with great certainty traced to the soil. It is true that some places are exposed to emanations of gases from subterranean reservoirs, but gases such as can be prepared by the chemist, combinations of inorganic bodies, are not known to be able to produce the agues and peculiar fevers which we connect with the true malarious district. Atmospheric phenomena, the condition of electricity and heat, for example, affect the health, and so does the amount of water, of cloud and of light; but all these causes seem to be different from that insidious poison arising from those organised bodies found neither deep in the earth nor high in the air, but only near the surface of the ground.

If the soil of our fields were not kept acid, but were kept alkaline and warm, there would arise from it a greater amount of exhalations. "If the soil is very alkaline and moist, the conversion of the organic matter into ammoniacal compounds is very rapid. I put some soil not very rich in organic matter into this condition by the assistance of a little ammonia, so as to make it alkaline, and the consequence was the rapid occurrence of a very intense putrefactive decomposition, not in any way differing, as far as could be perceived, from that of ordinary putrefaction of animal and vegetable matter. These nauseous and unwholesome odours are therefore possible from the ordinary soil of our fields; but any occurrence such as this on a large scale would be disastrous, and the ground is protected from it by an almost constant acidity, which sometimes increases so as to be injurious, forming what is called sour land. This very acid state generally occurs in wet land, where it is probable that alkalinity would be most injurious, but the soil may be found alkaline in a well-manured garden, and where the ground is dry, without apparent injury."—*Witness's Report on Air and Water of Towns, British Association 1851*, p. 69.

In this experiment I produced in fact *artificial malaria*. The conditions were exactly such as the best observers have in most cases described, with the addition of the alkaline state, which will probably be found to play a very important part, but which as far as I know has not been attended to. Not that I say that it is impossible to have malaria without ammonia,

but ammonia is the wing on which some of the products of decomposition seem to delight to fly. This experiment, which brings the usual condition of warmth and moisture, shows that there may be many modes by which the organic matter in land may pass from the soil besides the transformation into plants, and besides simple oxidation. The decomposition spoken of shows that from soil numerous products may arise. If we allow that putrefaction begins we know no end to the number of substances produced. These products will be according to the nature of the substances in the soil, according to the season when one or other substance predominates, and, perhaps, when one or other substance acts as ferment. This condition of putrid soil may be brought about by water alone, acting on the vegetable matter in which case *marsh* is formed.

It is not necessary to go further than this experiment in order to show that there may arise from soil under certain conditions substances producing the most desolating diseases. I suppose this artificial state to be the extreme, such as probably has never happened to an extensive district. All other conditions of insalubrity are probably stages of this. It may be said that it was well known that soil retained organic matter, and that organic matter could putrefy, but this state of actual decomposition had never before, as far as I know, been observed. By the sense of smell we have found reason to believe that volatile products arise; disease has also led to this indication, and minute quantities have even by careful experiment been observed; but in the experiment I speak of the amount rising was gross and unquestionable. But the variety of substances found will probably prove to be extremely great. We can imagine some washed down by the rain, and some removed by the plant. In the same way some classes of malarious diseases may be removed by rain, some caused by more and some by less moisture and heat, and others better removed by the agency of plants and the processes of agriculture.

The soil is an extremely complex machine; the balance of forces in it has not been studied. The surface is acid, the lower part is alkaline; it is a filter, with a power of retention and selection. The flow of air and water is from the surface downwards. The surface therefore becomes first oxidised, and is made acid. This acidity is itself a prevention of great putrefaction, and this oxidation is a destruction of those substances which may have resulted from the rotting masses. When land is well drained these processes will go on with greater rapidity; it is as if the lungs were enlarged. But notwithstanding this oxidation and prevention of decomposition we must not forget that it is useful to counteract another agency of great importance, that by which the plant rots. This rotting is accompanied by grubs, insects, animalcules, and vapours and gases; it closely resembles, and without doubt in part is a suppressed putrefaction. The soil has the power of retaining the products to a great extent, and until it has destroyed them, when they are not excessive.

If the passage of air through a soil is not sufficient the products of decomposition are not destroyed. If the passage of water through a soil be not sufficient the soluble products are not removed into the soil, but left and assisted to putrefy.

It is certainly an object of great interest to be able to know by the examination of a soil if it could or would produce malaria, or if it were really in the act of producing it. By the view taken moist soils, indeed all containing putrescent organic matter, will be subject to malaria when the oxidising influence of the air and the balance of vegetable and chemical life are disturbed. The soils most productive of malaria are low grounds, and moist ones with abundant vegetation. At the same time there are others not described as such, and not very thoroughly investigated. If we examine the surface water flowing from such grounds in this country we shall find it to contain animal or animalcular life in immense variety, and we shall also

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find that if we allow it to stand vegetable life will show itself in great abundance. The hilly districts of our own island do not contain water of this kind. I was extremely surprised, on taking my microscope to the north west of Scotland, to find that the ditches were so meagre of living creatures. A green pool was scarce, and when found it was small, whilst on examination it was vivified by very few living forms. The whole hills in fact were either void of matter capable of putrefaction, or they were so rapidly washed that the putrefying matter was passed at once into the soil. The moisture, too, produces no corruption; it is water in rapid motion filled with air, and rapidly traversing the soil, oxidising all the small portions of putrid matter that may be forming in the soil, and fixing the products in the earth. The animal life is repressed, i.e. the life of that class which arises from the infusion of plants or animals. But why should this be? Let us push the argument further. If grass grows in such places there must be food of plants, and elements for the production of infusoria, &c. It is true that grass grows, but not in great vigour, and as the rain passes very rapidly through the soil there must be very little matter kept soluble at one time. The plants must be fed by small although by very frequent meals. Besides, the soil is not deep; the power of retaining soluble matter is therefore small; the stock of food laid up over the whole district, in other words the material from which such animal life must spring, is extremely scanty. Now I am not prepared to say that all unhealthy districts actually contain a large amount of matter either putrefying or forming into animalcular life, but it certainly is the characteristic of what seems to me to be the soil most blamed; there may be some, as already stated, where other causes arise. On all our lower lands the ditch water swarms with life; muddy wet lands present it in every drop of water; whilst on our high hills, purified by barrenness and disinfecting peat, we have hunger and health. But I say that the presence of even the smallest living creatures is one of the indications of certain conditions, the exact intensity of which is not as yet known.

If we can imitate the production of malaria, can we not also imitate the mode by which it is destroyed or prevented? When the products of decomposition are formed in a soil they are removed by natural processes. Mere mixture with the soil will remove or render decomposing matter innocent. The soil will act as a porous body. But the soil may be overburdened. It may be shallow, and its machinery may be of small force; or it may be inefficient from the excess of organic matter over the amount of air passed through it. The first act of disinfection is the action of the soil as a porous body. The next seems to be the act of oxidation by which the soil at the surface is rendered acid. By these means decompositions are confined within the soil itself.

We may view the atmosphere to be in a constant struggle with the vegetable matter of the soil. Substances containing nitrogen are constantly tending to give out ammonia, the ground is constantly tending to convert this into nitric acid, whilst it converts other portions into carbonic and organic acids. By manuring we assist the tendency to become alkaline, taking the side of vegetation, and we resist the oxidising tendency of the air. A large portion of our manuring is simply the addition of alkalies, a struggle against the acidifying influence of the air. No wonder it requires so much lime for the fertilizing of acid peat lands. From lands of this kind it is probable that no miasma arises.

Moisture lying on rich lands becomes filled with animal and vegetable life, a sure sign of rapid decomposition. Allow this moisture to pass through the soil and this animal life disappears. This is an act of purification by drainage. It may not at all times be possible to obtain the requisite amount of drainage, and there are even cases where the land produces malaria, without, according to the greatest

authorities, showing need of drainage. We can readily imagine one condition which will produce this result, viz. excessive dew, which will evaporate and carry a large amount of organic matter,* others may depend on the plants and animals present. The oxidation in the soil may also be aided by the artificial opening of its structure, but this may not always be convenient, and the labour demanded may be too costly. Are we not able to imitate some of the other methods taken by nature to prevent infection?

If we add any acid to the putrid soil of which I spoke, that peculiar mode of decomposition ceases; if we add any other disinfectants or antiseptics we put a stop to decomposition. If we add antiseptics to the water over soil containing a great variety of animalcules, and giving every evidence of decomposition, we find these instantly dying; the same of course results with grubs, larvæ, &c. Animal life is arrested, and chemical action is stayed or impeded according to the amount of material used; but a very large amount must be taken in order to show an injurious effect on vegetation. In this experiment we do in reality prevent malaria; we arrest the decomposition of substances in the soil. We cannot call this a theory or a speculation; it may be considered simply as a fact. The use of antiseptics will arrest all animal and vegetable decomposition, and where there is neither of these malaria will not arise. The chemical action which goes on in a vessel containing a few cubic inches will not differ if extended over a surface of miles. I look on the results, therefore, as certain, viz. that by the use of disinfectants malaria will be destroyed.

The idea of the disinfection of whole districts rose out of a proposal made long ago to disinfect whole cities by beginning at the root of the evil, the sewers. That was intended for this country, the land of great cities. This plan for the disinfection of districts is intended chiefly to apply to other countries. I may, however, be allowed to give one illustration from this country. Mr. McDougall has used sewerage over one hundred acres of land; sheep and cattle have fed without any case of disease. The growth of vegetation was great; the moisture was constant; there was also the constant presence of decomposed matter, but there was no disease. There was, on the contrary, a large production of healthy vegetable and animal life. This experiment suggests many questions, but I do not intend to enter on any except so far as to show it as a proof that putrefactive decomposition may be arrested without any fear of destroying the life of plants, and that rich water meadows may be used for feeding cattle without fear of rot even if treated with sewerage. The disinfectant used was crude carbolic acid, with lime water; the preparation was that patented by Mr. McDougall in 1859. The arrest of decomposition was thus caused by a process which at the same time diminished the acidity. I think the amount required will be small enough to render the process possible over large districts. At the same time also I expect that the idea will lead to other and perhaps even to cheaper modes of producing a like result. As it is to be hoped that an opportunity of using it will occur, it is well not to attempt to speak of details.

I may add also at the same time that the extinction of insects obnoxious to a country,—gnats, mosquitoes and those dreadful enemies of cattle the zimb and the tsetse,—will probably follow the destruction of the obnoxious decompositions in the soil. Nor do I suppose that one disinfectant will alone do the work, although the one I have mentioned is, as far as I know, the most powerful, and can be made in all countries and climates where coal lies or where trees grow.

I wish now chiefly to show that decomposition to a most pernicious extent is possible in soils, that it is not a mere opinion, but a fact readily demonstrated. Next to show that decomposition may be arrested artificially to the preservation of health without the destruction of vegetation, and

* Dr. Smith has since been informed by an Italian friend that this opinion is prevalent amongst the scientific men of his country.

that in these facts we have not only a surer basis in our reasonings on the origin of malaria, but an almost certain process for its ultimate and total destruction.

2695. (*Dr. Farr.*) In what form did you apply the ammonia?—I merely used liquid ammonia. This experiment shows that in a soil which is rich with ammoniacal compounds, and which is kept warm, decomposition goes on, which is productive of sulphuretted hydrogen and other noxious gases and vapours, and those vapours themselves constitute the malaria. I believe that this is the first time that any such experiments have been tried, and the first time that any laboratory proof has been given that malaria is caused by emanations of that kind. Since that time I have been able to do it in a more simple way. It has been supposed in all ages that malaria is caused by a wet state of the soil, and there are many historical proofs of this. I put a quantity of soil into a glass vessel, and added water to it; it was a soil containing very little organic matter, that is to say, there was only a very thin covering of loam, and a little grass upon it, the rest was sand; nevertheless, in a few weeks the putrefaction was very decided, from the fact that the conditions were so altered that no vegetation could grow, on account of the amount of water, and also the facilities for decomposition from the water being present, and the temperature being warm. This is another proof that the mere existence of stagnant water in the soil is productive of gaseous emanations, which are unwholesome, and it is in fact a proof that our theory concerning the evil nature of marshes is a correct theory. Upon examining these soils with a microscope, I always found that there were a great many infusoria in them, and not only infusoria, but also many larvæ of insects, and these even existed in soils which were by no means bad, that is to say, by no means filled largely with organic matter, in fact, very good grass land; but if a disinfecting material were poured upon them, these larvæ died, and the infusoria ceased, or at least diminished to such an extent that I could only see very minute ones moving, I scarcely know what, but perhaps they might be termed monads. The disinfecting material was used only in such quantities as could not have interfered with the vegetation, which was growing very luxuriantly. I draw from this the conclusion that by the use of disinfecting materials you may not only prevent gaseous emanations from the soil, which are injurious to health, but you may also prevent an increase of insects and of animalcular life, which we know, to a certain extent, affect vegetation. It has often been said that the existence of infusoria in large quantities was absolutely necessary as a provision of nature for the destruction of impure matter. I have no doubt it is quite true, and I am willing to allow that it is a provision of nature for that purpose, but their existence always shows the presence of a large amount of organic matter, and this organic matter may be used by plants, and removed by them. I think, although I cannot prove it quite at present, that by the use of the microscope we shall be able to ascertain when the soil has a sufficient amount of organic matter in it to produce unpleasant and unwholesome emanations. When soil is rich and moist there is a very large amount of animalcular life; but these minute creatures disappear with a very putrid state of the soil. Now I have shown by experiments that this animalcular life is not at all necessary for vegetation, and that these animalcules and this animalcular state of the soil are by no means in proportion to the wants of vegetable life, but that the vegetation can flourish, and the atmosphere can decompose as much as is wanted for vegetation apparently without the assistance of these animalcules. Whilst, then, we can completely destroy these emanations, and cause this great advantage to health, we have no fear of injuring the quality of the soil as the grower of fruits, but, on the contrary, I believe we may expect to improve it. These conclusions are new I believe, but they are obtained by an unbroken chain of reasoning, and by experiments which seem

to me conclusive, so much so that I think we may fairly make use of them in malarious districts, both in this country and in others. In speaking upon the subject with persons who are deeply interested in these matters, I was asked by one of them, "What would you do in India, where there are 1,000 miles by 2,000 miles of land more or less aguish and more or less affected by malaria; could you put the disinfectants over so large an amount of land, and how often must you put the disinfectants upon it?" Of course I cannot answer that question completely, but one portion of it I might answer in this way. If it were desirable that we should disinfect such large districts, it would not be a more difficult matter than sowing corn over them; we sow corn over 1,000 miles by 2,000 miles, and it is not only no difficulty, but it is a pleasure. It is quite possible, therefore, that disinfectants may be thrown over an aguish district in the same way, and the material of the disinfectants is certainly not so valuable as the corn is. I believe it is absolutely certain that the soil, in small aguish districts, upon which people are living for a short time, may be disinfected with extreme rapidity, instantly, in fact, for the use of the persons at the moment. We know that in Italy persons are more affected by a malarious soil if they dig it up; that is to say, the effect is perceptible from small portions of the soil, such as they can lift up with the spade; the focus of infection is often so confined that a man could disinfect his own ground by the simplest means in a few minutes, and so be enabled to till his land with ease. Every farmer could do it on his own ground in the same way, and if every farmer did it, to a large extent, every district would soon become greatly purified. I was asked, however, how often this was to be done, and how long it would last? I cannot answer that question, but in confirmation of what I have stated I may mention that I had a disinfected soil very full of manure; it was the soil at Carlisle which was treated with the disinfecting material. I found that the disinfectant had lasted three months. I believe that no soil will be found so full of matter likely to decompose as was this soil upon which I tried it. I have, by means of a friend, submitted these matters to prominent persons in Italy who have been much struck with these views, and have desired that I should send all information. I hope to have it tried in that country, where there is so much of the land affected by malaria, both natural and artificial, for the rice grounds produce artificial malaria, exactly like that produced by my experiments in the laboratory. The water is allowed to stand on them until the substances are ready to decompose, and when the rice is taken out, and the land is warmed, the conditions are still worse, and putrefaction is still more assisted.

2696. (*Sir R. Martin.*) Have you tried any experiments in the fen districts of England?—No.

2697. How did you discover that the emanations from the soil, of which you have spoken, were, in reality, of a malarious nature?—They contained sulphuretted hydrogen and organic substances.

2698. Did you judge from any effect that they had upon health?—No; but I know sulphuretted hydrogen in a moment both by the use of lead paper and by the nose.

2699. Were the emanations in question productive of any form of fever?—They would unquestionably be, but of course I have not produced fever by the experiment; they are apparently such vapours as have been found by many inquirers to be productive of fever and disease.

2700. The supposition with regard to the malarious effect of the sulphuretted hydrogen on the west coast of Africa has not been verified?—No, I believe that arose from mistake. I do not mean to say that malaria is sulphuretted hydrogen, for, on the contrary, I do not believe that malaria is a chemical gas at all, but much rather a vapour or a substance carried up by gases, and readily brought down to a solid or liquid state. I prefer, therefore, to use the word vapour; but we

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have generally found that sulphuretted hydrogen is a concomitant of putrefactive gases, and wherever we find it in large quantities arising from organic matter, we may be certain that there are vapours containing organic matter in connection with it. In the case to which I have referred I was quite certain, both from the peculiar smell and from the peculiar fungi; the mass had the appearance which occurs in the putrefaction of flesh, which it very much resembled.

2701. You are aware that there are two descriptions of emanations, judging by their influence upon health; one which produces periodical fevers, and the other which produces what physicians call continued fevers of the typhus character; have you made any experiments in order to distinguish them?—No, I have never been able to distinguish those two; on the contrary, I do not know that I have been able to prove the existence of any matter capable of producing fever more than in this way: I found some time ago a method of proving that there was organic matter in the air. This was done by means of permanganate of potash. I found that by taking very weak solutions of permanganate of potash, and allowing the air to act upon it, that the permanganate was deoxidized by the organic matter. I went over various parts of the country, trying experiments upon the subject, and I found that Manchester contained a large amount of oxidisable matter, whilst pig-sties and such places contained a great deal more. I can give the relative numbers in some places. In a pig-sty 100 cubic inches of the air decomposed 98 grains of a normal solution; in Manchester the same amount of air took about 54 grains; and then upon common agricultural land, in low grounds, it took about 14 grains. I found it to be nearly the same in various parts of Germany and Switzerland. In the low plains about Milan it took above 18, in some dry fields 6, and about 8,000 feet up the Alps it took about $2\frac{1}{2}$ grains; in the middle of the German ocean, on a calm day, it was about $3\frac{1}{2}$.

2702. The permanganate of potash, of which you speak, is the principal ingredient in Condy's liquid, is it not?—It is.

2703. (*Dr. Farr.*) You are an analytical chemist, and live at Manchester, where you have been engaged for some time in sanitary inquiries of various kinds?—Yes, I am a chemist, analytical and professional.

2704. Your attention, I believe, has been particularly directed to disinfectants, and you have spoken of a dozen that you thought might be used?—That have been used.

2705. Is there any one in particular that you think is preferable to the others?—Yes, the one that I have been obliged to use is carbolic acid.

2706. Which is applied in what way and under what name in commerce?—At present it is known as McDougall's Disinfecting Powder and McDougall's Disinfecting Liquid.

2707. You were the discoverer of this powder and liquid were you not?—The true discovery of the carbolic acid or creosote belongs to Baron Reichenbach, who obtained it from wood. Runge obtained, I suppose the same, from coal. It was sometimes used for smoking hams, but had no wide application. I have even shewn that the same substance was used for toothache as early as the time of Pliny. The extension of the idea to sewage, with the whole method of application, is the result of the work of many years performed by Mr. McDougall and myself. I left the practical part entirely in his hands, and am desirous of continuing the inquiries relating to the purification of towns, and, my favourite subject for the time, the destruction of malaria.

2708. Are you commercially connected with these inventions?—No, I have no connection; I receive nothing from the sale of the powder.

2709. But, however, you were instrumental in making it known as a disinfectant?—I was; I spent a great deal of time upon it, and I believe the first idea was also mine, although Mr. McDougall has done so much to develop it that I left it at last

entirely in his hands. His interest in it is scientific as well as commercial.

2710. The disinfection of sewage is now in full operation in Carlisle, and has been, I believe, for some time?—Yes.

2711. Do you know whether the sanitary state of Carlisle has at all improved?—I do not know.

2712. You have not seen it, have you, applied very extensively to the soil in any part of the country except Carlisle?—It has been applied on 100 acres at Carlisle, and they have resumed it at Croydon. They used it last summer at Croydon; they had attempted to do without it, but they have been obliged to resume it again this spring.

2713. Is its use expensive? Suppose, for example, that it were applied to a certain area round a barrack in India, occupied by British troops, would that involve great expense?—A very trifling expense.

2714. Supposing that you were to disinfect an acre of land, what do you suppose would be the expense?—For the fluid of 100 acres it would be 5s. a day when the soil is drenched with sewage matter daily, and requires much disinfecting; the chief trouble is in putting it on.

2715. The labour to be employed in applying it is the great element of expense?—Yes; the material is exceedingly cheap.

2716. How much would the material cost that would be sufficient to disinfect an acre?—I do not think it would be more than a few pence for ordinary land.

2717. What is the retail price of it per gallon?—I think it is sold at a $1\frac{1}{2}d.$ a gallon. It used to be sold at this, but it was very crude; and Mr. McDougall prefers purifying it, redistilling and operating on it with nitric acid, thinking it cheaper to do this even if he raises the price to $8d.$ a gallon. I think he is right. By this course he obtains more strength in less space. The crude carbolic acid, from which it is made is sold at $1\frac{1}{2}d.$ per gallon; it is then operated upon with nitric acid, which takes away a good deal of the unpleasant odour, and gives it more the smell of the pure acid and nitrobenzin. It would not cost more than $2d.$ per gallon, if crude; but let it be called $8d.$ (and this might be transferred to India,) then this gallon is mixed with lime water in the proportion of 1 to 1,000 gallons of lime water; or rather one gallon of this liquid is mixed with from 100 to 1,000 gallons of water, with a little lime, so that 1,000 gallons would cost something very trifling.

2718. You would propose to send the carbolic acid to India, one gallon of that making 1,000 gallons of the fluid, which might be applied to the soil?—Yes; that is the present method, but I should mention that this is carbolic acid obtained from coals. If it were used in any large quantity in India then the best way, I think, would be to make it there. This disinfectant is found in all parts of the world, wherever coal is to be found, or wherever trees grow, for it can be made from wood as well as from coal; and when prepared from wood it is much purer, and no doubt quite as efficient, if not more so. It could be prepared in India as well as here, wherever there were large forests to be found. Mr. McDougall and I have never tried extensively that made from wood, but my first experiments were made with it.

2719. Supposing that a gallon of pure acid were used in India how much of the land would it disinfect?—I should be sorry to give an opinion upon that, because it depends upon the amount of the organic matter in the soil, and there would probably be a great deal of it in India.

2720. But taking the utmost amount that you can imagine, what would be the amount of fluid that would be required?—If you used one gallon per acre it would be a large amount I think. Such a large quantity is not used at Carlisle.

2721. How often do you think it ought to be applied?—That is a question that I cannot answer except to this extent, that if there are no rains falling upon the land, I think one application will last until

the rain begins; it is very probable that whenever the fall of rain is over another application must be made.

2722. And another application of it you think would then be quite necessary?—Yes, I think it probable, and then, although it is a mere theory, I think it is very probable that if it were done for a few years the soil would get into a more wholesome condition, and vegetative decomposition would go on instead of putrefactive decomposition.

2723. You would apply it to all the middens in India I presume?—Yes, and for that purpose there is no doubt that the cure would be instantaneous.

2724. What advantage has this carbolic acid over Condyl's fluid?—Condyl's fluid is very different from the carbolic acid, and for this reason that it oxidizes substance with which it comes in contact. It destroys the smell perhaps more rapidly than any, and for a private house is extremely elegant as well as effective, but it has no antiseptic property, and the makers do not even pretend that it has; the instant that it is thrown down, that instant the putrefaction is over, but in the same instant the fluid is decomposed and made inert. There is another objection to it, it cannot be used for the preservation of manure; it burns it or oxidizes it instead of preserving it. I may add also, that it destroys the healthy matter as much as it destroys the putrefactive matter. If you put it upon your skin of the healthiest kind it is destroyed instantly, you cannot even filter it through a piece of blotting paper without having it destroyed. The carbolic acid, however, has no striking effect upon pure substances; it merely preserves them from decay.

2725. What is the effect of Condyl's fluid upon metals?—It oxidizes metals.

2726. Then the putrefaction is a process, and the acid you think arrests that process?—Yes, in writing articles upon these matters I have called them colytic agents, in opposition to others, decomposing agents. We have decomposing agents in chemistry, and here we have colytic or restraining agents; there are many others in the world, and this is one, that is, a restrainer of putrefaction, arresting the process of putrefaction, and retaining the substance in a quiescent instead of an active state.

2727. Are there any other substances besides that employed by Mr. McDougall which would have a like effect?—Several. There are many acids, for example there is pyroligneous acid, and all the essential oils; there is turpentine, and many other substances of that kind, also camphor, and in fact the number is large, but those are all expensive.

2728. This is the most economical substance that can be used?—I think so.

2729. Will you state what it is made from?—It is made from coal tar.

2730. Is it to be obtained in the manufacture of gas?—Yes, very largely, in fact they scarcely know what to do with it. I was told of a person who had something like 4,000 gallons of it, that he would be very glad to part with it for a penny a gallon.

2731. Why was McDougall's fluid discontinued in London?—I suppose it was done for two reasons, one being because the season last year was so cold that there was no putrefaction in the Thames. The other being that truth does not prevail without a struggle, and a struggle of the kind needed is expensive; besides, most people suppose that it is made solely from the love of money. The subject is new and the best chemists come to it quite unprepared, and put their two or three experiments against our years of labour.

2732. Did he not offer to disinfect the Thames for a certain sum of money?—I do not know that he made that offer, but he gave reasons for his belief that it could be done for a certain sum.

2733. Can you state what that sum was?—I think it was at first about 15,000*l.* a year if continued during the whole year; but that would have disin-

fected not only the Thames, but the whole of the metropolis, all the sewers and the streets and the Thames besides.

2734. Do you think that that was a reasonable sum to name as the probable expense?—There might have been perhaps a few thousands to be added to that, making the sum possibly 20,000*l.* if it were used for the whole year; but as it would require to be used for only a part of the year, the first sum is probably too large, or at least abundant.

2735. Was it McDougall's powder that was employed in the Crimea?—No; we were very anxious that it should be employed there, and Mr. McDougall and I sent a few tons of it to the War Office for the purpose of having it employed there. I am told some or all was sent to Balaklava, but it was not allowed to be used, as there were no orders. It was returned and sold as old stores.

2736. (*Dr. Sutherland.*) Only a few bags of charcoal were used for disinfecting purposes in the Crimea?—I refer to the Crimea merely on account of the condition of the environs of the tents of the men being very filthy, but I may mention that the powder was used on board ship in the transport of horses to the Crimea, and there are many letters from various captains of vessels who transported the horses to the Crimea showing that they had never before been able to convey horses in such a healthy state.

2737. With regard to the subject before this Commission, namely, the stations in India, where you may have malaria arising from large tracts of country affecting a station, altogether apart from any malaria arising from the station itself, how would you propose to deal with such a case as that, suppose there were 100 square miles of land giving off malaria, and so affecting the health of the station?—I shall not pretend to deal with such an extent at once, I am not prepared to bring nostrums which will cure whole districts by one touch of the hand at a particular spot, I am only laying down principles which I think may be applied very extensively, although not in that extensive manner all at once.

However, in a matter of this kind, so entirely novel as the absolute destruction of malaria, I must distinctly say that my calculations of amount to be used must be very uncertain, and my expressions may even be contradictory. I will state in as few words as possible the exact position I can take in my own belief. I have given reasons for believing that the decompositions producing malaria are of the kind so long suspected if not proved. I have shown that these decompositions can be put a stop to by the use of disinfectants. I have pointed out a simple, efficacious, and cheap one. I have shown a method of applying it easily to such spaces as 100 acres of land or to whole cities. Now, the question arises how are you to apply it on a still larger scale, and carry out the greater idea of disinfecting whole regions? Having arrived at this length I am incapable of making experiments; private resources are insufficient, and the assistance of many persons may be needed to to advise according to the peculiarity of place and circumstance. I have, however, given an opinion as to further extension.

Camps may at once be operated on, the filthier parts perhaps by watering cans or carts. The ground surrounding camps may also be operated upon either by using a system of watering by carts, or by the irrigation system used at Carlisle, or by the use of a dry powder scattered by the hand afterwards to be washed down by the rain. It sometimes happens, as I understand, that the infected part is confined within small limits. In such cases the ground is readily treated by the means suggested. It happens also that land must be turned up either for the purpose of cultivation, for building, for railways, for canals, or other public or private, but still important ends. When this is done the loss to health in malarious districts is very great; men on the railway cuttings suffer greatly, and many have died. The soil seems to con-

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tain the substances generated by decomposition, and when opened they issue out in great abundance. If the sun had been warm enough to have entered into the depth of the soil to dry it up no malaria would be given out by digging, or, if water were continually passing down as with us carrying away the products of decomposition and supplying the soil with air, no malaria would be given out. As it is I think it would tend to the destruction of the evil, if the soil were either moistened with the disinfecting liquid beforehand, or as soon as it was turned up; circumstances must determine these points. In general I believe water is to be obtained in such places. It may be that much will not be required; this also experience will determine. In cutting down jungles there is malaria escaping from the interwoven plants. I have had no experience in this matter, and it may happen in this instance that the use of the powder or of the liquid would both be difficult. The air from the jungle may come from a considerable distance laden with vapours. In such a case the pioneers of clearances may find it a great advantage to use Dr. Stenhouse's charcoal respirators, which I do not doubt would protect them from assaults; afterwards the land could be disinfected as spoken of. But again we come upon large tracks of land suffering from malaria. On these I certainly would not begin to operate until the result in small districts was ascertained. It cannot be doubted that drainage must be resorted to; I never for a moment wish to put disinfection in the place of drainage or of cleanliness. Still I cannot tell what may happen, and I may as well draw out my system to what appears to me at this moment to be its farthest development, viz., to scatter disinfecting material, as we scatter seed on the ground, perhaps even along with the seed, and in water meadows to put it along with the water.

I begin, however, with smaller intentions; I propose it in stations, and around them, and in confined districts, or land which is being turned up for public works, or dug by the hand in gardens or fields, and for all accumulation of filth not removable at once.

2738. The three apparent causes of malaria in India are found to be jungle, want of drainage, and want of cultivation. Would it not be better to clear away the jungle, to drain, and to cultivate, and not to trust to disinfectants upon the surface?—I may say, as to that, that the mere tillage of the land will remove malaria; but it is a fact that persons actually refuse to till the land, on account of the danger to health, and the use of a disinfectant at the spot where you work will in those cases be absolutely essential to attain that end. The same thing will occur in the clearing of jungle. This will also be the case where the condition of the land is such that people can breathe the day air, but cannot breathe the night air, for, the moment you lift up the soil, you produce a night air instead of a day air; the moist air from the under soil is deadly; it is, in fact, air laden with vapour analogous to the air of night, the produce also of cold and darkness. For the purpose of having the soil well tilled, or having the jungle well cleared, it is almost necessary to use disinfectants during the process.

2739. (*Chairman.*) To what extent would you suggest that these disinfectants should be used in the neighbourhood of a station; you would use some, I presume, within the station, that is to say, in the immediate vicinity of the barracks and the surrounding buildings; but in order to deal effectually with malaria prevalent in a station where troops were quartered, to what distance round would it be necessary to employ the disinfecting material of which you have spoken?—I would scarcely venture to give reasons for going to any particular distance, but I would, of course, begin cautiously and carefully. I believe, from what I hear and have read of armies, both in ancient and in modern times down to the latest war in India, that diseases have very much

arisen from filth within the camps, and I, therefore, would begin with the camp internally. Of course physicians would know whether any diseases arose that were different from those created in a camp by filth, and they would then seek probably that part of the ground which was most offensive, and if it were a small district, it could be easily disinfected. If it were a district of 100 miles, I grant that the difficulty might be so great as to render it impossible for the time, and it might take years to produce any great effect upon it. But very often bad health arises from a marsh close to a station, which is very often a very small area indeed. In those cases the evil could be dealt with instantly, but, of course, every case must be treated according to its peculiar circumstances, and 100 miles could only be got over by time.

2740. In what manner do you propose that this disinfecting material should be applied? Is it simply by pouring it upon the soil?—Yes. I think probably it would be the easiest way to apply it in a camp with a sort of water-cart; but it is quite possible that it might be made into a powder, and thrown over the land. In that case I would recommend the powder to be made rather differently from McDougall's present powder; that is to say, I would have less lime and magnesia in it, perhaps none, or with a great excess of carbolic acid, so that a small quantity would go over an immense surface; and such a powder could be readily made. I mentioned this to Mr. McDougall, and he has made such a powder, containing, he says, 50 per cent. of the carbolic acid. There is, however, a limit to the amount vegetation will bear. This very strong powder would be valuable where health alone was sought; but, perhaps, plants would not bear very much of it. In this case, a little at a time would be preferable.

2741. (*Col. Durand.*) You have referred to a kind of scale with reference to the comparative purity of the air on particular soils, and you referred to Manchester and the surface of the sea in the German Ocean, and one or two other places; have you had any opportunity of testing it in forests?—Yes; I had an opportunity in the Alps, and I found nothing deleterious in it, but the ground was very dry. I never tried it in a jungle, or in a forest on the low lands.

2742. (*Dr. Sutherland.*) You have paid a great deal of attention to the question of the water supply of towns?—Yes.

2743. Will you be good enough to state to the Commission what steps are generally taken now in the way of examining water before towns are supplied?—The present practice is first to examine the physical appearance of the water, and to test it; the next is to examine the hardness of it according to Clark's test. The hardness means simply the amount of salts of magnesia and of lime; it is then analysed.

2744. There is first an examination as to the hardness of the water, and then a qualitative examination, and then a quantitative examination?—Yes; and an analysis is generally made.

2745. Do you think that a town in England would be likely to be supplied with water at the present day without such a preliminary inquiry?—I believe that a preliminary inquiry is always made; but it is very remarkable that the inquiry is, generally speaking, useless, simply because the engineer decides upon the spot from which he shall take his water, and whenever he has made his decision, and the bill is going into Parliament, he sends for a chemist to make an analysis. The water is, therefore, good or bad very much by accident.

2746. But that would appear to be the fault of the proceeding before the House of Commons?—I think that an analysis should be made a little earlier; that the chemist should be consulted by the engineer as to what will be the best spot to obtain the water from.

2747. Would you consider it safe in a hot climate like India to select a watersource or dig a well in such a soil as that of India for the purpose of supplying water to stations without a previous chemical examination being made?—I think it would be very far from safe unless certain conditions were observed. I think that a rule might be laid down by which a well could be dug in India, and in any other place, so as to produce water free from organic matter in this way. If you dig below the vegetable soil, that is, below the loam, and encircle the place by tubbing or by bricks, and then dig under the sandy soil, or the inorganic soil, all the water that was taken from a depth below would necessarily pass through the inorganic soil, and being thereby filtered you would generally get more or less of it always pure; but if that precaution is not taken, the water will necessarily contain a good deal of organic matter, and will, upon standing, putrefy.

2748. If that precaution were taken, would that enable you to dispense with the necessity for an analysis?—I think that it is always better to have an analysis, as it makes you more certain; and there may be inorganic poisons which will not be filtered out by the subsoil; but there are cases in which it is difficult to obtain an analysis.

2749. Take the case of India. I suppose, for example, that they had a competent chemist at each of the presidency towns, Calcutta, Madras, and Bombay; do you think that water could be sent from any ordinary distance to either of those places, for an analysis with perfect safety as to the results; do you think the water would not undergo a change?—It would. I ought to have added that I never think water has been properly examined, until it has been allowed to stand some time, in order to see what are the products of decomposition; we generally find at the bottom that there are either vegetable or animal matters collected, and these should be examined by the microscope, and the result of that examination added to the chemical analysis; no analysis of water is complete without that. Good water will have very few of these products, while bad water will have a considerable number; but during the deposit a good deal of gaseous matter will go out, and the whole quality of the water be entirely changed; and if it were sent to a station passing through a hot district, that decomposition would begin to go on from the first day, and when it arrived at the station, it would probably be finished, and the water would then be different in quality.

2750. Would it still contain the inorganic elements?—Yes.

2751. They could then be submitted to an analysis, could they not?—Yes. It would contain organic matter also; but some of them would go off in gas, and if that gas were very carefully collected, whilst opening the bottles, it might all be examined.

2752. Supposing that there was a chemist at Calcutta, another at Madras, and another at Bombay, would it be practically useful in making a selection of water, to send the water to those three points for analysis?—Yes; not a doubt about it. A great deal of life might be saved. I believe also that a chemist to whom questions on various subjects might be put might probably turn out to be one of the most valuable officials in the Presidency. As a nation we are extremely unwilling to seek the aid of science, we wait until it shames us into listening.

2753. Have you made any experiments to shew the smallest quantity of organic matter that is likely to be injurious to health in water?—That entirely depends upon the quality of the organic matter. If it is water from a peaty district I consider that three grains are scarcely to be considered bad, in a sanitary point of view, if from putrefying matter half a grain might be intolerable.

2754. But, suppose water containing from five to six or ten grains of organic matter per gallon?—

Such water here could not be drunk, and could not be used at all, I believe.

2755. And, therefore, still less in a hot climate?—Yes.

2756. (*Col. Durand.*) Would not the general conclusion from your observations, referring to military cantonments be, that cultivation in the neighbourhood of those cantonments should be avoided, and turning up the soil, particularly fresh soil, around the cantonments, speaking without reference to disinfectants, but considering this merely as the result of your experiments and experience?—I think it is true, that such a conclusion could be drawn from the observations which have been made on some soils, such as those that give out malaria, and it is quite certain, from all I have heard, that it is the case with reference to those soils round Rome; but I do not think we can draw the same conclusion as to soils in this and similar countries here, because the soil here is well aired, and there is a great deal of oxidation going on; when it is turned up every year, nearly all impure matter becomes oxidized, and very little goes off. Constant cultivation and good drainage would everywhere improve the land, but the occasional turning up of malarious ground is the chief evil dreaded.

2757. (*Dr. Farr.*) Do you know anything of the chemical composition of the water of India?—No.

2758. Is there any scientific information on the subject contained in the chemical journals?—If so, it must be almost entirely in the Asiatic journal; there is not any in the ordinary chemical works in this country.

2759. No Indian chemist has published any analysis of the water contained in the wells in the alluvial plains of India?—I do not remember any.

2760. What should you infer as to the composition of the water in the wells, in the alluvial plains of India; take the course of the Ganges, the Irrawaddy, and other rivers, and wells sunk into that sort of soil of a superficial kind?—I suppose it would follow the laws which it follows here. If water is taken from the soil in the loam without going deeper, it contains a portion of all that is there, a good deal of organic matter, five or six grains per gallon, and if it stands, a very large deposit of vegetable matter is formed in a short time; microscopic animals of many descriptions may be found in it; but, whenever you go below that, say, down to four feet, the organic matter is reduced to about from one to two grains per gallon, and I think that the same thing would occur in India at a greater depth, as the soil may be much deeper.

2761. Would that be likely to cause disease if taken in any quantity?—I think that it is beyond a doubt that it would cause disease.

2762. What kind of diseases do you think it most likely to give rise to?—I would rather not attempt to answer that question.

2763. Is it likely to cause dysentery?—No doubt about it, and I have been told of an instance in which water long stagnant caused ague when drunk.

2764. If organic matter undergoing decay does induce disease, is it as likely to produce the same diseases when introduced into the intestinal canal as when it is merely floating in the atmosphere?—No doubt the action is not quite the same; but we cannot expect that to be wholesome in the digestive organs which is poisonous to the lungs.

2765. Are you aware of any method of purifying such water which would be readily applicable in camps?—Yes, I think that it might be very easily done. Filters might be established with the greatest completeness, and at a very cheap rate, and if that process were carried on of which I spoke, that of making the carbolic acid in India instead of exporting it from this country, then it would be made in this manner:—The wood would be heated in retorts, and that which remained would be charcoal; the charcoal would be the material of which filters might be formed

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for the purification of the water; the remaining could be also used for burning. To make a filter, perhaps the best way of all is to make a mixture of charcoal and sand, or at least a layer of charcoal and a layer of sand, for sand evidently gives the final purification to the water, and makes it very pleasant to the palate, that being the most usual natural substance for purifying water; and if a large barrel were used, with a division made about one-third from the bottom, and with small holes in it, whilst one-fourth of the barrel above this was filled with a layer of stones and sand, and a large portion of the upper part filled with charcoal, a filter would be made at once.

2766. Which would supply a large quantity?—Yes, it would supply probably more than sufficient for a regiment, and it might be done extemporaneously at any station. Animal charcoal or burnt bones ground, is more efficacious than wood charcoal.

A filter, now, I believe, to be seen at the Society of Arts, has intervals of air between the layers. This causes much evaporation, and cools as well as purifies the water. I do not know the inventor's name.

2767. (*Dr. Gibson.*) What is the effect of alum when used for the purpose of purification?—It deposits many impure substances from the water, but it is certainly not advisable to use it, because alum is not wholesome in itself, and even if it were converted in the water into sulphate of lime, it would rather deteriorate the water than otherwise. It is very much used in some places where the water has much mud and organic matter mixed with it.

2768. (*Col. Durand.*) Amongst the very interesting matters which you have stated to the Commission you mentioned one, namely, the escape of noxious gases through the brickwork; are you carrying on

any experiments with reference to that point, or making any observations upon it?—At present I am dealing with the analysis of gases from putrefaction more especially, but I hope to do something with regard to that point.

2769. (*Dr. Sutherland.*) Will you be good enough to state to the Commission generally the result of your investigations into the changes effected in the air by the presence of human beings in closed rooms?—I have already spoken of the air test, by which I find how much organic matter there is in the air. As to the existence of organic matter in the air I may say this that I have taken deposits on walls and deposits on glass which are formed by the moisture floating about in crowded rooms, and have found that these, after a while, become putrid; that is to say, if they are examined by the microscope you find *confervæ* growing thickly, and minute animalcules growing in them, and if you examine them chemically you will find that they contain the same elements that are found in the flesh; and I draw this conclusion, that these are the substances which render crowded rooms unwholesome; that it is not so much the carbonic acid of which people speak so much, but that it is these organic matters which are developed along with the carbonic acid, the carbonic acid itself not having that power, but acting in a very different way, and to a much smaller extent. It would detain you too long to enter into more particulars.

2770. (*Dr. Farr.*) Putrefaction would be more rapid of course in warm weather?—Yes.

2771. And therefore in a hot climate?—Yes.

2772. These organic matters being in the atmosphere, they would be more likely to be injurious in crowded barracks in India than in England?—Yes.

The witness withdrew.

Saturday, 20th April 1861.

PRESENT :

The RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Colonel Sir PROBY CAUTLEY, K.C.B.
Sir RANALD MARTIN, C.B., F.R.S.
JOHN GIBSON, Esq., C.B., M.D., D.G.A.M.D.
Colonel GREATHED, C.B.

Colonel DURAND, C.B.
WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

JULIUS JEFFREYS, Esq., F.R.S., Staff Surgeon, Bengal Army, retired, examined.

2773. (*Chairman.*) Will you have the kindness to state how many years you have served in India?—I served in India for 12 years.

2774. With Queen's troops or native troops?—I served with the troops of the East India Company, but I have served both with Queen's troops and others.

2775. In the Bengal Presidency?—Yes, chiefly with European troops.

2776. Will you be so good as to name the principal stations at which you have served?—My first service was at Fort William, and then I was at Kurnool and at Agra. I was staff surgeon at Cawnpore for two years, and eventually the greater part of my time was passed at Furruckabad and Futtighur.

2777. Is there any one of those stations that you have named which appears to you to be peculiarly unhealthy from natural causes?—Kurnool was, when I was there, from the peculiar state of the canal, unhealthy; it used to be allowed to run too low; the natives drew the water out, which much exposed the banks, and it was too frequently drawn out, and then filled again; the banks were frequently exposed, and

sometimes in warm weather, perhaps, for a month or two together, to the sun, they then gave off noxious effluvia.

2778. (*Sir P. Cautley.*) It passed through an old hollow, did it not?—Yes.

2779. (*Chairman.*) The station was unhealthy from an artificial swamp?—Yes; and yet not exactly that. It was chiefly from the canal being occasionally low and exposing extensive mud banks.

2780. With regard to Fort William, that is in a low situation, is it not?—Yes; I do not know that it is lower than other parts of that part of Bengal; it is a flat plain.

2781. But the water, I believe, is within a few feet of the surface?—Yes; and so it is in Calcutta and about the suburbs generally; but the barracks of the European soldiers, if I recollect rightly, were then faulty from being on the ground floor, and oftentimes their quarters were about the walls, or under the walls of the fort.

2782. Agra, Cawnpore, and Futtighur, I believe, you consider as not being entirely unhealthy?—Not peculiarly so; neither Agra nor Cawnpore, certainly not Futtighur; but Cawnpore was rendered artificially so.

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2783. Will you state from what cause that proceeded?—It arose from the high mud walls that were permitted to be erected round almost every building in the cantonments, and especially from the large ravines about the bazaars; some of the barracks were very ill placed; the barracks of the European infantry more particularly were ill placed in those days.

2784. Ill placed in what respect?—They were in a part of the cantonments where the circulation of the air about them was obstructed not only by the walls, which were considered necessary to keep the men in, but by the walls generally of the cantonments, and by the quantity of wood that was growing on all sides; they were also not far from the ravines to which I have referred, which were at times very filthy places.

2785. When you say filthy places, do you mean that there was a swamp?—No; they were the places that were visited by the natives; they had no places of accommodation, and they were visited every day by the natives.

2786. But that was a mischief easily remedied, was it not?—Yes.

2787. (*Sir P. Cautley.*) Was there not the cultivation of indigo going on in the cantonments in those days?—Not in Cawnpore.

2788. Not in Agra?—When I was in Cawnpore it was in its palmy days; it was a much larger station than it became afterwards; there was a continuation of the cantonments for five miles, either bungalows or barracks, without any intervals.

2789. But at Agra?—Yes, there was indigo cultivation about Agra.

2790. In the cantonments?—Yes, I think so.

2791. (*Chairman.*) With regard to the drainage in those stations which you have described, was care taken to remove all offensive matter to a distance?—Certainly not; the bazaar pigs, which were chiefly eaten by the European soldiers, were the chief scavengers.

2792. Do you think that, to a certain extent, malaria was induced by nuisances being left in the neighbourhood of the stations which might have been easily removed?—Yes.

2793. We have been informed by witnesses who have been examined that care was taken, at least once in 24 hours, to remove everything of an offensive nature; has that been your experience?—I doubt whether it was the case; in my days certainly not about Futtyghur. I cannot say that my impression is that it was so at Cawnpore; certainly not with such punctuality as that.

2794. Will you describe how the stations were supplied with water, whether it was sufficient in point of quantity, and whether it was good?—The up-country stations were almost entirely supplied with wells, and the water was very good in general. At times it ought to be filtered, but in general the well water of the upper provinces is not to be complained of; there are peculiarities where it is affected by saline matters, but not in the stations to which I have referred.

2795. In the lower country the water is chiefly supplied from tanks, is it not?—Yes; chiefly, or from a river where the station is upon a river.

2796. In that case it is often impure, is it not?—Yes, I think so.

2797. Full of organic impurities?—Yes; and indeed that led me to think of some means by which, in a facile way, it might be purified.

2798. If you have in your mind any method by which the water might be purified, will you be so good as to describe it?—By the employment of a simple article, very thin sheet iron, the use of which I am about to describe for another purpose also, and that perhaps even a more important one, the soldiers themselves, with little more than tailor's handshears and mallets of wood, might easily construct tanks supported exteriorly, if you will, either

by the common boards of the country, or by slight walls. To form a waterproof material, capable of holding water, there is no surface to present to water better than iron; it oxydizes, and gives a slight colour to the water, and when the iron rust is allowed to settle, it tends rather to purify the water drawn from it. Such tanks would be very easily made by the men, and made waterproof; in fact, the edges of the sheets have to be simply turned over into a flange with a mallet, and placed between battens of wood, which are then held together by little cleats of hard wood, and wedged up—that is all. To render the seams water-tight there are placed between them, before the cleating together, narrow strips of felt, soaked in a cement, or narrow strips of vulcanized rubber, which are still better. The European soldiers could make not only tanks in this way, but a filtering apparatus also, by the addition of a syphon and so on, and by that means they might always have water well filtered and stored. I should also be glad to see them carrying the measure a little further, for, by a slight modification, they might be enabled gradually to acidulate the water with fixed air, carbonic acid, so as to make it a little brisk and pleasant, and satisfy their taste, and make it gratifying to them without mixing it with stimulants. I do not mean that it should extend to making it like bottled water, but merely to giving it a brisk and pleasant flavour, grateful in satisfying thirst.

2799. But have you considered the cost of carrying out the latter proposition?—I think it would be very trifling, especially as I should like to see the thing done by the men themselves as a means of amusement and occupation, which they would the more gladly undertake, as it would serve their own convenience and comfort. If it were desirable to go into the details of it, I think the Commissioners would be satisfied that the thing is perfectly practicable, and might be easily carried out by persons accustomed to construction.

2800. We think it is very desirable that your plan should be fully explained to the Commission, but it is a question for you whether you would rather state it verbally now, or send it in in writing?—I should have to touch upon other points, which would also require some full explanation, and perhaps this would be better deferred.

2801. You cannot at present state the probable cost that would have to be incurred?—The cost would be hardly anything, or something merely nominal.

2802. You stated just now that European soldiers were almost invariably quartered in barracks that were built on the ground, and not elevated above it?—Yes.

2803. And that you considered the cause of their bad health?—From the time that I first took charge of Europeans, I do not recollect anywhere in India having seen them quartered on a first or upper floor, and there was evidence, quite conclusive to my mind, that much disease did arise from their being housed on the ground-level. We have it both historically and in medical writings, and it is well known in all tropical countries, that the density of malaria is in some very high ratio inversely proportionate to the distance from the surface of the ground. You may see something of this indicated in India in all kinds of exhalations, rendered visible by smoke or fog in cool mornings. You will see vapour and smoke overlying the whole face of the country at the level of a few feet from the ground, with the air, immediately above a certain level, transparent. That exhibits to a certain extent the state of stagnation of the lower atmosphere, and the exhalations from the surface to be very much more dense there than at a certain height above it. In a work published about three years ago, I dwelt at some length on this subject, and endeavoured to show that the housing of men on a first floor would involve very little extra cost, as the ground-floor would be available for all those purposes for which extensive warehouses have

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to be built, excepting the storing of gunpowder, and over which sentinels have to be placed, which in the other case would be unnecessary. I would also provide wide verandahs on the first floor, in which the men might take exercise, and their families also, if the form of rearing them in the plains of India is still to be ostensibly maintained. This, raising them above the level of the ground, would at least put them within reach of the currents of air, which obstructions near the surface of the ground keep off, and they would derive the benefit of the general and less impure breeze that would be often blowing gratefully at a height of 15 or 20 feet.

2804. You contemplate something more than merely an elevation of the floor of the barrack above the ground; you contemplate the placing of it at a height of 10 or 12 feet?—Yes; I would place the men in the first floor of a barrack universally, at least 15 feet high, especially in Bengal, and indeed everywhere in the plains of India. I do not say in the hills, but it would be a measure that would be productive of much good in various ways. One among others would be this: As things are now, it has very often been found necessary to build a high mud wall round the compound, which not only obstructs the air, but is sadly dispiriting to the men; whereas if they were placed on a first floor, and the sentinels were up at the same level, it might be so contrived that a man could not get down very easily 15 or 20 feet; he would be placed above the level of the wall, and he would have the verandahs on the shady side, where, in the rainy season, when the heat is not great, he might recreate himself, and walk and stroll, or sit down to read and enjoy himself; it would be in every way productive of benefit, and perhaps most of all at night; if he is sleepy, he might lie then in a current of air, which he will now always do, but it would be of a very different character from that below in which he does lie now, only two or three feet from the ground.

2805. (*Dr. Farr.*) The soldier sleeps and lives in the same room, does he not?—Yes, and on the ground floor.

2806. Your desire would be to raise him to the first floor?—Yes.

2807. It is usual in England for people to sleep on that floor, and not on the ground floor?—Yes; but in Upper India nearly all persons sleep on the ground floor, as I think faultily.

2808. (*Chairman.*) I gather from your evidence that you consider the main requisites for a barrack to be a free circulation of air, no surrounding walls or buildings to obstruct the circulation of the air, careful attention to the removal of all nuisances from the immediate vicinity, an absence of all undrained or swampy ground, and a sufficient elevation above the level of the soil?—Yes.

2809. (*Colonel Durand.*) Were you ever on the Burmese coast?—Never.

2810. (*Sir R. Martin.*) You are probably aware that several of the modern barracks have been raised on arches?—I had not heard that, and rejoice to learn that the advice of qualified reformers is receiving attention.

2811. Such a mode of construction was recommended by the Sanitary Commission on the Condition of Calcutta?—Not having seen their Report, I was not aware of it.

2812. Their recommendation was that barracks and hospitals should invariably be constructed on arches, and furthermore, that they should have double roofs?—I am very glad to hear that.

2813. And you approve of both?—Yes; and I hope the measure is not from any mistaken economy a half one, but that the barrack floor is at least 15 feet above the ground level. If the addition of cost from the greater outward thrust of arches of any width, at that height, were viewed as an obstacle to such elevation, since wood may, probably, be rendered proof against the white ant by

creosote or the chloride of mercury, or even of zinc, the floors might be laid as usual on joists or girders, without arches. I found wood soaked in saltpetre ant-proof.

2814. (*Dr. Farr.*) Armies in the field often sleep on the ground?—Yes, they must do so.

2815. Can you suggest any ready mechanical means of raising them at all from the ground?—I have never directed my attention to the devising of a plan for raising them in tents from the ground, though it is undoubtedly a point of much importance when sleeping. You are probably aware that there is an officer who has taken that subject up, and he has a plan, or some civilian has, for suspending the hammocks; whether that plan would answer in India I do not know.

2816. (*Sir R. Martin.*) You are aware, I dare say, that such a plan was recommended by Mr. Robert Jackson in the West Indies?—My attention has been called to the fact since the publication of my work on the British Army, but I do not recollect the name of the proposer. This, like many other points, could not fail to force itself upon the attention of observant minds at various times. In fact, about Calcutta no one who can avoid it sleeps at a lower level than the first floor. All who can, elect to dwell altogether on the first and upper floors of their houses.

2817. (*Sir P. Cautley.*) I believe that at Chinsurah the men slept in the upper story of the barracks there?—I am not aware of that fact.

2818. (*Chairman.*) From the construction of tents, there would be only room, I suppose, for a smaller number of men if the men were placed in hammocks, above the ground as compared with their lying upon the ground?—Perhaps so. I thought that perhaps the Commissioners might this morning be occupied with the question of housing and tenting the men, and brought with me a drawing and the details of a plan upon which, to the best of my judgment, tents for Europeans in India ought to be constructed; and also I am prepared to describe a plan for the construction of temporary barracks,—barracks for the hills, and, indeed, for soldiers placed in such a position as they were in when in the Crimea. It is a plan which would have value, not only in India, but elsewhere.

2819. We shall be glad to hear the details of your plan?—I was led to this plan by having used in India, in a somewhat similar way, about 15,000 square feet of the very thin sheet iron, the easy adaptation of which forms the basis of the plan. When the housing of the army in the Crimea became an anxious question, I made a communication through Sir Charles Trevelyan to the Government proposing an immediate construction of barracks in this way. The plan has also been explained to different persons; upwards of two years ago to Captain Fowke, R.E. This model is not at all a model of a barrack, but it is simply a model to enable me to explain to the Commissioners with what facility such a structure might be put together.

The only wood employed is that for the uprights, or posts, and for the trusses of the roof, and also for the cross shelves between the uprights and between the trusses. All the scantling is of one size, viz., 8, 9, or 10 inches wide, and about $1\frac{1}{4}$ or $1\frac{1}{2}$ inches thick. The length of the planks for the rafters of the trusses is from 12 to 18 feet, according to the width of the barrack, and of those for the uprights from 10 to 15 feet, according to the height of the eaves.

The sheet iron is about 6 feet long, and $2\frac{1}{4}$ or $2\frac{1}{2}$ or 3 feet wide, if procurable, of which about 120 to 150 square feet are contained in a hundredweight.

The wire is soft iron wire, between $\frac{1}{16}$ and $\frac{1}{8}$ inch diameter.

The building is rapidly formed thus. Fig. I., AA are two rafter planks laid on the ground, with the upper end (α) of one crossing that of the other at an obtuse angle determined by a pattern angle of wood. The lower end of each plank-rafter is crossed at an

Fig. 1.

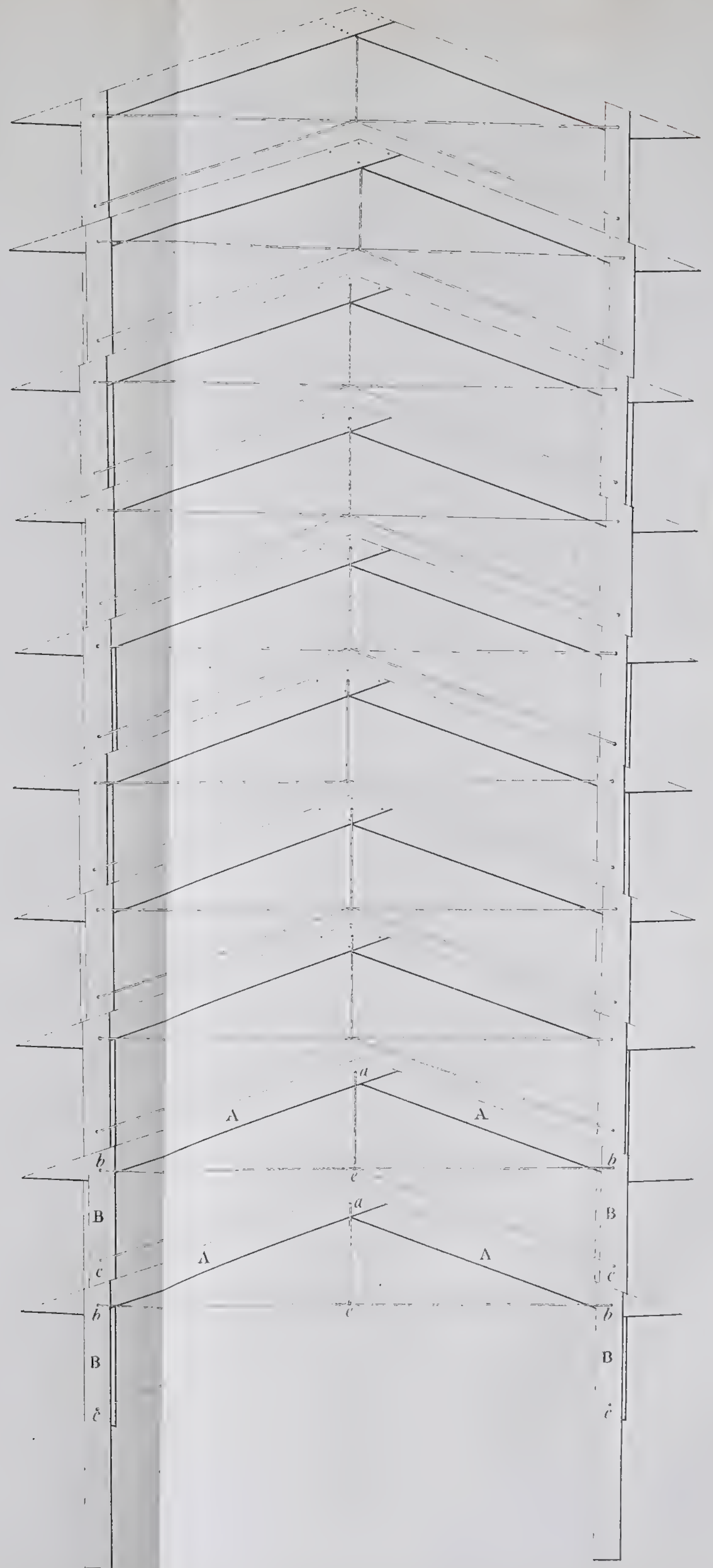
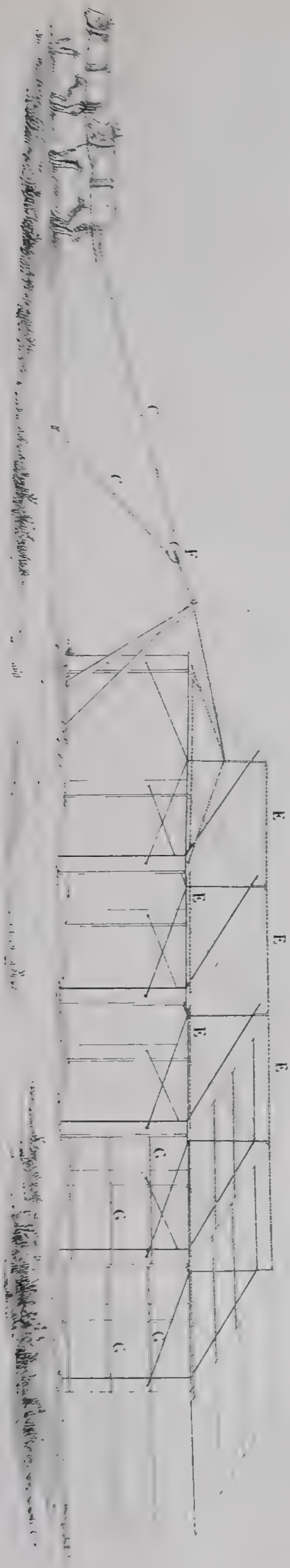


Fig. II.



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obtuse angle by the upper ends *b, b*, of similar planks *B, B*, which form the uprights or posts. The planks are then severally nailed together with four or more strong and clenched nails at each crossing. While the *square* scantling of ordinary rafters, whether they meet each other or an intervening king-post, renders iron plates or clamps necessary for a secure junction, by employing broad and flat planks we obtain very large junction surfaces, forming a joint capable of bearing a great strain when simply and securely nailed together. This is at once one of the advantages of the system of plank-timbers, which saves all expense and delay of fitting by tonguing or rebating. Round iron pins are then driven through the five spots *a, b, b*, and *c, c*, so as to stand out about an inch on each side of the wood. A wire-man instantly commences to throw wire across between the pins *b, b*, say half a dozen or a dozen times (always hitching home on the pins), until he has formed a strong "tie" for the truss. He then loops up the middle point *e*, by sufficient returns of wire hitched over the pin *a* to form a king-tie. He then makes a right-hand oblique tie *e, c*, the wire being hitched over the pin *c*, and passed over the ties *a e* and *b b* at the middle angle *e*. Lastly he makes, in a similar way, the left-hand tie *e c*. All the pins, to ensure the wires keeping *home*, have their ends bent a little in the opposite direction to the tension. The uprights *B B* have near their foot a stout piece of faggot wood passed through a hole *f* loosely, and projecting about a foot on each side. At the foot of each upright a hole is dug about 18 inches deep, to receive it when the frame is erected. The cross faggot lies a foot or more from the surface; and when the hole is rammed full of earth, this cross piece holds the post from being depressed, or pulled out by the action of violent winds tending to upset so light a building as is this construction, which contains the smallest quantity of materials enclosing a given space.

Thus are formed and very firmly connected together a truss and its supporting uprights. When erected, the span may be even 30 feet or more, the height of the eaves 12 feet or more, and of the centre ridge from 15 to 20 feet. As these frames *AA, BB*, of trusses and posts stand about 5 feet 6 inches apart to suit the length of the sheets of iron, and allow them some overlap, a barrack 100 feet long would take 19 of those frames, and one of 50 feet 10 of them. The frames, having been made rapidly on the ground where they are to stand, are drawn into their exact position *A1, A2, A3, &c.*, Fig. I., overlying each other in a line, each extending 5 feet 6 inches beyond the one over it. Ropes *EE*, Fig. II., connecting all the frames along the three angles *b, a, b*, are held by a running loop or ring *F* at the end of the hoisting tackle *CC*, which passes over the elevating straddles *D* to the power, whether men, bullocks, or horses, by which all the frames, for a barrack of 50 feet or longer, are erected at one pull, and sustained in position until secured by stay ropes to strong tent pins in the ground.

Cross shelves *G G*, Fig. II., are then inserted from $2\frac{1}{4}$ feet to 3 feet apart, if iron sheets wide enough can be procured between the frames from the ground to the very ridge, and secured by nails driven into their ends through the frames.

The casing the whole with an inner and outer skin of iron is now done, commencing either from above or below, as may be most convenient; care being of course taken that the overlap of the sheets is in the right direction for the descent of rain. The *ends* of the sheets overlap each other and the edges of the frames about two inches, and the long sides of the sheets overlap each other and the edges of the shelves *G*, as seen on the right hand division of Fig. III. The two layers of metal of the overlapping ends and sides of the sheets are pierced by a light blow with a hammer on a pointed punch, and secured to the edges of the wood-work by inch-nails with good heads driven home. At first the nails, to hasten the work,

may stand six inches apart, and after the barrack is finished, and even occupied, they may be tripled and stand two inches apart. As each quadrangular space (formed between the shelves *G* and the frames right and left) is being covered in by the inner and outer coat of metal, it is desirable that it should be loosely stuffed with straw, stubble, or dry turf, the iron having been tarred on the inside before being laid on. Between the overlapping edges of the sheets, prior to the nailing down, slips of thin tarred felt are placed to render the walls air-tight. The gable-ends of the building *H H* are, in like manner, made with upright planks set edgewise, and cross-shelves between them of equal breadth, as a framing, which is then similarly crusted inside and out with the thin sheet iron. The inner and outer surfaces of metal, from the ridge of the roof to the ground, are well tarred, japanned, or painted, as the work proceeds.

Openings are left at the top for flues and for ventilators, and at the sides and ends for doors and windows. The floor may then be either left as it is, or planked, or filled to a few inches with dry sand, to be overlaid with square tiles or bricks, if either are at command.

Thus is formed a spacious barrack possessing the following advantages, both in the mode and in the efficiency of its construction:—

1. The materials are at all times procurable with the shortest notice in any quantity at fixed market prices.

2. They require no preparation whatever; the rough sawn plank, rolled sheet iron, and wire being fitted together as they come to hand. The erection requires no scaffolding whatever, and therefore no materials for it, and the shelves *G*, as fast as they are nailed in from below upwards, serve as ladders for the work.

3. The form of the material is highly favourable for facility of construction. Thus, while the ordinary square timber of rafters and posts requires rebating, morticing, and tonguing, and that with careful fitting, at well-gauged angles, and yield after all a weak joint, unless strengthened by clamps or shoes of iron, these flat planks present a wide surface of contact, and with none of the wrenching strain which thickness of timber gives. Each joint can, therefore, receive all the nails necessary for strength, and at such a distance apart as to give them great mechanical effect.

The simple application of a wooden angle-pattern determines the position of the planks before driving the nails. One pattern angle of 120 degrees, formed with two battens of a yard long each, will suffice for setting all the three angles—that at the ridge, and those at the eaves. This will give a pitch of 30 degrees to the roof, which is ample. This flatness in the scantling of the rafters and posts is also favourable for fixing the wire-ties, and for carrying the holdfasts or cross-sleepers of wood at the foot of each post.

The thinness of the iron sheeting, which for the outer casing may range from 12 oz. to 1 lb. per square foot, and for the inner from 8 oz. to 12 oz. per ditto, greatly facilitates the nailing of it down, and brings it within the range of carpenters' instead of smiths' work. This thinness also, while leaving the metal ample cohesive strength, deprives it of any inconvenient thrusting power when expanded by the sun. An imperceptible arching of the edges of the sheets between the nails by solar heat, which is aided by the softness of the intervening felt, relieves the metal and gives it the necessary thermometric play.

4. The form of the materials and their relative position conduce to strength to such a degree as almost to solve the problem of producing a maximum of rigidity and strength with a minimum of material, labour, and cost. The plank trusses and posts receive all strain edgewise, without the possibility of any flinching to the right or left, and a double layer of metal runs down both their inner and outer edges, bringing an addition of strength where it is most

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effective, and shielding all "shakes" or cracks at the edges of any planks from the effect of weather and strains.

5. The edgeway employment of the timber produces a wall from 8 to 10 inches thick, which, even when loosely filled with straw, becomes a very tardy transmitter of heat either inwards or outwards; the metal casings enclosing it preventing any passage of air which would produce a *convection* of heat within the walls. Such a wall would be more protective against cold or heat than a brick wall of equal thickness.

6. The double casing of sheet iron with felted joints would give place to none of the injurious draughts of air which enter houses of wood planks at all points, in spite of careful fitting.

7. Lastly, such a building exposes nowhere combustible matter; the surface everywhere is sheet iron, the "ties" are all of wire. It is, therefore, proof against all ordinary causes of fire. No embers from camp fires carried by the wind, and no carelessness with lamps, candles, or spirit would endanger it.

Though I have not constructed a building on precisely this plan, it is founded on one of far more lofty dimensions, erected three miles from Futtighur for a refinery of saltpetre upon certain peculiar processes, which gave a high value to a neglected material. These processes required a variety of novel apparatus of large dimensions; one of them, a reverberating furnace with a circular bed no less than 12 feet in diameter, and mounted 18 feet high, on an arch under which stood a huge vat. What with copper and iron boilers, and leaden coolers 24 feet long, &c., the containing building had to be made 120 feet long, 100 wide, 18 feet high at the eaves, and 40 at the centre ridge. It stood like the roof of a modern railway terminus, but much more lofty, and deriving its strength entirely from the framing of the roof, which was covered with the thin sheet iron described. For the roof 15,000 or 16,000 feet of sheet iron was employed, all from England, of course. Like the barracks proposed it was erected without any scaffolding, its timbers being all stayed with ropes, like ship masts, till the forming was completed. This building was not quite finished when an Indian hurricane assailed it, driving against its matted sides which had no walls to support them, but rested against the timber uprights, presenting to the wind a flat surface 120 feet long and 18 high, besides the incline of the roof. Both buildings and trees in different places were blown down that night, but, much to the surprise of the natives and myself, that erection stood firm; and would have stood I believe to this day, had not a native who purchased it three or four years after my return to England pulled it down for the materials! I mention this fact to show that the present proposal has some constructive experience of a like kind to support it.

2820. (*Sir R. Martin.*) The roofs and sides of the proposed structure being double?—Yes.

2821. With a view to the slow conduct both of heat and cold?—Yes; it has also the advantage of great mechanical stiffness. It is so stiff that if I had the opportunity of fixing to the trusses of the model wire ties like those in this pattern truss, I would undertake to place many pounds, even an hundred weight upon the model, though it is made of only seven or eight of those slight frames about half an inch wide, and one eighth of an inch thick.

Without any particular sympathy for the Crimean war, I would have been willing to have gone out, if it had been desired, and with a few packages of the thin sheet iron, say 250 tons only, with a corresponding proportion of rough planks, say a ship load or two, I believe the army might have been housed before any serious suffering from the winter was experienced.

Presuming that the banks of the many mountain streams which fall into the Black Sea on its Asiatic side, must be fringed in many cases with pine forests

down to the sea, (a fact since confirmed by a friend who served with Omar Pasha), it seemed a very feasible thing to form and to tow rafts from the Asiatic coast to Balaklava, and there to set all sawyers from the fleet and army upon reducing them into timbers and slabs for a wooden road up to the camp; and the surplus into planks for such barracks as those here proposed. It is surprising how far a few rafts of timbers of fair scantling would go towards a single roadway of eight miles in length, and eight feet wide.

2822. (*Dr. Sutherland.*) What advantages do you think would be derived from having a bright surface?—The surface of this model is partly bright because I could not get any sheet iron thin enough to show anything like the proportional substance; therefore I made it in tin; but this casing is not necessarily to be of sheet tin; you cannot get sheet tin of any adequate size. After having made barracks of sheet iron, if you had any idea of these being permanently occupied in a situation where you wished to avoid a loss of heat in cold weather, by radiation, or a reception of the solar ray in hot, in that case I would recommend them, and indeed all dwellings of Europeans in the arid parts of India, to be coated with sheet tin. The vertical walls would trouble nobody by their reflection of light any more than do the panes of windows, excepting just when the sun is setting. The sloping roof would also trouble no one where there were other barracks near it; supposing that you had a succession of barracks, no man could get in such a position as to be troubled by the rays from the roofs, of any but the exterior barrack. It would no doubt shine brightly into the eyes of persons approaching it. I believe you could purchase very thin sheet tin at about 1½d. the square foot wholesale. The current size of tin sheets is 14 inches by 10. They might be laid over the sheet iron like slates, but very little overlap would be needed. Their under side having been roughened with sand paper (great care being taken not to blur the upper face), and coated with well boiled oil, with a little resin and brick-dust stirred in it, such a cement, if allowed to dry exposed until it is almost solid and very adhesive before the tin sheets are laid down, will be found to hold them on firmly; and if they are very thin, to keep their edges so closely down as to permit no water to lodge under them. This will also dispense with the use of nails, which cannot indeed be used where the under surface is sheet iron, and which in any case expose an edge of the iron of the tin sheet, detain drops of water there, and lead to rusting.

2823. Supposing you had a sheet of tin with a good reflecting surface, what thickness of roof would it represent, so far as arresting the progress of the sun's rays inwards?—I think I might go this length, and say that if it were tolerably bright, it would be better than half a yard of masonry, or better than nearly a foot of straw thatch, if you kept it tolerably bright.

2824. With regard to double roofs, what would be the advantage of a polished roof that was double, having a space between them?—That depends upon how the double roof is constructed; the straw roofs in India, which are made so that all the edges are presented against the wind, very soon come to the mean temperature of the air; in the day-time it is blowing all through the straw, and each straw is soon brought to the temperature, say of 110° or 120°; but the advantage in a construction of this kind, of putting straw between the metal casings, is that the wind could not get into the straw, and you would have a mass of air retained there, that would not be affected in the same way.

2825. Would it be a cheaper roof?—That depends upon the durability of sheet tin; in India, in the Western Provinces, I believe it would last a long time if laid down with cement as above described.

2826. I observe that you have not shown in the model any system of ventilation?—No; this model was merely prepared to show the mode of construction. With respect to the ventilating of barracks in India, I would beg to refer to the general principles

laid down in my work on the British army there, as I believe those to be observed.

In the hills there would be this kind of advantage, that these planks could be sawed up by the men themselves in the hills, there being an abundance of pine timber there, and cedars. The sheets of iron are so thin that you have an immense surface with but a small weight, as I mentioned before; a hill coolie could therefore easily carry up half a hundredweight, indeed, many of them could carry one hundred weight; but half a hundred weight would be an easy load for a hill coolie to carry up; he would be able to carry up, say, 70 or 80 square feet for 3*d.* a day, and take it a distance of 15 miles, so that the carrying of it up would be no matter of expense; the bulk would be merely nominal, such thin sheets as I am supposing packing up into so small a space.

2827. (*Sir P. Cautley.*) Can you form any idea of the relative cost of barracks constructed as you have suggested, and of barracks as they are now constructed with thatched roofs?—I do not propose these for *permanent* barracks in the plains of India; they are more intended for the hills, and in the plains in places where you intended only temporarily to canton the men. I have had no experience of the action of creosote or of chloride of mercury in preserving wood from the white ants, but I presume that that matter has been considered with regard to railway sleepers used in India, and if they would stand, the wood used in such buildings as these would also stand, if it were thus preserved. I think that these would prove a cheap kind of barracks for India, and particularly cheap where you could get the wood easily sawed up like the fir. In the plains of India the supply of that kind of wood is not abundant, some woods are in sawing very hard and troublesome; mango, which is generally abundant and cheap in the plains, is easily sawn up into planks, but it warps and cracks. These defects, however, would not materially interfere with the use of it in such a construction, in which it is hidden from view, and constrained, as by a laced jacket, to keep its place. Saul timber would go far, as thin planks would answer, this wood having great strength, but it is an expensive wood, at any distance from the terrai jungles of its growth. For all kinds of temporary barracks, such as those which I have suggested, it seems to me to be about the best.

2828. (*Sir R. Martin.*) The only objection that you would have to it, in the plains, would be the invasion of the wood by the white ants?—Yes; I think so.

2829. (*Sir P. Cautley.*) The restoration of such slight work would, however, be easy?—Yes; if this sort of wire were used, not very much thicker than bell-wire, a man might lace it backwards and forwards; he could do it easily; and furthermore, if between these wires little pieces of wood were placed, forming a lever of a certain length, so that they could be twisted round if they were too slack, they could tighten up any that should be slack; and in constructing them for hurried occupation, I would have the workmen drive the nails six inches apart, until the barrack was ready for the troops to go into, and after the men were in they could go on finishing them, and putting nails between each of the first. In wire-tying the frames, they might do it quite carelessly in the first instance, and tighten them up afterwards. These are all the remarks that I have to make as to this method of housing troops, a method which, I believe, to be equally applicable for temporary barracks in Europe, especially for such camps as at Aldershot.

2830. (*Chairman.*) If I understand you, the plan which you have proposed is not as a substitute for permanent barracks upon the plains, but it would be adapted for all stations where there was any doubt as to whether the occupation would be permanent; they would be temporary, but substantial enough to

last for a considerable number of years?—Yes, precisely; how far they would answer economically as permanent barracks I cannot venture to say.

2831. There is another question connected with the subject you have been considering, and I think you stated that you had some plan for the better accommodation of men in tents?—Yes; and the first object would be, as much as possible, to get rid of the walls of tents, not only with the view of diminishing the weight, but, on sanitary grounds, to get rid of the nuisance which walls are liable to become. Physicians well know the effect of cloth in absorbing impure matter, and thereby becoming a source of impurity, and producing a poisonous influence,—that is a very old fact; and, in point of fact, we find that it is supposed that the plague has been carried from one country to another in cloth. A particular name, *Fomites*, has been from early days given to cloths impregnated with impurities. Any person who has been employed much in India will know this, that if soldiers have been kept any length of time in tents, the walls of their tents will become in time very impure; the men spit against them, and dogs from the outside filthify them, and constantly these cloths, in marching, will be rolled up, especially if rain has fallen against them, steaming with impurities, and packed in the hackeries, and then pitched again; the men every night sleeping in the tents in a foul state; at other times stinking of tobacco and otherwise impure; therefore to get rid, as much as possible, of the walls of tents is I consider a matter of great moment, and not only on account of their impurity, but even more from their boxing men up in small spaces, and presenting an extensive surface of many tents to the sun. In short, who would think of dividing a barrack intended for a given number of men into small rooms by partitions of any kind especially in a hot climate, and those partitions, cloth *fomites*! Or who would think of lodging them, if he could help it, in a multitude of separated little huts, exposing collectively a great amount of surface to the sun, instead of in one spacious barrack? Yet such is the principle of tenting troops in India. But the system has other great defects, which I desire to enumerate before describing a plan designed to evade them all. I have been told that the European troops in the late conflict were even afforded field officers' tents for their protection. But even these are very faulty, especially when crowded, as they must be, with men. Having no ventilation at their summit, heated air stagnates in their deep pyramidal roof, doubly deep from the the lowness, about 5 feet 6 inches of the eaves. This air long after sunset keeps the tent from acquiring the coolness of the evening air, indeed keeps it hot nearly all night, and tempts the inmates to the unsafe though very common practice of sleeping in the open air. Many do so for years, but more are caught by disease through it. Again, the props of the eaves are contained within the cloth of the walls inseparably. As these walls are made to reach up to the eaves, and have to be laced to them by men standing on the ground, the eaves cannot be above about 5 feet 6 inches high. Also the maintenance of the eaves in one straight horizontal line by means of a multitude of props in the walls, renders necessary a great steepness or pitch of roof, to prevent a flatness just behind the eaves, like a Chinese roof, or even a hollowness if the tent be not very tightly set up. At this hollowness in heavy rains water leaks through; whereas the eaves might be propped up so high as to reduce the slope of the roof to a very small angle, if the props stood far enough apart to allow the eave-line to hang in slight catenary curves, or gentle festoons. The swell of these curves would, in the nature of the case, be the lowest points down which all flow would take place. Hence the common ill propped (or rather in principle well propped) awning, of a booth or shop will, though almost flat, carry off not only its own rain, but that also poured down upon it from the face of a lofty wall. In short, canvass, if in no part abso-

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lutely flat or hollow, will carry off the heaviest rain. Again the ordinary tent has no openings but at the doorways. If for freedom of air the walls are tilted up, down drop the eaves half way towards the ground, bringing the slope of the roof near to the heads of the inmates. Moreover the ventilation takes place at the lowest level where the atmosphere is rendered impure and stagnant by the surface vegetation, instead of being invited from the highest level, the ridge of the tent, where it is far purer and often freely current, while arrested, and injuriously impregnated below. Furthermore you have far more dust and insects entering near the ground's surface. At the very surface even heavy sand blows in if the door be open; and will form quite a bank sometimes against the walls, showing their effect in keeping it out. Lastly, doors opening to the ground let in the intense glare of the ground which is thrown up towards the eyes in a degree oftentimes so distressing as to make the closeness of closed doors preferable to it. What is wanted is to have at command ample window space, but doors only opened for the moment of passage. Lastly, the best Indian tents with double roofs and walls, containing together seven or eight layers of cloth, are such imperfect arresters of the sun's rays that you may see where the luminary is all day through both roofs. They are also, when they have lost their pure whiteness, readily absorbent of its radiated heat, and there is of course no such substance in them as to have much effect in retarding the transmission of heat inwards. There is value in the double roof, but the want of an outlet for the intervening air greatly reduces the value of the two roofs. It reduces to a minimum the value of the principle of convection, which is the chief value, and permits a powerful radiation from the outer roof down upon the inner roof, and thence down upon the inmates.

Where tents are so numerous, the necessity of pitching them as near to each other as their ropes will permit, causes alleys to be left between them at the back, which, prevented by the crossing ropes from being made thoroughfares, invite impurities, especially from the numerous dogs which infest all Indian camps.

These alleys in stormy weather give rise to gusts and violent eddies, in which form wind is most trying to the stability of tents, especially where the quantity of wall surface or steep pent roof is so large in proportion to the area enclosed, and where the tent pegs are exposed to the weather, and their hold in the ground is soaked by rain conducted down to them by the ropes. 6thly, the ventilation of ordinary tents, taking place from below, eddies of accumulated dust are constantly whirling into them, or to keep it out the doors have to be closed and oppression endured.

I have now to invite attention to the system which appears to me to embrace all the main properties of tents which are to prove as protective of British troops as is possible in a tropical climate.

The improvements in tents for British troops in India, which I have to submit for the attention of the Commissioners, will be best understood by a reference to these large drawings; but it will be well to premise certain remarks on important points before turning to the drawings.

At the time I was in India the tent of the common soldier was totally unfitted for the reception of our countrymen in such a climate. During any protracted campaign in the hottest months it must have caused a destruction of health, if not of life, to many, and a waste of vigour to all—consequences far more costly in merely their money estimate than the superior tents with which, it is gratifying to hear, the Government has provided its British troops during the late commotion; for I am informed that the soldiery were supplied with field officers' tents; but even these, as I have already endeavoured to point out, are very defective in principle, although so cumbrous in proportion to the number of men they can accommodate.

The modifications I am about to suggest are so considerable that I must earnestly deprecate that prejudgment of them which usage might prompt, and exhort attention to the grounds upon which they are based. Some of them, however, must, I presume, have long ago forced themselves on the attention of others, from their simplicity; and I have at various times explained their advantages to military men and others. It may then be hoped they will have the advantage of not appearing quite novel.

Instead of pitching tents separately I propose that their flies or roofs should be looped together,—say any number from two up to twenty tents or more in one block; four or five tents in length, and three or four in breadth.

Fig. IV. represents a side view, and Fig. V. an end view of such a system of tents. Such a square block of tents would present the least surface to the sun; but if the object were to increase the side ventilation, an oblong shape, like an ordinary barrack, might be assumed, formed by having only two tents one way, and say ten the other. Since the plan provides for varying the position of the tents from a line of three to a square, and the number from a single tent to twenty or more, experience should soon decide the best form.

All walls would be dispensed with, excepting the outer walls of the tents surrounding the block. Thus a square block of twenty tents, each of thirty feet by twenty, would form one large room about 120 feet square. In places and seasons where malaria was rife the block could not, I believe, be too solid, ventilation at the surface should be avoided, and ventilation from the roof invited down, as will be described.

Before proceeding further, it may be well to invite attention to the stability and facility of erection of such a system of tents. Each of the tents has a roof-tree or ridge plank of strong wood, B., Fig. IV. and V., from fifteen to twenty feet long, and from one to one and a quarter inches thick, and from six to nine inches wide, suspended edgewise, being supported by an iron eye, clamped on the upper corner of each end of the plank in the following manner: A A, are supporting poles (a couple of stout bamboos) employed in pairs in lieu of the usual pole, and standing 12 feet apart at bottom, but inclined together at top. A staple clamped on the top of one pole carries a short chain, the other end of which is passed through the eye at the upper corner of the ridge plank B, or through both its eye and the eye of the ridge plank of the next adjoining tent, as at B 1, B 2, Fig. V., this chain is then linked upon a staple at the top of the fellow-hole, A, Fig. IV., and kept from riding off by a hook or wedge.

Fig. III. represents the ground upon which a block of 16 tents is to stand. All the care necessary is to determine the points for the feet of all the poles. It may be done quickly and accurately in this simple manner: OP is a cord stretched along one side of the ground. Red marks SSS, &c. upon this cord are the spots for the feet of the first line of poles in pairs. QR is another cord, having on it equi-distant blue marks *tt' t''*, and stretched at right angles to the line OP. A sloping line RS to the fourth mark S is marked at just such length as will set the line QR truly square with OP. Stakes having been driven into the ground at all the points SSS, the line OP is advanced to the position *tv*. Stakes are then driven in at the points S'S', &c., and the line OP is then advanced to *tv'*, and stakes are driven at S''S'', &c. Thus the line OP is advanced to a third and fourth or fifth position, according to the numbers of tents in the breadth of the system.

The pairs of bamboo poles are then laid flat upon the ground in rows, as shown by the dotted lines S, Y, S, &c., the top angles of all the pairs pointing in the same direction. The fly, or roof-cloth of each tent C C, Plate VI., is then laid in its place upon the prostrate poles A, and all the roof-cloths, both length and breadth ways, are quickly looped together, as along *g, g*, &c. The roof-planks B, B, are then brought

FIG. IV.

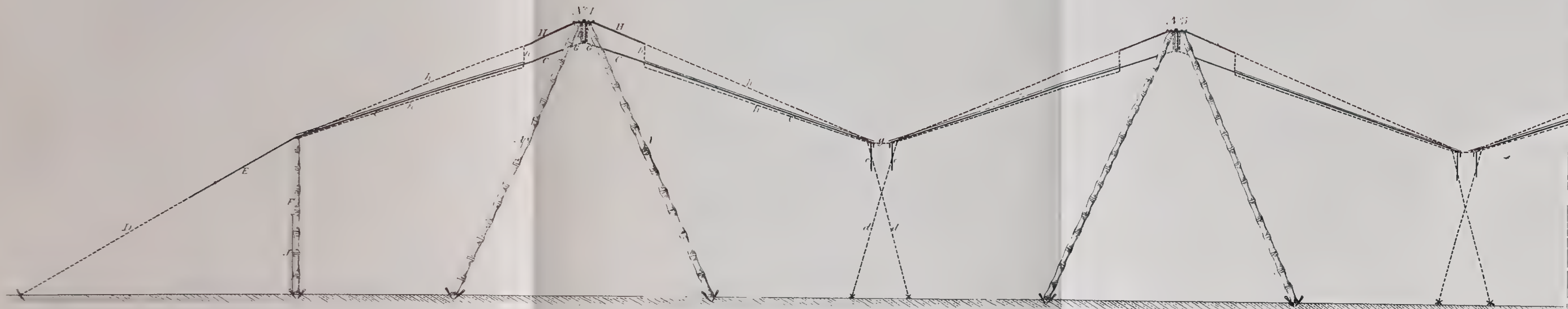
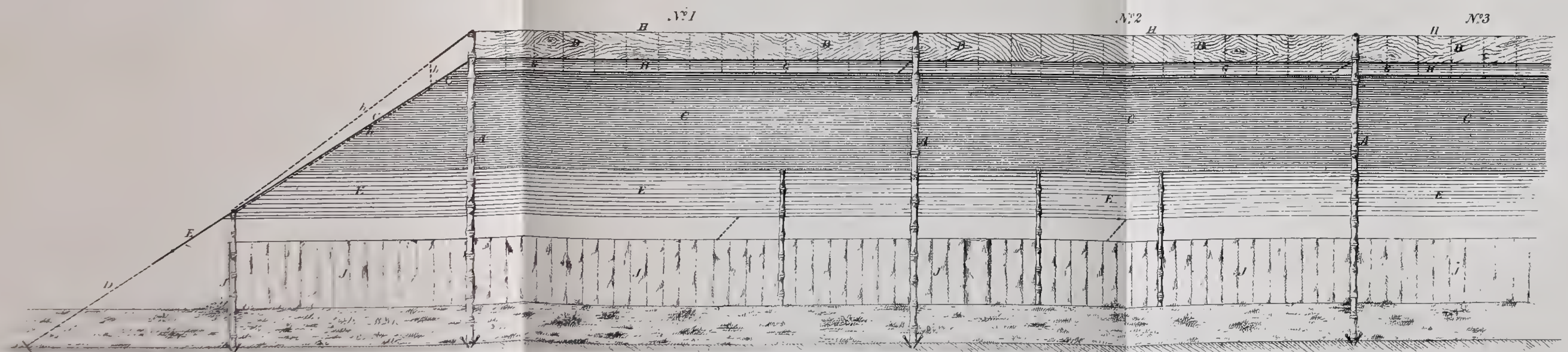


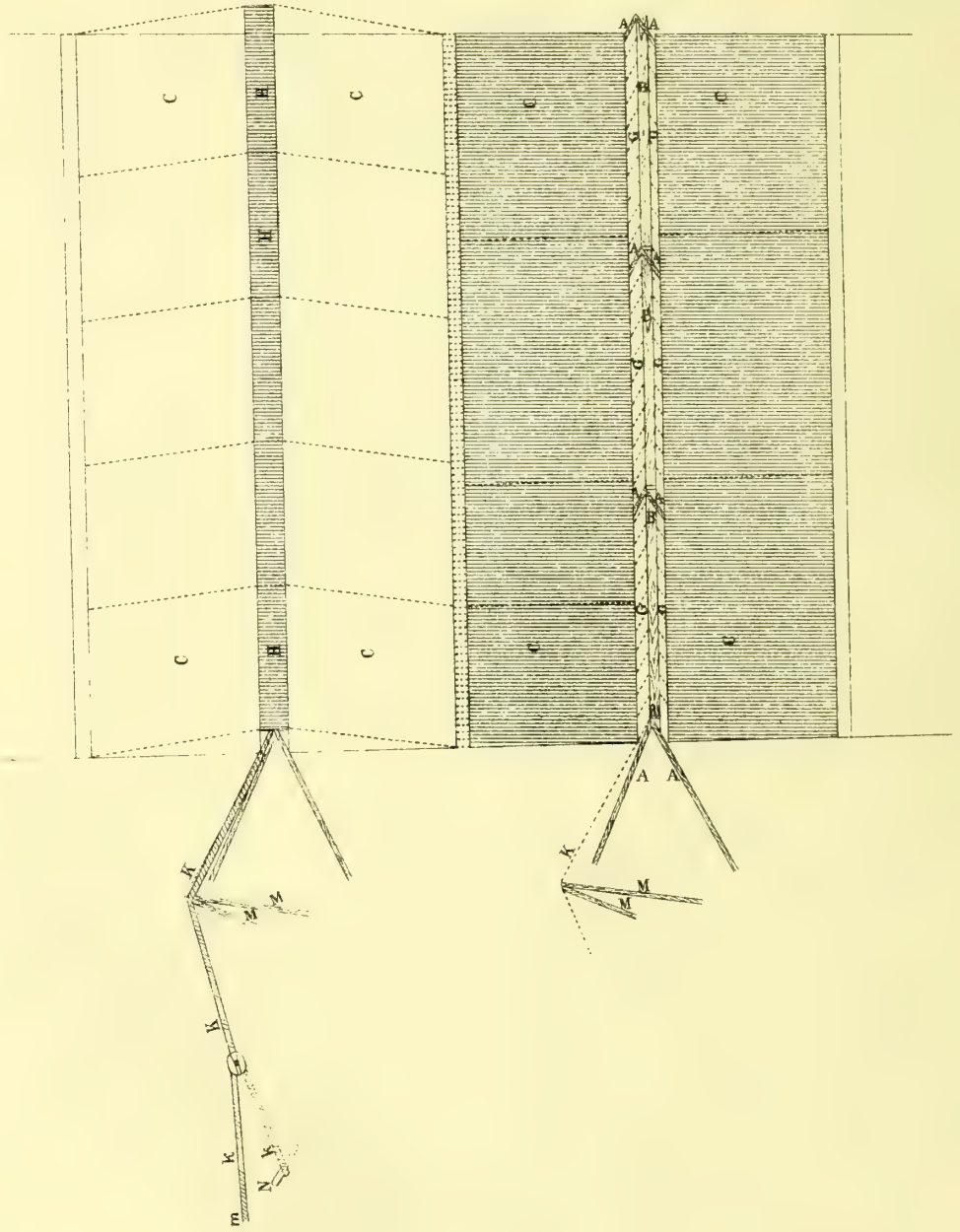
FIG. V.



There are to be four of these divisions; N°4, to the right hand being an outside Tent, with an inclined fly and curtain, &c like N°1 to the left.



Fig. VI.



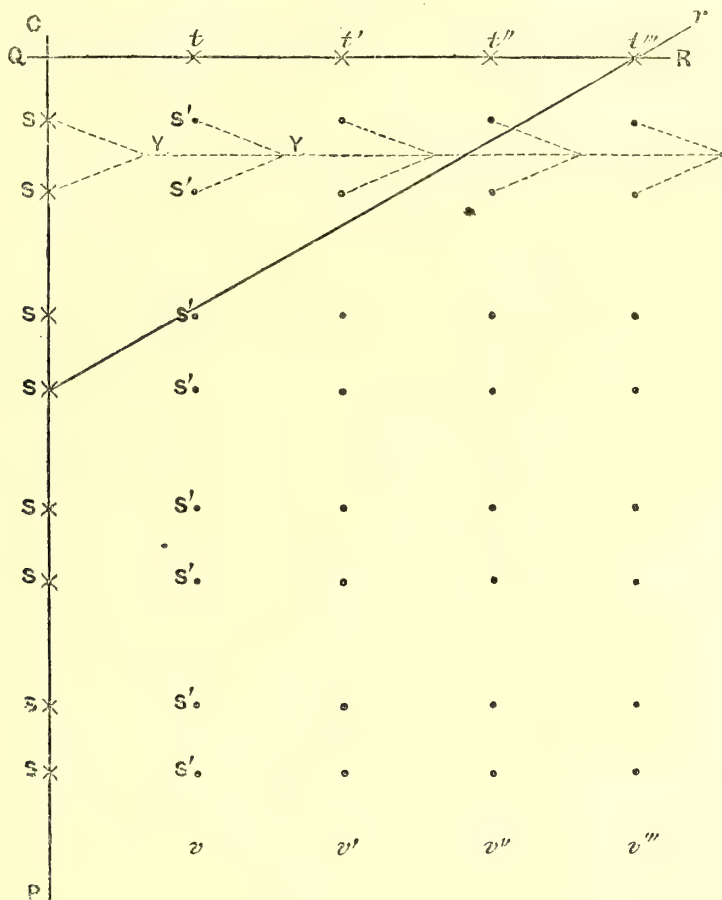
into position. They are slid through loose cord-loops G, G, Plate IV., V., and VI., fixed along the ridge line of the roof-cloths C, C, for suspending the latter

under the planks, while a pent awning lying over the planks, shelters the ridge ventilators to be presently described.

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Fig. III.



The whole system of tents is now ready for erection. From the end of the first ridge plank or roof-tree B 1, Fig. VI., of each front row, a stout rope, K, K, proceeds over the angle of a pair of bamboo cross stilts or shears M, M. The rope being secured at the angle is extended on to a block, through which is rove a rope K, one end of which is looped over a stake in the ground N, while to the other end, m, is attached a team of bullocks. The teams attached to all the four rows of tents being ready, and the stilts M of each rope raised to a sufficient angle to give an upward tension to the prostrate tents, the teams are set in motion together, and by one pull erect the whole system at one haul. There are, of course, check stays at the opposite end of each row fastened to ground stakes to prevent the tents being drawn beyond the perpendicular. Similar stays, of which the erection ropes form some, are then made fast at the hither end of the rows. This simple hoisting tackle is got ready while the tents are being prepared for erection, so that no time is lost.

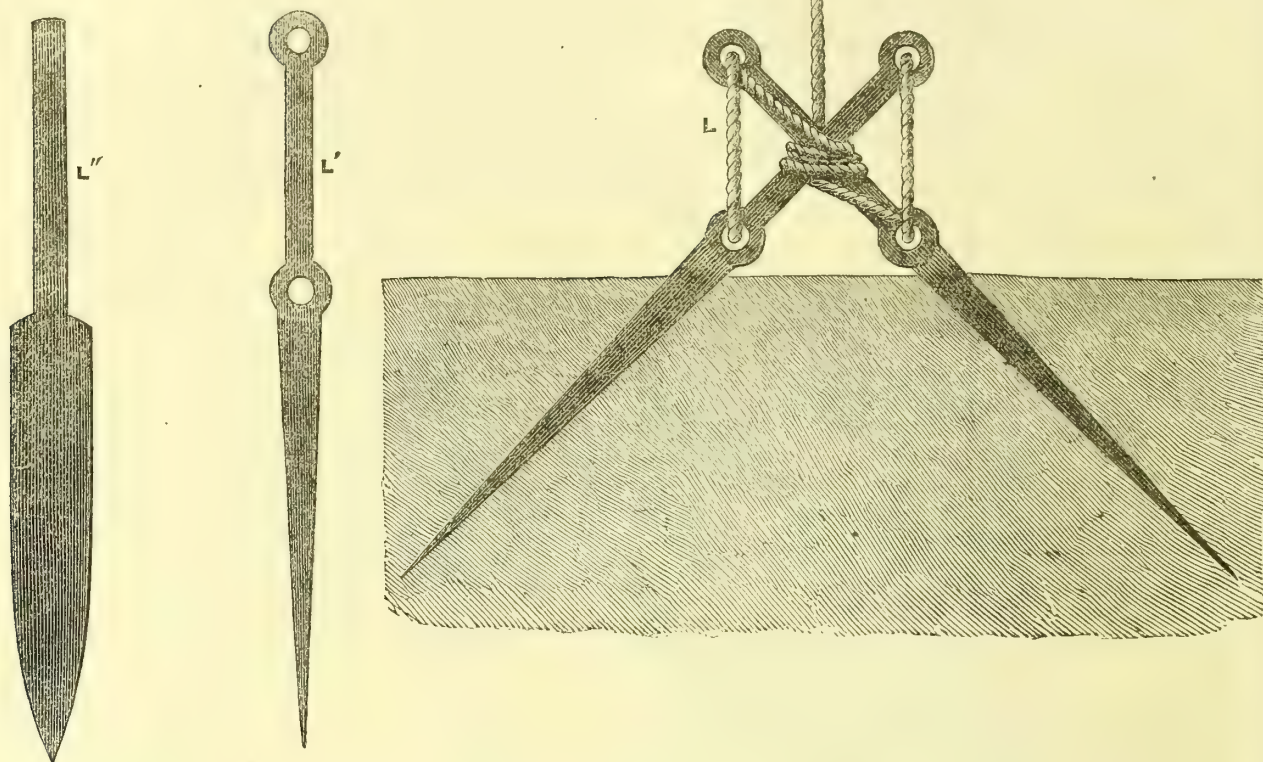
This great tent barrack, covering 14,000 superficial feet, supposing the block to contain 20 tents, is now ready to give shelter at once to a whole regiment, although the pitching is not quite complete. Along the lines of junction g of the several rows of tents, ropes, d, d, Fig. IV., hang down at suitable distances, which may now be made fast to double tent pins inserted as cross stakes in the ground below. The small inclination or pitch of the roof cloths gives these ropes a great mechanical power in keeping them tight.

The foot of each bamboo pole is then made securely fast to its cross stakes L. As the bamboos are 12 feet apart, at bottom, as the ground is sheltered from wet, and the cross stakes from their construction have a hold in the earth, from which they could not, without great force, be torn away, the stability of the system

in that direction will at once appear, especially when the general absence of walls, and the small resistance presented to the wind by roofing so little inclined is taken into consideration. Moreover, spare ropes may hang down the poles A, A, Fig. IV., which on any great emergency, as of a violent gale, may in a moment be extended to the foot stakes of the neighbouring poles; and some of the vertical cords, d, d, from the eaves g can be also carried obliquely to the next row of stakes. But there could be very rarely, if ever, any occasion for employing such additional security, for the system has far greater stability than ordinary double-poled tents.

To proceed. The small inclination given to the roof not only diminishes materially the hold of wind upon it, and increases the area covered by a given quantity of cloth, but, in conjunction with the looping of the roof cloths of the different tents together, it has the especial advantage of permitting the eaves to be no less than eight feet high, while the central ridge is no more than 12 or 13 feet high. This height of the eaves everywhere should be jealously maintained. Let it not be feared that rain would leak through a roof of that flatness. Canvass of fair quality and fairly stretched will carry off any rain with much less inclination than this. We see this in the case of booths and awnings before houses, which, though almost flat, will carry off, in addition to their own rain, that also running down the walls they project from. A sheet stretched at the four corners will convey all the rain that falls upon it into a tub under its centre, if it be weighted down a little by a brick placed in it. The leaking of ordinary tents, although they have a much steeper pitch, is caused by the continuous propping up of the eaves behind which there is a flatness or even hollow, as in a Chinese roof, however steep the pitch may be.

Fig. VII.



The *inside* tent-pins, or stakes, being in this system subjected to a vertical strain upwards, the stake seen in this Figure No. VII., and marked L, has appeared to me to combine ease in use, with great security. It might be of wood, but of forged or cast iron; it could be cheaply supplied from England. It has, you will observe, a somewhat spear-shaped blade, shown in L, to be driven obliquely into the ground, and with the broadway of the blade towards the surface. The butt, or part above ground, about nine inches long, has an eye through it close to the ground, and another at top. When two such stakes are driven into the ground, so that their butts cross each other nearly at a right angle, if the upper eye of each be tied down by a cord to the lower eye of the other under it, any rope made fast to the point of crossing of the stakes could only be dragged from its position by breaking up broadways the ground over the whole of both blades. The corkscrew stake, proposed by a gentleman whose name I do not recollect, would also, I have no doubt, be very secure. What kind of stake would upon the whole be the best is a point to be determined by experience.

An outline of the general construction and erection of the system having been premised permit me to invite your attention next to the momentous question of ventilation, as explanatory of the particular details which now claim attention.

To do any justice to the question of ventilating soldiers' tents, which are of necessity more crowded than officers, we have to bear in mind, 1st, That the largest possible amount of ventilation should be *at* command, and at the same time *under* command. 2ndly, That the supply of air should be received from as great a height above the surface of the ground as is possible. Every foot of elevation diminishes materially the amount both of malaria and of dust, with which the atmosphere is impregnated. 3dly, That at all times when the outer air is warmer than the inner, the tendency of the ventilation is downward of itself. 4thly, That while soldiers should have an abundance of fresh air during sleep, they ought not to lie in a current of wind at the earth's surface. The

natives themselves are, in many cases, careful on this point. The solitary watchman, lying on his bed in a field of melons, (translated in our version of the sacred prophet, "his lodge in a garden of cucumbers"), is usually careful to prop up a mat on the windward side of his bed at least, and thereby greatly to diminish the risk of an attack of intermittent or rheumatic fever. 5thly, That, not only should there be an abundant change in the air, but that it should have free and unimpeded circulation over a spacious area. To fulfil these conditions we have here, in the first place, a vast mass of cloth wall swept away, and with it the removal of a magazine of fomenters of impurities, and of obstructions to the circulation of air about the persons of the living occupants of the spacious area, which thus *immures* them as little as possible. I must beg to express a hope that this great advantage will not be lightly cast aside. Again, ventilation, to be effective, must be as general as possible. To command this, and to bring in and let out air freely at a high level, the roof, throughout the whole length of every ridge, is open for two feet in width, as you will observe at G, G, Fig. IV., also seen in this Fig. V., and in this prostrate, Fig. VI. The cloths on either side of the ridge terminate about a foot from it, in small cords, some inches apart, which are attached to the cords carried by the ridge plank. In the system of 20 tents we have at the ridges alone 1,000 square feet of ventilating surface. To shelter the opening from sun and rain, and to *catch* the wind at one time, or *exclude* it at another, a cloth pent H, H running the whole length of the ridges, and 3 feet wide on either side of them overlies the ridge openings, and is permanently fixed along the top of the loops enclosing the ridge plank. Cords, *h, h*, are attached to the outer edges of the pent cloth, from 3 to 6 feet apart. These cords pass down to the eaves, and passing through an eyelet hole in the cloth ascend up the under surface of the flies, as you will see by this line marked *h'*, to a point under that from which they started. They, there, pass through the roof cloth again, and terminate again in the edge of the pent cloth H. Thus the pents may either be stretched open by

tightening the upper lines of these cords (secured then by a slip-knot at the eaves), or the pents may be drawn down close to the roof by tightening the lower lines, as shewn in the dotted lines H'H". Thus the ridge ventilators may be entirely closed, or that to windward may be shut if gusts unacceptably cold blow down it, allowing still a free ventilation to leeward; the pents will then act as a cowl. Or again, the pent to leeward may be closed, that to windward being kept open; the pents will then act as gigantic windsails, inviting down the upper breeze, when often the air entangled by vegetation is stagnant and impure below.

I have next to request your attention to this line of junction G between the eaves of the several tents.

We have here the opportunity, by not bringing the eaves of the opposite roofs into contact, but linking them to each other apart by the loops of one side, or of both, to command most desirable lines of ventilation all along the eaves parallel to the ridge lines, and of less, equal, or even greater width, if desired, according to the distance apart at which the tents are pitched, or the slope which at the time may be given to the roofs by lengthening out their loop connexion, and tightening the vertical ropes. Thus we may have a gutter ventilation of 500, 1,000, or more square feet. Eave flaps *e, e*, hanging down will confine the sun's rays, when shining in vertically, to narrow lines between the tents, and will cut off its rays altogether when they are oblique. And by drawing the flaps together the vertical rays may be shut out also; and by the same means the ventilation may be restrained, or even cut off.

2832. (*Dr. Sutherland.*) How would you dispose of the rain water?—In the first place, I would have each tent of these larger than an ordinary tent is.

2833. But would you not have a large rain-fall accumulated at one point?—I will explain that point. Supposing that these were separate tents, and each of them was large, each would require of course its little gutter around it to carry off the rain. I would then have a provisional gutter running along the ground at the junction of each line of tents. This would equally carry off all moderate rain falling from the eaves. For heavy rain I would have the eave flaps turned up one under the other; thus forming an eave gutter between the tents, say 1 or 1½ feet wide, and 9 inches deep. Such a gutter would amply suffice to carry along any rain to the end of the line of tents. If the cloth forming the eave flaps were soaked in drying oil, the gutter would be quite water-tight, but this would hardly be necessary.

How preferable this arrangement to the 8,000 or 9,000 square feet of wall cloth and rods dispensed with, which in the case of separate tents would become soaked with wet, and then in marching be folded up damp, and steaming with impurities.

I have now to invite your attention to the outer eaves of the system; the eaves are here also eight feet high, and instead of having numerous eave props enclosed in the cloth walls, and therefore inseparably accompanying them as in usual tents, there are separate strong props F, F, to support the eaves wherever there is a tent rope.

The eaves ought I conceive to be propped up only wherever it is stretched by a rope. The intervening props, encased in the ordinary cloth walls by not allowing the eaves between the ropes to drop in slight festoons cause hollows to be formed behind the eaves, in which rain is liable to lodge, and then leak through into the tent; whereas by allowing the eaves to hang in slight curves, the fly itself may be stretched with half the usual pitch without causing even the heaviest rain to leak through; for all that is necessary in a cloth tent is that the descent shall be constant. By allowing the eaves to drop a little between the stretching ropes, each rope line forms a kind of secondary cross ridge to which the swell of the cloth forms a gutterline. A dwarf wall of cloth or cannaut J, only four feet high, having a rope bound along its upper edge, and stiffened or not with sticks, sewed

into it, is supported, by being tied against these eave rods F. An open space four feet high is thus left, you will observe, between the top of the dwarf wall, and the eave above. To the whole length of the eaves there is attached a cloth curtain E, E, six feet wide. It may, in fact, form a continuation of the roof cloth. This cloth is divided into separate curtains at every eave prop; every other curtain being made broader than and overlapping the intermediate ones. When these curtains, furnished with short cords at their edges, are stretched out to the tent ropes D, and secured to them by their cords, they form awnings before the window space, which, as I have already observed, is four feet high, and runs round the whole erection between the low walls and the eaves. When the curtains are down they overlap this window space by two feet, and may be secured by their cords to the eave props F, F. The window space is then entirely shut in, or every second, or fourth curtain may be raised up, forming a series of separate windows, which probably, in any but the hottest weather, would at night be the usual arrangement. For keeping off glare and dense ground dust by day, and impure ground air and intruding animals at night, the low four foot wall would in general be kept in its place; but, if desired, it might be removed or tilted up like an awning below the one above it. Lastly, this upper curtain E might at night be coiled up to give still greater freedom to air. In a violent storm the long eave props on the windward side might be removed, and the roof cloth inclined down, until the eaves rested on the low four foot wall, while the eave curtain might be stretched out on a slope to the ground, and pinned down to it. The force of the wind would thus be broken much more than in an ordinary tent.

We have, then, in this simple construction, lofty eaves, eight feet high, always stiffly propped up, with window and door spaces anywhere, or everywhere, if desired. Such ventilation as is thus offered, super-added to the universal ventilation in the roof, would keep the entire area, up to the very ridges, at all times fresh, and would rapidly sweep away that after heat of the day, which renders tents so stifling of an evening, and sometimes for half the night.

The question of main importance remains to be considered,—the exclusion of solar heat. My own experience in tents and experiments carefully directed to the inquiry, lead me to the conclusion, that the many folds of loose wove cotton employed in India are peculiarly ill-suited for the purpose.

The seven or eight layers in the two flies of a tent do not form even an opaque mass. The position of the sun may be readily discerned through them all. When new and brilliantly white, they certainly reflect many of the rays, but they absorb a great number, which they rapidly transmit, and radiate down upon the persons of the inmates. The principle of non-conduction, or rather slow-conduction of impinging rays, is not appreciably applicable in the case of tents. If two flies were employed in the system of tents here proposed, and each were made with two or even one layer of such close canvas as is now made abundantly and cheaply in Calcutta it would answer much better than the three or four layers of cotton cloth usual in a fly. While the outer fly might be covered with fine white cotton cloth in strips removable for washing to maintain such whiteness as would have reflective value. In any common tent the outer fly ought by all means to have a large ventilating opening at the very summit; for want of which the capacious space usual between the flies is, excepting when wind forces a circulation, almost useless for convection, the chief purpose such a space should serve.

In the drawing before us it will be observed that only a single roof is adopted and that is of a single layer of close strong canvass.

This is not done without mature consideration, in the hope that the following important provision will be adopted, otherwise there ought to be two separate roofs. It is of the greatest importance that the *reflective power* and *opacity of metal* should be put in

Julius Jeffreys, Esq., F.R.S. requisition for the sun-resisting surfaces of tropical tents.

20 April 1861.

Even such limited trials as are justifiable in uninvited efforts have satisfied me that a cloth durably coated with tin bronze might be manufactured at a cost of from one to two shillings the square yard according to the quality; in India, with the appliances at the command of the Government, at less. Such a cloth, however brittle might be the cement employed for holding on the bronze, would bear any amount of rolling up on wooden rods, though it would be damaged by much crumpling. A flexible cement is therefore not necessary for the present purpose, though I doubt not forthcoming, and very desirable.

I would employ this cloth, in breadths four feet wide, attached to a rod across each end, and of lengths to suit the surface it has to cover. These reflecting cloths for the roof would reach from the ridge ventilators down to the eaves. Each cloth would be detained in its position by cords ready placed so that the cloths could be either placed in position before the tents were raised or drawn up afterwards by letting loose a sufficient number of the eave loops to admit the cloths to pass up over the roof. In like manner at sunset these reflectors could be taken down. Each dozen of them might then be laid upon each other and rolled up firmly into one bundle, which might, or not, be slipped into a case like a sack. All these rolls might then be stowed away into the waggons ready for the morning's march. In a standing camp they might, excepting in a very hot night, remain in position on the roof. The end and side walls of the system of tents on which the sun shone ought to have similar reflecting cloths suspended exterior to them. The walls of these tents being vertical could not dazzle the sight of beholders from without. Neither could the greater part of the roof, it being out of sight. The exterior, or end, slants could alone reflect light in the eyes of passers by, and that only of persons at a particular distance and when the sun was low; when, of course, if it were desirable, the metallized cloths would be removed from those slants of the roof which faced outwardly.

Tents of this description would be found to surpass many substantial buildings in their resistance of solar heat.

Such metallized cloth would, I believe, suffer little from rain. When we see the gilding of domes—a mere film of metal, lasting through a century, and patches of gilding still bright on ruins in the tropics, neglected for many centuries, and find even the slight gilding of the backs, and especially on the edges of books, to bear so much friction, I think the sufficient durability of the tin cloth need not be doubted; for though tin is more oxidizable than gold, it is very little affected by atmospheric or solar action at natural temperatures. The cloth itself, as well as the main roof cloth under it, would be so effectually guarded from wet and rotting that there might actually be a considerable economy of materials in the plan. There can be no doubt that such a system of tents would cost much less than separate tents with double flies and walls surrounding each one of them.

In a military point of view, to diminish by one half or more the weight of matter to be carried, and the space an encampment would occupy, where a regiment might be accommodated in one spacious room, and to have large bodies of men at once under the eyes of their officers, are advantages I should suppose of no small account. It is, however, in a sanitary point of view, and therefore indeed in the highest military, that I do sincerely hope the attention of those who are responsible for a due preservation of military life in India may be turned to these proposed improvements. Whether any part of these plans have been suggested or tried before I do not know. If they are properly carried out I cannot doubt of their answering their promises.

Since polished steel rolling mills would form the chief agents in the manufacture of the tin bronzed

cloth for the tents, and of the finer tin or aluminium cloth for hats and back curtains for the neck, and since the splendid rolling mills in the Indian mints are not, I presume, occupied half their time in laminating metal for coining, I do not see why they should not be employed for the former purpose, whether the bronze powders were brought from England or made in India by the natives, who are great adepts at beating out metals into thin leaf and making bronze of it. India also would yield on the spot the very best gums (as they are called in commerce) of which to compound the most suitable cements; and the India-European service abounds now in able men, full of zeal to direct any inquiries in practical science. One or two skilled workmen as superintendents would of course be required from Europe. In the meantime the metallized cloths might be obtained from England at a very moderate cost, as soon as the manufacture was established; but the tents would of course be made in India, and so likewise might the hats, with much advantage. It behoves the Government, I think, to afford such employment as it can to some of the native labour, which has been largely, though unavoidably, supplanted by the products of European. To encourage new art in India is of the greatest importance to the Government as well as to the people. A few native gilders with each force, supplied with the leaf metal, or bronze powders and cements, and with burnishing stones, would repair abrasions of the reflective surfaces of the tents and hats, and burnish any dull spots, though the reflecting power of even dull metal is great.

In conclusion, I may express the hope that a metallized cloth, *i.e.*, a cloth faced with tin bronze, will soon be produced at a moderate cost. Some years ago it occurred to me that a flexible cement for fixing the metal on the cloth might be formed of india-rubber. In 1857 Messrs. Bishop, painters and banner makers, in Doctor's Commons, coated with metal some rubber-faced cloth prepared for me by Messrs. Silver and Co., of Bishopgate Street, which had the advantage of flexibility, and for a first attempt was as promising as could be expected. It may be doubtful if rubber would stand an Indian sun, even under a metal face, which throws off the greater part of the rays. Trial can alone decide this. But for cloth curtains to be simply rolled up, like a map or blind, cement of such flexibility is not needed. I am informed that lately a metal-faced cloth was submitted to the India Council, but costing the price of silk. When once fairly produced, since the materials are so low priced, the cost of manufacture would be rapidly reduced. A manufacturer, if encouraged by a positive and large demand, and by some good process, ought, I should think, to produce a superior calico cloth well and durably faced with tin, at 1s. 6d. per square yard, if not less.

2834. (*Sir P. Cautley.*) What is the width of each of those spans?—I suppose that might be just as you please; but say 30 feet.

2835. To what extent would you carry the number of tents in the maximum?—I do not see exactly where you need stop; why not house a regiment? The only limit is set by the sufficiency of level ground and the power you can bring to operate simultaneously and conveniently for the instantaneous erection of the whole system of tents.

2836. (*Dr. Farr.*) Your tent has not yet been used in any part of India?—Never.

2837. Will all these tents be in communication the one with the other, so that the persons in one will be breathing the atmosphere which will be common to all, or would they be isolated?—It would be a common atmosphere, but ventilated at numerous points.

2838. Would not that be objectionable?—No; you would get rid of the walls which cause the stagnation of the air about the men, and which become very offensive, and you would have ventilation here and ventilation there, and so on internally throughout. In fact, as no one would think of dividing a barrack or hospital ward into numerous rooms by

cloth walls, or of having instead a number of small detached buildings with low cloth walls, so, I contend, ought tents for European troops in the tropics to be, as far as is practicable, thrown into one spacious area having air *at command* at all points.

2839. (*Chairman.*) If I rightly understand your plan, any considerable inequality of ground would be fatal to it, for it would appear that you must obtain a perfectly level plain upon which to place this assemblage of tents?—Surely not; I think not; but you do really find the camping ground in all the plains in India very level; as a general rule there is no inequality whatever; but if it were very unequal all the inconvenience would be this, that they would be a little awry; some parts, for example, might be depressed at a greater angle than you would find under ordinary circumstances. But there is nothing in the plan to prevent the tents being pitched in pairs only, or even singly, if it be desired; and as single tents they would still possess considerable advantages in their stability, the loftiness of the eaves, and the central line ventilation, and the windsail action of the pent cloth along the ridge line. But in this case, of course, an extra supply of outer walls, and of central poles A, A, to support the roof would be needed. You would lose the great economy of the plan and its saving of carriage; and you would sacrifice the great advantage of exposing only a minimum surface to the sun. There is an eave curtain, which either hangs down during the night, and overlaps and shuts it up, or during the day is open like a verandah, so that you can raise it or not as you please, portions of which you can shut down, or leave it just as you please.

2840. (*Sir P. Cautley.*) The eave, in fact, drops down?—Yes, and overlaps the dwarf wall; it is sufficiently long; here is the edge view; there is the eave curtain, and there is the low wall; there are these advantages in this mode of construction: the first is, that it will protect the men from the heavy sand and dust, which is very dense at a low level—at four feet high it is troublesome enough, but at that height it is nothing like what it is down on the ground. Another point is one upon which, as I have remarked already, the natives teach us a lesson. A native watching a garden of melons at night, invariably places a mat to windward of his low bed, which is generally of a certain height, to shield him from the wind, and to cut off the immediate current of wind from his body; that is a matter really of prime importance, for it will often just make the difference whether a man escapes or not an attack of rheumatism or of intermittent fever. It is, of course, much to be desired that the men should have air coming in copiously, but it should be above the level of their bodies. Therefore the men sleeping to windward should have a curtain four or five feet high always up at night, but with an entirely free circulation of air above it. This is a sanitary point of much prophylactic importance.

2841. Would not that be open to objection during a north-west hurricane?—During a hurricane I would bring the curtain down, remove the eave props F, F, and bring the wall right down to the ground. I would have extra stretching ropes *d, d*, Fig. IV., with their pins ready driven to be brought *taut* as the eaves dropped. Having dispensed with so large a proportion of outer ropes and pins, we may well afford this extra provision; although even with the eaves left two or three feet higher than usual, the various other points in the construction, especially the broad base and span of the main poles A, A, and the facility with which the inner eave ropes can be carried to windward and made fast to the next line, would ensure a more than usual stability in a storm.

I would now desire to revert to a question of the highest importance—of great importance in the case of houses, of greater in that of tents, and in greatest of all with respect to head-dress, and body dress also. It is this. What is the *surface* which can

be employed with best advantage for warding off the solar ray? I speak of the very surface. It may be a film immeasurably thin. I do not refer to the heat retarding mass of matter carrying that surface.

If I should appear to press my views somewhat emphatically, I hope the Commission will lay it to an anxiety to establish the truth, where the objects are so vitally important. This compels me not to rely only upon its being known that I have had my share of experience of tents and houses in India, and more than a usual experience in head-dress, and its being presumed that in common with others devoted from youth to the branches of science concerned, I have not remained unpossessed of the growing stock of facts and laws which constitute these sciences, but also to refer to my own experiments made at various times, and in a variety of peculiar forms. I will trouble the Commissioners with a few only of the general results bearing immediately upon our subject—and some of them familiar enough to all observers.

1st. With respect to visibility by and inconvenience to beholders. I find that when favourably placed a bright metallic surface is the best in existence, and a thoroughly white surface the worst. Thus if bright metal surfaces, far or near, about the level of the eye, are suspended in vertical or horizontal planes, they will in sunshine be less visible than almost any other, while white will be most visible, and in a bright light more or less dazzling from every point of view. But if both these surfaces are given the spheroidal form of a helmet, or in other words are broken up into an infinity of tangent planes at all angles, then, indeed, let the eye of the beholder be where it will, and the sun at whatever elevation, the sun will dazzle and endanger the eye very far more where the reflecting surface is bright metal than where it is dead white; but still the latter will be increasingly dazzling, though not intolerably so, as in the case of bright metal.

Next, with respect to protective power in averting the solar ray. I find that metal of polished brilliancy, however thin, will refuse admission to the sun's rays almost altogether when they do not fall perpendicularly upon it, and even when they do that the greater part are reflected. If the metal be not so very thin as to be translucent, what is yet a film of it would vie with masonry a yard thick. Even when much duller than that, a metallic surface surpasses any other in averting power. Next to it comes a purely white surface; but soiling rapidly reduces its power. Nevertheless the facility with which it may be employed in the form of cloth, flexible as this is in all directions, and easily renewed, gives it great advantages. All *colors*, even when pale, admit a considerable amount of heat; when dark they are but little better than black itself. Smoothness of surface partakes of the nature doubtless of reflective brightness, presenting a plane for the rebound of impinging rays; while fibrous roughness so greatly entangles and detains them as to vie with darkness of color in causing an absorption of them. Hence a dark felt surface is about the very worst in this respect; as is likewise an old dark straw roof.

The property of the matter *immediately below the surface* in accelerating or retarding the transmission of rays which have obtained a lodgment, is a distinct point. Straw is one of the slowest transmitters, especially when used in bulk as in a roof, and felt in its soft state also. When stiffened with lac cement it is less so. Cork is also known to be one of the slowest conductors of heat in its ordinary forms. The Indian pith "*sola*" and cotton wool are about the most tardy conductors. Nevertheless while the sun is shining with force upon any of them there is some *vis a tergo* in the succeeding rays which seems to impel on those in front by a different law from that of ordinary conduction. If a thermometer with a cylindrical bulb be rolled up in the thin cork, used *singly* in hats (and supposed on account of it to be

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Esq., F.R.S.

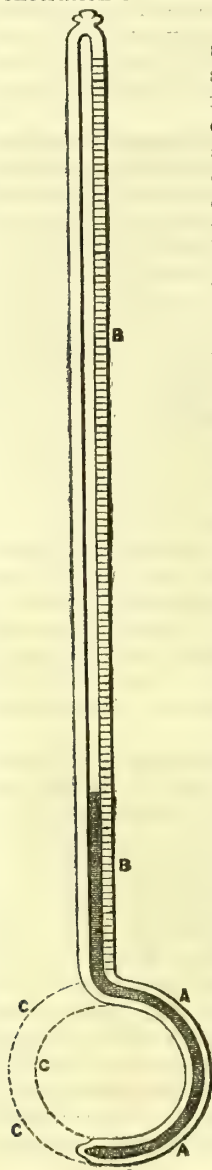
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non-conducting) until the bulb is encircled by a dozen layers, a thermometer thus guarded with pale brown cork will, in a few minutes, rise up to within a few degrees of one with an exposed black bulb, while another thermometer, guarded only by a single layer of common tin-bronzed paper, will not have risen in temperature one-third or one-fourth as much. Furthermore if a thermometer be isolated in a small cylinder of paper one-eighth of an inch from it on all sides, and coated with burnished gold leaf, such a thermometer will almost refuse to acknowledge the presence of a midday sun. At the end of some hours it will not rise more than three or four degrees above the temperature of the air; but if we place exterior to that bright cylinder, at an equal distance or more, a second cylinder of felt or of flock paper of, say, a light brown color, the doubly encased thermometer will actually rise in temperature, and that considerably, though not so much as if the inner cylinder were also of a fibrous surface like the outer one. The results were of a similar character when the inner protecting medium was in encircling contact with the bulb. There were many other results connected with the *intrusion* and *exclusion* of rays, and others relating to the *extrusion* of them by dissipation from a solar-heated body, which all possess much interest, but the above facts may suffice in conjunction with the results of actual experience to establish the grounds upon which I would urge in the construction of barracks, tents, and head-dress, more discriminating attention to exterior surfaces, and to the spaces and exits required to give any value to currents of convection for cooling interior surfaces.

It may be of interest to describe one of the instruments employed in the more recent of my experiments made with a view to ascertain the *rapidity* of the penetration of the solar ray.



In order to command an instrument more instantaneously sensitive than an ordinary thermometer, and to determine the difference in the action when rays are received on a convex or in a concave surface; and also (by closing with a diaphragm of gold paper the mouth of the concave side, like a kettle drum,) to be able effectually to cut off dissipation of heat from the back of the instrument when the convex side was the one acted upon, I had a thermometer made of the form and size of this sketch. A, A, is a transverse mid-section of a hollow hemisphere of glass, with an ordinary stem B, B, rising up from its edge. The dotted curves C, C, C, complete the form of the bulb, as seen on its concave side. It is rather deeper than a hemisphere, being five-eighths of an inch deep, and one inch in diameter. In such an instrument the expansion and contraction of the glass bears of course a larger proportion to the quantity of metal expanding and contracting than in the case of a solid bulb, but, unless the shell of mercury be made too thin, not to an extent preventing the instrument from yielding various interesting results. It is due to Messrs. Negretti and Zambra, opticians, to state that Mr. Zambra, with characteristic dexterity, produced the instrument for me, I believe, after a second trial. There is a contrast in experiments made under an Indian and English sun, which shows how much the extreme power of the former is

due both to the high temperature of the atmosphere and to its frequent stillness, especially shortly before and at intervals in the rainy season. Any current of wind of our summer temperature under 80° will wash away heat as fast almost as it can be received by some surfaces; but when the shade atmosphere is at 110° (or 120° , as I have found it in experimenting in India), and especially if it is still, the solar ray penetrates with a force incomparably greater. Hence all experiments in England ought to be made with our thermometers well shielded from currents, if not in vacuo.

Applying our experience, then, to practice:—As a surface, whether for houses, tents, or dress, bright metal exceeds every other, provided we can so employ it in only vertical or overhanging planes, and in horizontal or slightly inclined planes, as that it shall not distress the sight. Where we cannot command these positions, a well stretched, reversible, and changeable white cover, similar to that provided for this felt helmet, is the next best substitute. It will not equal metal indeed, and it will be more or less dazzling in all positions, which metal is not, but it may equal all our interior provisions put together, provided its purity be preserved. For this end all covers ought to be, I think, reversible, the fresh under side being turned up when the upper is soiled at all, and also exchangeable for a fresh clean cover when both surfaces are soiled.

It is doubtless a providentially designed fact that white cotton is so spontaneous a gift of nature in the tropics (bleached indeed by the very luminary its whiteness has to defeat), that the native must go out of his way to give it colour—must be at cost and trouble, neither of which does he delight in. Hence in this rare instance he has by employing it set us an example countenanced by science, and in following it of late the Indian authorities have taken one of a very few steps, during an occupancy of 100 years, towards a better protection of their troops. But a suitable surface alone cannot be relied upon, either for houses, tents, or still less for dress.

In raising up the dangerous Sikh and Punjabee to occupy the place of duty between the European soldier and the sun of India, deserted by the Hindoo sepoy, and a commander in Lord Clyde, to employ them thus to the uttermost as a shield to the latter, undeterred by the vaunting spirit of the Seik, the design of Providence was manifested that the bulk of our countrymen should not suffer that ruinous exposure to the sun which would have inevitably issued in the passing away of our dominion in India. The ample resources of nature and science for shielding the soldier, well nigh sun-proof, and the ample time of 100 years for perfecting them, has been afforded us in vain. It is appalling and humiliating, but most needful, we should consider the destruction which the puerilities of fashion had left the sun of India to inflict upon our countrymen.

Amongst many others, the instance of the detachment marching upon the jungle force in the Arrah district is especially instructive, as exhibiting the effects of the sun upon the moral as well as the vital powers of the brain. The detachment is stated to have become unaccountably panic-struck, though drawn from a distinguished regiment and the naval brigade; and out of so small a body no less than 107 are said to have died in the day or two's exposure from solar apoplexy, 18 of whom had been wounded.

2842. (*Dr. Farr.*) When did that occur?—I forget the exact date, but it was the detachment at Arrah, Her Majesty's 35th Regiment.

2843. (*Sir R. Martin.*) The terror of the men on that occasion was brought about by the effects of the sun?—Surely, the brain is the seat of all human feelings, it is the seat both of courage and of cowardice, and one has only to see a man, even the bravest man, suffering from delirium tremens, a state of the brain kindred to that which is produced by the sun, to perceive that courage is dependent upon an easily disturbed condition of the brain. I have seen a man shake with terror at a mouse when suffering from

delirium tremens; and are we to suppose that there is no medium between that and a man being in possession of the full power and vigour of his mind? I can view it as no otherwise than through providential interference, that exposure to a tropical sun does not "make cowards of us all." When we find that luminary has power to strike into extinction the functions of the brain, I can see no physiological or psychological reason why in its lesser operations it should not send a whole army of heroes into a delirium of abject cowardice and panic. It is painful to know that a small square of this tin-bronze cloth or even this tin-bronze paper arched over their hats might, though it is but an imperfect protection without other provisions, have probably saved several of these lives, by sufficing to keep the solar action in such cases within the point of destruction.

2844. (*Sir P. Cautley.*) You have said that there is great facility for making this material in India?—Yes.

2845. That is to say, of putting the tin-bronze upon the cloth?—Yes, I think so.

2846. A gentleman of the name of Michell came to the India Office a few days ago, and exhibited to the members of the Council there, cloth of this description, and with regard to the price, he made a very different statement from that which you have made, for he said that the price would equal the value of silk; he brought a specimen of the cloth covered, looking very like the specimen you have produced; he had a variety of textures, but the one that he recommended for tents for the Crimea he estimated would cost as much as silk?—I have only to say that, with respect to this bronze paper, the question will arise as to the difference in cost of laying it down on paper, and upon fine calico; if the thing was seriously gone into on a large scale, I think the prices would be very different from what he stated; you cannot form any judgment from a mere specimen; and I think that these sheets of tin paper are sold wholesale for about 1*d.* a piece, and the cloth that I speak of as suited, from the fineness of its texture, to be tin-bronzed would, in India, I think, be procurable for about 6*d.* a square yard, and if you had this bronze material on cloth, you would have a very fair article. Now if the tinned paper is only 2*d.* a square yard, and the cloth 6*d.* per square yard, I cannot but think that 4*d.* ought to pay the difference of putting the tin on to the cloth, especially when you have polished steel mills for rolling it smooth in the Indian mints.

2847. You consider it would be a simple operation to put the tin-bronze on to the cloth?—Yes. I had some cloth which was coated with an india-rubber preparation, and then coated with silver leaf, and it seemed to be no very serious operation; the way in which the makers of flags and banners go to work in London is too operose; all that work has to be done very minutely and carefully, as the banners are of various colours and of various patterns, and that work is done on a comparatively small scale; it is put on to silk, and they have a kind of privileged price.

2848. (*Dr. Sutherland.*) If this texture which you have produced were to be used for the purpose of covering a helmet, how would you attach the tinfoil to the material, so as to prevent the heat of the sun from melting the cementing substance, or the rain from dissolving it?—The substance should not be liable to be injured by the effects of wet, it should be of a resinous character; shellac forms the stiffening substance of all the hats that go to India—all those felt hats which are sent to that country; and if it will answer to form a stiffening material exposed to a very considerable summer heat for a medium like felt, *à fortiori* under a tin surface it would answer the same purpose, and I have no doubt that a solution of shellac would perfectly suffice to keep the tin, as far as that is concerned, intact, or a cement like gold size might be employed. As I have already remarked, domes gilded with it as

a cement lasts for centuries. On the ruins near Agra may be seen brilliant patches of gilding which have outlasted the lapse of ages. The question of brittleness is a more nice matter to deal with. With regard to cost, I do not think that it could be at all arrived at accurately, as it is not used in the arts. The only instance that I am aware of is in the making of banners, and if you were to go to a banner maker, and get him to do it, you would have to pay him a totally different price. With regard to laying on the cloth, I took the trouble to go to one of the best banner makers in London, and I had a good deal of conversation with him, and suggested to him the use of india-rubber cement, inasmuch as it would be unaccompanied by brittleness, which is the trouble connected with laying it on the cloth; but brittleness is only troublesome in the case of banners which float about in the wind, and troublesome when you wish the article to endure crumpling up; but it would not be of moment if the cloth upon which it was laid were only rolled up like a map on a roller.

2849. (*Chairman.*) Your argument is, that the price cannot be correctly ascertained because no demand exists for the article?—Yes; and I think that any person who undertook to make it would suggest a price that would cover the expense of a particular apparatus. I think you must have recourse to some additional means to do it on a large scale. In India you could have the bronzing done by handwork, and then by passing the bronzed cloth through the rolling mills, which you have at command in the mints, you would avoid the charges incident on providing such expensive machinery in England which a manufacturer would probably expect that his first contract should pay for, lest future ones should not be obtained, although the mills and other apparatus might last a lifetime.

2850. (*Dr. Farr.*) You think so favourably of the specimen which you have produced that you would recommend a trial to be made of it in India?—Yes.

2851. (*Chairman.*) You have spoken of it as a possible protection for a man's head against the sun in India?—Yes; so far as all that can be effected by surface is concerned; but I shall beg to explain this more fully when speaking of head-dress.

2852. I understood you to say that you would apply it also to tents?—Yes; in this case to tents, and in the other case in the form of a very thin sheet of tin cemented down upon a barrack—the kind of barrack I have recommended; but in all cases in such directions as shall not distress the sight of beholders.

2853. Have you now closed that part of your evidence which relates to the tents and to the housing of the troops generally?—I wish to add that I once made an underground chamber for coolness, or what is called a *tye-khanu* in India, which led to a plan based on the cheapness with which wells are made for commanding a great extent of underground surface, for absorbing into the cool earth the heat of a hot weather atmosphere. This is for cooling a barrack in the hot season, and giving them also a warm ventilation in the nights of the cold season. In my work on the British army in India I have entered more fully into the theory of the subject than I can at present. In a full persuasion of the value of the tempering power of the earth in the tropics, I would almost prefer to refer to the details given in that work; but I will briefly explain the proposal to the Commissioners. We are all familiar in England with the equable temperature of a cellar—its coolness in summer and warmth in winter. The cooling power of the walls of a cellar-room in India will suffice tolerably well to cool the quantity of air needed for a few inmates, but it is utterly insufficient for cooling much air. If the air be at all frequently changed the effect is lost. The mass of earth *below* the first six feet, down to the water level, say, 40 to 60 feet, should be put into requisition in such a way as to get the action of a maximum of surface upon a continuous current of air of moderate diameter.

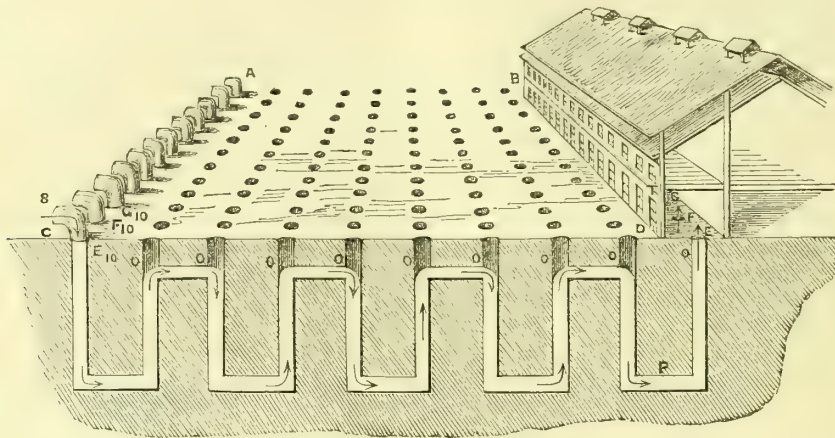
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I propose, then, that the ground on the long side of a barrack, to the distance of, say, 150 or 200 yards, should

be studded with rows of common earth wells, each about one yard in diameter, E, F, G, &c., Fig. VIII.

Fig. VIII.



The first row of each well may be sunk in the enclosed verandah of a barrack. The bottom of this well is connected with the bottom of the next well outwards by means of a passage P, about two feet high and one and a half wide. Of this second well, and of all the rest outwards, except the outermost, the uppermost five or six feet are plugged up with grass laid on a "jarfree" or frame of bamboo sticks, crossing the wells, and overlaid at top with earth. Just below the plugging, a passage, similar to that at bottom, connects this second well to the next, and so on alternately; the tops and bottoms of the wells are connected. A large cowl or windsail S, made of common matting and bamboos, and so suspended as to be turned, at will, to face all winds, surmounts each furthestmost well of all the rows.

The hot wind, caught by the mouth of the wind-sail, which should be five or six feet in diameter, blows down and up each well until it makes its exit into the verandah thoroughly cooled, but without receiving much addition of moisture, unless the bottoms of the wells are carried below the water level. By simply falling in temperature it loses dryness quite enough when well cooled, and verging towards its own dew point—a great advantage of this system over tatties, which undoubtedly make air damper than is to be desired when transitions to and from drought cannot be avoided. The wells may stand from six to nine feet apart, according to the stiffness of the underground earth, and it would be prudent to encase the tunnel passages with one layer of brickwork, or with earthen arches, which the natives make and bake successfully of any shape. Mortar would not be needed; the wells themselves are mere earth wells with no casing. Such wells used to cost in India, if dug only until the water was approached, from 1s. 6d. to 2s. 6d. each, according to the price of labour in the locality.

It may be shown that a system of 100 or 120 such wells would effectually cool for seven months or more each year air enough to ventilate freely a barrack 300 feet long, 60 wide, and 20 high. In the cold months, especially at night, indeed whenever the temperature of the atmosphere was below the mean of the year, air ought to pass freely through the wells, in order the more effectually to cool their earthy surfaces down again, removing the heat they had received from the hot season air which they had cooled. Part of the cold night currents thus passing through them and becoming tempered should be allowed to enter the barrack, that instead of too much shutting out of air at night on account of its coldness in that season, there might be a freer ventilation with air warmed by the well surfaces. Thus some of that very heat, by being deprived of which the hot season air had been rendered gratefully cool, is now imparted by the earthy mass in which it was stored up, to the chilly night air of the cold season

to temper it to a pleasant warmth. Thus caloric taken down from its position as the crowning heat of a blasting wind is put by to form the topping warmth of genial currents, cherishing in the cold season nights those whom it would have distressed in the hot.

2854. (*Chairman.*) To what depth do you think these wells ought to be sunk?—To about a foot from the water level, which at Cawnpore and Futtyghur is about 40 feet from the surface. At Meerut and Kurnool perhaps 20 feet. In the Agra district from 60 to 80. These, as far as my memory serves me, are the depths I ascertained when instituting inquiries into the state of irrigation in Upper India. I sent an intelligent European round all those and other districts to take notes on the state of agriculture, especially with reference to well irrigation, and the apparatus used at different depths of water.

2855. (*Sir P. Cautley.*) However excellent theoretically the plan may be, do you think that you could carry it out practically in a barrack?—I think so. All the mouths of the wells would be closed for some feet down to shut out the upper heat. I would close them, as the natives do sometimes their wells, instead of filling them up.

2856. (*Chairman.*) Can you form some estimate of the cost?—Yes; I think I can give something like near an approximation. I may first mention that in the year 1825, the principle of cooling air underground, copied, I think, from some hospital in England, was applied to one at Cawnpore, by carrying air through a capacious tunnel just below the ground level, but the effect was insufficient, and could not be otherwise. The single capacious channel, only 100 yards or so in length, would present too little surface (and much of that at too high a level for coolness) to the volume of passing air to act at all effectually upon it. The right principle plainly is to employ as extensive and deep a surface of earth as possible. With respect to the cost, such a system of wells would last as long as the barrack itself, would cost comparatively little, not near 100L., perhaps not 50L. altogether. It would save an annual cost of tatties amounting to nearly as much. It would be effective for all the warm months, while they are only so for three months at the most, and fail in effect at the most trying period, the month before the rainy season. I do not think that any person who is prepared to enter into the philosophy of the question, and will calculate the weight of the mass of earth embraced by the area of the system of wells down to the water level, who will bear in mind that that mass has conducting and radiating power enough to become annually cooled and warmed, who will estimate its capacity for heat compared with that of the utmost volume of air which can be needed for the ventilation of the largest barrack, and who will make the calculation that such a system of wells and passages will present to and act upon the passing air with a collec-

tive earthy surface of between 40,000 and 50,000 square feet, I do not think that a person taking such full view of the question will see any theoretical ground for doubting the value of the system.

An objection to it has been raised,—that the earthy surfaces might contaminate the passing air, since fresh-ploughed land in India has been said to give out malaria. But to this there is the ready reply that only surface land, reaching down at most two or three feet, is *humus*-vegetable land, abounding in organic matter, animal as well as vegetable, whereas the uppermost five or six feet of the wells are in this plan entirely closed up; below that we have strata, the micaceous sand of which shows their origin from the disintegration of the gneiss and slate mountains of the Himalayas—primitive rocks more free from fossil remains of organised matter than the general subsoil of Europe. The question may rather be raised whether the fresh earthy surfaces, which are so powerful as deodorizers, may not also prove disinfectant, and tend to improve the quality of the air transmitted through the wells. All the care needed would be that no straw or other matter in any quantity was allowed to fall into and rot in the wells, the plugged mouths of which should be lightly thatched over to keep the plugging dry.

That wind caught by the wind sails would travel freely through each row of wells we have too good proof in the manner in which it will rise, not merely by its buoyancy, but often with force from gully-holes when blown in at the mouth of a sewer, perhaps half a mile off, and after making many abrupt turns. It is true that at a certain distance the friction in tunnels will destroy the force of wind, but that distance is very far beyond that of the wells. It is true also that, as the air becomes cooled in the wells, its density is increased, which adds a little to the force necessary to propel it; but that is small compared with the force of wind necessary to press air through the closely matted “*kuskus*” of tatties.

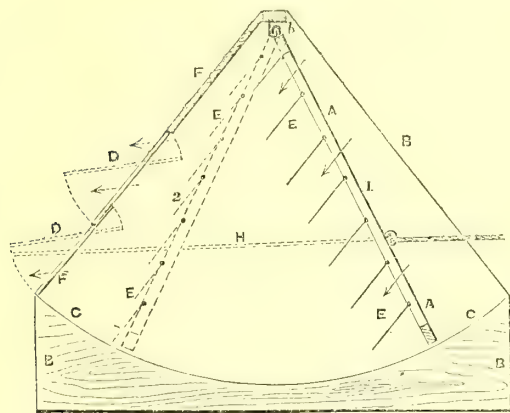
For drawing air through the wells when wind was wanting or slack, if the centrifugal ventilator should not have enough power when of large size, and quiet but slow motion, as it was introduced into India by Dr. Rankin, with good judgment, in the original form proposed by Dr. Desseguillier for the House of Commons last century, sufficient power would be ensured for it, in the manner obtained in the arts, in which it is largely used, as in blast furnaces, &c., namely, by greatly reducing its size and increasing its velocity. It then draws air with much power, but is very noisy, and far from economical of power. The large and slow fanners of Desseguillier and Rankin are silent (a great advantage), and fairly economical of power when the resistance to the current is small. They then give a full volume of air, but any considerable resistance reduces it so much that the air may be easily made to revolve round in the drum, and not make its exit at all.

Any air pump would have more certain power. In point of certain effect and economy of power, I do not know of any form of air pump which surpasses one upon a principle and of a form I was led to adopt in India, since it admitted of a great freedom of the valve space, and was almost free of all friction, owing to the piston being a flat oscillating pendulum, suspended on knife hinges, and not touching the enclosing walls or the arched bottom of the chamber in which it swung, well weighted along the bottom. When not encumbered with the layers of wetted cloth it carried to convert it into a “*refrigerator*,” but employed solely as a ventilator, or to draw air through an adequate surface of tatties (wetted grass frames), it becomes a very effective instrument, being an absolute pump, and not depending for its action merely on the centrifugal force of revolving air, which is a feeble one unless the air is given a great and noisy velocity. The late Colonel Forbes of the Bengal Engineers and the Calcutta mint repeatedly expressed his preference of this pendulum pump, as a sure ventilating power. Figs. IX. and X. are a side section and a back view of

Julius Jeffreys,
Esq., F.R.S.

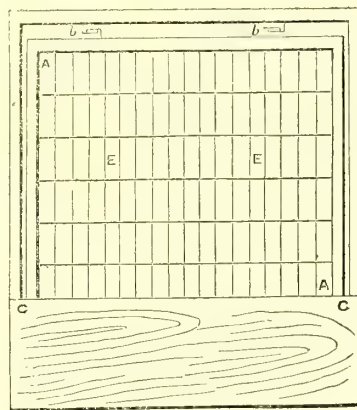
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Fig. IX.



Side view in section.

Fig. X.



Back view.

it. In the hope that the well-ventilation may be fairly tried, I think it right to invite the attention of the Commissioners to this cheap and easily constructed instrument for pumping air through them, which any mechanician will perceive to be very economical of power, should the centrifugal fans prove feeble, or to waste power.

2857. The efficiency of your plan of wells, I think, depends upon the quantity of moist earth through which the current of air passes?—Not exactly moist; but the earth is so slow a receiver of heat from the sun that it never gets up to anything like the heat of the hot season; it remains all through the hot season at something like the mean temperature of the year; it keeps falling below it in the cold season, and rising a little above it in the hot season. When you get down 40 feet into the earth, the temperature will be nearly the mean temperature of the year; the humidity that it had would add also virtue to it by evaporation, but the main principle here is to cool it,

and nothing is better than earth for that purpose; it is better than if the earthy mass were a quick conductor, like metal, and better than if it were a slow one, like charcoal. It might strike some persons that such a number of wells spread over an area of 150 yards square, was not likely to answer, but any person who has witnessed irrigation in India will not say so. You may see a number of wells in a field surprisingly near to each other, and these wells are not dry wells, but wells in which vessels are passing up and down, and splashing the water against the sides.

2858. (Colonel Durand.) But how would you secure the wells from infiltration during the rains?—That would be very easily effected, as the natives do their own common earth wells; they raise a wall of trodden clay a foot or 18 inches high round the earthen well, and that entirely suffices, although there is a constant splashing of water about the mouths of their wells, while those in question would be dry and undisturbed.

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2859. (*Dr. Farr.*) It is an idea which any commanding officer almost might carry out?—Just so.

2860. (*Chairman.*) Perhaps you will now be so good as to describe the head-dress which you have invented?—Prior to describing this helmet, I would wish to proceed with a view of the protective principles, which for real effectiveness must be observed.

I have already dwelt upon the character of the surface presented to the sun, whether by houses, tents or dress, especially the latter, as the point of first importance.

If a head-dress be of a spheroidal or helmet shape, it cannot be given a metallic face without distressing the sight of beholders. With respect to the substance of the shell or shells for a solar hat, I may mention that the first I made was in 1824, for use in the Himalayas, where the power of the sun is very great in the valleys. It was a kind of gothic-shaped helmet with a broad inclined rim, made of a rattan cane body, carrying layers of cotton wadding, lined inside and out with white silk, and with a ventilating space with free exit.

The next solar hat which I used for several years had a cylindrical crown of large dimensions, and a very broad brim. It was formed of the pith "sola" of two layers, each one-third of an inch thick, and nearly an inch apart all round and at top, with very free exits for the currents. It was covered with silk. This was, I believe, the first hat of the kind made in India of two crowns, with a capacious passage between them for a current of convection to carry off heat from the interior surface of the outer crown, before it is imparted to the inner crown. The efficiency of this hat led to the construction of others like it, but gradually much of the advantage of the principle, in some cases nearly all of it, has been lost by reducing the intervening space and the outlets for air. In a much reduced form the plan has been made the subject of a patent by a London house for helmets of stiffened felt; when carrying a white cover they are said to prove about the best in use in India. But the exit for the current of convection is altogether insufficient.

Before describing what I believe would prove the most suitable head-dress for military use, it is necessary to come to some decision upon the questions of weight, bulk, and form.

As to weight, while all needless weight should of course be avoided, it is useless to hope to see any really protective head-dress until the mind ceases to be misled by false impressions to seek with anxiety to bring the head-dress of the soldier down to three quarters or half a pound. The head-dress I wore in the Himalayas, walking many miles a day and ascending many heights with it, (one of them greater than any height in Europe), was quite as bulky as this one, and weighed I think near $1\frac{1}{2}$ lbs. I was in feeble health at the time I commenced my tour, yet the weight never distressed me.

When an European regiment has been marching in the sun, distressed by the *weighty* feeling of their shakos, many a Hindoo girl might have been found in any village they passed, who would for 6d. a day have gladly carried 20 of those shakos in a basket on her head the whole march, and it would have been a much less load than the milk she will bring from the marshes, often many miles, up to market. It would be small compared with the six or eight hours of labour at "*courie-khappe*," carrying baskets of clay, mortar, or bricks to the builders of the almost impregnable mud forts, which are thus carried on the heads chiefly of women and children. But if, instead of baskets full of shakos *on the top of* the head, allowing the air to circulate freely round the head, while warding off the sun, you were to make the girl wear *one* of those smothering shakos, and could impart to her an English degree of sensitiveness to the force of the sun's penetrating heat, she, like the soldier, would soon complain of a feeling of *oppressive weight*.

In all ages and countries, and climates, both men and women have instinctively chosen the head as the part of the body, perhaps the best fitted of any, for carrying weight for a length of time. Our own fish and fruit women, carrying often a hundredweight, are familiar proofs of this; as also coal and corn porters, who in proportion as they carry much of the weight resting on the head, are able to work the longer.

An effective head-dress may be made to weigh $1\frac{1}{4}$ lbs., a thoroughly sun proof one $1\frac{1}{2}$ lbs., but any weight under 2 lbs., if rightly and comfortably poised, with all provisions for keeping the head cool and refreshed, ought to cause no inconvenience to an adult.

Next as to bulk. In a paper read at the United Service Institution last year, I dwelt upon the importance of a point, which at first might sound only like a play upon words; namely, that a man wearing an opaque hat, or in an opaque tent, or under an opaque roof, cannot suffer from sun-stroke. He may too easily be hat-struck, tent-struck, or roof-struck, but if the intervening matter is opaque, it alone is sun-struck. It imbibes and appropriates the rays, decomposing them, and sending inwards the heat by radiation or conduction to his head; and when by radiation, in a mean direction perpendicular to the surface from which it emanates. Hence an arched roof of masonry as in bomb-proof quarters, or the arched matting roof of many native boats, become absolutely dangerous if the heads of inmates are anywhere within the range of the rays concentrated by the arch. It would be worse still if the roof were dome-shaped. So far, then, as this principle is concerned, a large spheroidal helmet will receive and project in more heat than a small one, were it not that much more is gained by freedom for inner currents of air to remove heat than is lost by magnitude, within a certain size, intercepting a larger expanse of solar rays. What the limit of size is, where the effect of the one principle balances that of the other, has not been determined, but it is no doubt above any size which is likely to be used for military purposes. To avoid inconvenience from the pressure of wind, *form* is of more importance than *size*. A crown rising high and bulky above the centre of pressure on the brow, and not balanced by a large and inclined brim receiving the pressure of wind below the brow, is sure to cause inconvenience. Our ordinary black hats are very faulty in this respect, compelling the wearer in a high wind to depress his forehead, as it were to butt the wind, and bring its centre of pressure on the hat in a line with the pressure on the brow.

This helmet, seen in the vertical section, Fig. XI., and bottom view, Fig. XII., though much larger than a common hat, would not in a high wind cause equal weariness. It is capacious round the head, but falls off rapidly above, and has no great height, while it has a broad and descending peak and brim. This form has been chosen to produce a compensating downward pressure below the brow, to balance the upward pressure of the portion of crown above the brow. With the same view the peculiar form of the helmet, Fig. XIII., has been selected, with a large calibre round the head, but receding in steps, that it may not have what sailors term top-hamper to be acted on by wind.

2861. (*Dr. Farr.*) But there would be more pressure in the aggregate?—Yes, of course if you have a greater surface, but that would be small compared with the inconvenience of upward leverage; for instance, in a gale of wind, you find that the wind, acting upon a common hat, gives you more trouble than does its pressure upon your body.

With respect to the ideal symmetry of fashionable forms. When brave and loyal men have perished through the sun by hundreds and been damaged by thousands; when an empire has been imperilled and would have been lost, had no Indian mercenaries turned up to stand between the sun and the fashion-dressed European; when these are undeniable facts,

Fig XIII.

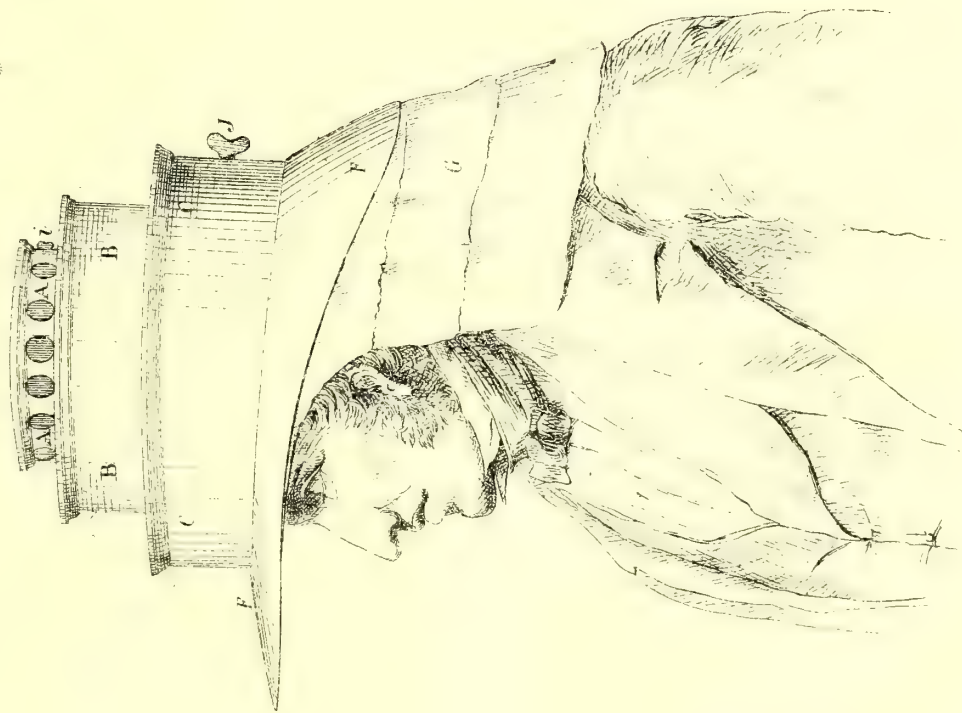
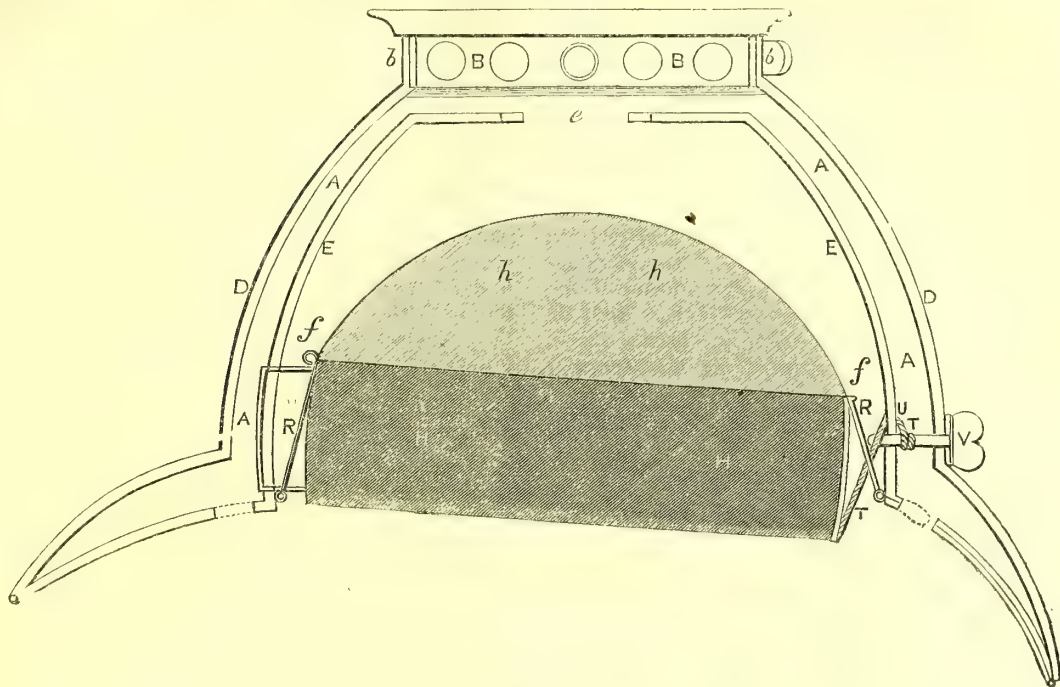


Fig XIV.



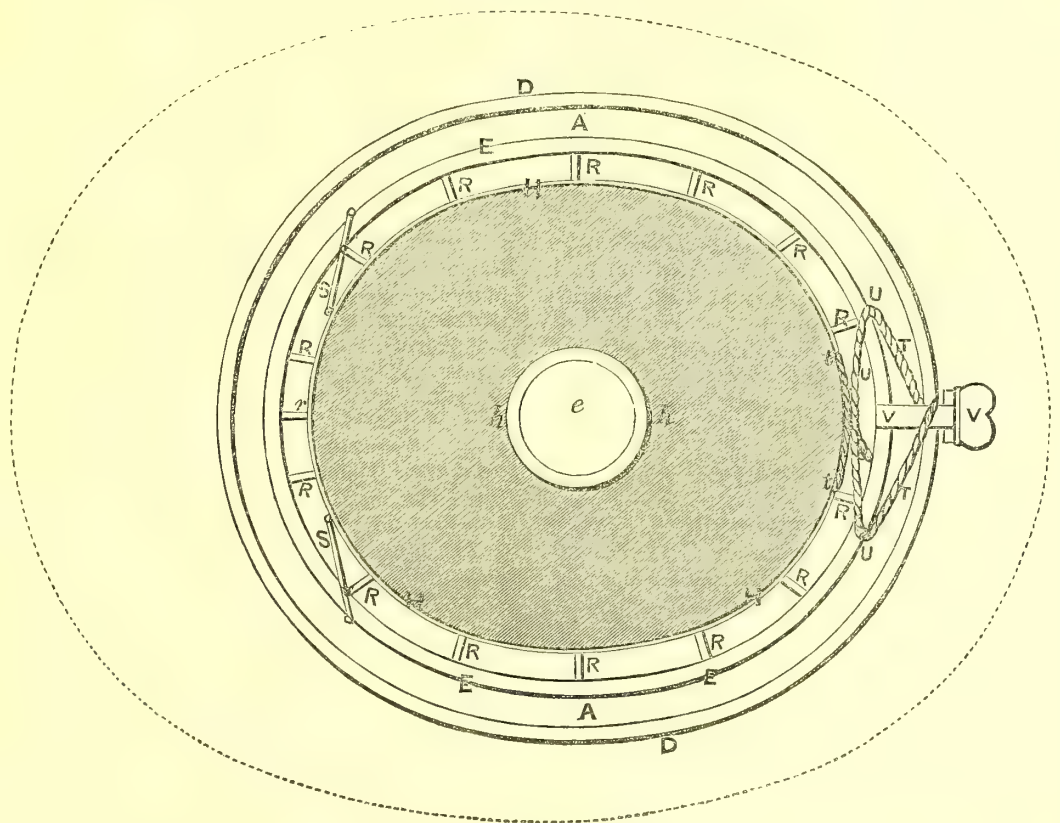
Fig. XI.



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Fig. XII.



one may well be lost in amazement on finding not a few persons still clinging to wonted forms which are incompatible with real efficiency.

This finished helmet, also shown in section in Figures XI. and XII., is constructed with all the provisions requisite for embracing the several principles which seem to be applicable to the case. It is indeed of a maximum size, being about an inch larger than the head all round it, and having an ample peak in front, and a descending brim sheltering the neck.

The crowns and brims are of stiffened felt, because Messrs. Christy, the leading hatters, with much public spirit undertook to provide them; and because dark felt, though nearly the worst material in a ready reception of radiant heat, when under a brilliantly white cover to correct its appetence of rays, is a fairly qualified substance as a slow conductor of heat; not that much reliance can be placed on this principle alone.

Within this outer shell is a space, it is nearly half an inch wide all round, and extending even to the edge of the brim, which is also double, the two shells meeting at its edge. This construction gives much strength to the brim. At top the space A, A, terminates in a circular chamber B, B, also of felt. This chamber is formed by an extension of the outer shell, and is surrounded by a brass hoop or coronet *b, b*, which is pierced all round with holes three-eighths of an inch in diameter. The coronet is encircled by an exterior band or hoop of brass similarly perforated to itself, and carrying a thumb piece *c*, for sliding this outer hoop round the inner. By a small motion of the outer hoop, either the holes in it correspond with those in the inner hoop and leave them open, or its blank surfaces pass over the inner holes and close them completely or partially, according to the degree of the movement.

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The universal space A, A, gives free way to a current of air entering by numerous apertures in the lower face of the brim, which current, sweeping up between the outer shell D and the inner shell or crown E, E, washes away as much heat as it can from the interior surface of the outer shell D, and passes, when thus heated, into the upper chamber B, making its exit to leeward, in whichever direction that is, through some of the holes in the coronet *b, b*.

The crown E is also of felt, and is, like the outer one D, a somewhat tardy conductor of heat. Both its inner and outer surface is lined with tinned paper or aluminium leaf; so, likewise, is the interior of the outer crown; bright metal being slow as well in radiating as in receiving radiated heat. Experiments, frequently repeated, have satisfied me that there is enough of virtue in bright metal, of however thin a film, when lining all interior surfaces, be they of hats or houses, to recommend so simple and almost weightless and costless a measure as pasting over such surfaces good tin-bronzed paper.

Between the inner crown E, E, and the head of the wearer a free space F, F, of $\frac{1}{3}$ or $\frac{1}{2}$ an inch intervenes all round, while above the head this space rises 2 or $2\frac{1}{2}$ inches, and communicates with the coronal chamber B by way of a circular opening *e* in the summit of the inner crown E, of $1\frac{1}{2}$ or 2 inches diameter. This free space F, F, gives passage to a ventilating current of air. If the passage around the head be reduced to $\frac{1}{4}$ of an inch, it will restrain the current so much as to diminish greatly its beneficial effect. Unfortunately half an inch of space cannot be allowed for it, especially in hats with double crowns, and space for the outer current of convection A, without making the hat more bulky than will be admitted into military use; otherwise, the passage and outlet for the *current of ventilation* cannot be too free. At the same time, both this current and the outer current of convection ought to be under control, even to cutting them off when a foggy and chilling state of atmosphere shall render it desirable. This will sometimes happen in the early morning of the same day in which, at noon, all the ventilation that can be invited through the hat will be grateful; it will even happen but half an hour previous to this, when in a state of profuse perspiration, the evaporation caused by a current of air is too chilling.

This requirement, *indispensable for efficiency in a head-dress, of a copious and a controllable current of ventilation*, places in a painful light the various devices in use for making the vent for air comport with customary forms. In most cases the apertures facing upwards at the summit of the helmet are insignificantly small, lest the sun's rays should strike in to an injurious degree. In such cases, the ventilation is little better than a mockery. In other cases the Minerva crest, which, in its ancient form with rich projecting mouldings of rigid metal, is handsome enough, is attempted to be imitated in rounded felt, lying like a sausage along the top of the hat, and made hollow, with a mouth facing forwards. Such a passage can give exit to air from the helmet only when the back is to the wind and the felt crest acts as a *cowl*. When facing the wind, or even when walking through a still air, the mouth of the crest must to a certainty act as a *windsail*, and conduct air down upon the head,—an inverted current which would often prove unendurable. The aperture sometimes provided in the tail of the crest, small as it necessarily is, and pointing downwards, can avail little to prevent such inverted action. What Praxiteles and Phidias would have said to this rough and rounded imitation in felt of the sharp and beetling crest of metal is a question of art which undoubtedly ought not to be entertained, if such an appendage to a helmet were a choice form for a safe conduct outwards of a ventilating current.

But when the very reverse is the case, it is well that we should be able to make appearance our ally, and appeal to the works of those great masters in art

against any attempts to imitate the ancient helmet crest in a faulty coating of felt.

Had the laws of our animal economy been understood in their day, had it been known that a head-dress was defective in any climate, and altogether unfitted for the tropics, which did not provide an ample freeway around the head for the entrance upwards of a ventilating current, and ample and rightly directed vents at top for its safe exit, can we doubt that, in accordance with the dictates of their great countryman and master of æsthetics, they would, seeing beauty in utility, have at once so modified the helmet that its virtues should declare themselves unmistakeably in its size and form? Can we believe they would have been so destitute of resources as to have clung to the crest when its presence in a crescentic form was an anachronism unbecoming days of advancing knowledge?

It is plain that the apertures in the outer crown of a head-dress large enough to give a free vent to a current cannot be allowed to face directly or obliquely upwards, lest the rays of the sun should strike into them and upon the head of the wearer, and lest rain should also beat into them. They must face laterally or nearly so. Again, for every such opening in one direction there must be an opposite one on the other side, that wind blowing in at holes to windward may have an equally free exit to leeward, and not be turned downwards upon the head. Furthermore, since the rays of an oblique sun will shine with force even into side openings, such openings must either be hooded by an inclined pent, or, what is better, there must be an inner crown or partition, as E, E, to receive them, in the centre of which must be a free opening *e*, for the ascending current. In order that the rays of the sun shall not reach that opening through the outer apertures, as those of the coronets *b, b*, this coronet must be given a considerable diameter.

I beg now to invite the attention of the Commissioners to that portion of the helmet which rests immediately against the head. This peculiar construction has been contrived to serve certain important objects. In the first place, you will observe the whole weight is rested with equal and direct pressure upon the top of the head by means of this draw-cap of open canvas *h, h*, such as that used for tapestry and Berlin work. This is manifestly preferable to supporting a perpendicular weight by lateral pressure round the head. It is this tightness which goes far towards making a hat distressing.

The supporting draw-cap covers only the upper part of the head. It is united to this crimson band of folded horsehair cloth H, H, made on purpose of so open a texture as to transmit perspiration freely, and admit cool air to the head. It is the smoothest and most cleanly fabric I could think of for the purpose, while it also possesses much greater durability than any other. This band is about $2\frac{1}{2}$ inches wide. It is, you will perceive, stiffened against crumpling by means of a vandyke of very thin whalebone, sewn upon its outer side all round. The cap and its horsehair band thus stiffened are connected with the interior of the hat in the following manner:—A number of stiff, hard wires R, R (made of hard drawn brass or German silver), having each of their ends turned into eyes, and ranging from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in length, are firmly attached by one eye, an inch apart, all round to the lower edge of the hat, at its junction with the brim. The other eye of all the wires is attached to the upper edge of the horsehair band on its outside, at equal distances all around it, the shorter wires at the back, and the longer towards the front of the hat or helmet. These wires suspend the helmet to the cap and band with a strength much surpassing that of any helmet itself; and when the band is tight round the head the rigidity of the wires R, R, effectually prevent the band from being drawn out of the helmet or the helmet being lifted off the head. The shortness of the hinder wires brings down the band behind, so that it clips hold firmly of the

incline of the back of the head, at the same time permitting the helmet to sit with military uprightness on the head, and the front brim to shelter the face. The middle of the horsehair band in front, at its upper and lower edge, is attached firmly to the mid-point *r* of an upper and lower cord *s, s*, Fig. 12, stretched across the inner shell of the hat one-third or half an inch from its front, and strongly fixed to it at either side by passing through its substance, and being tied round an upright wire pin, which receives the strain of these two upper and lower cords.

At the back, the horsehair band is divided, its two ends not meeting by an inch, and each of them is stiffened by a flat slip of whalebone. Each end has a cord loop *t, t*, one crossing through the other. These loops play in hooks on the two ends *T, T*, of a cord, which passes first through eyelet holes *U, U*, in the inner shell, and then through a round peg *V, V*, of hard wood, a quarter or one-third of an inch thick, which peg rests through a collar in both inner and outer crown. The shoulder of the peg plays round a circular ratchet on the collar on the outer crown. When the peg is twisted one way by means of its handle, the two ends of the cord are wound on it and tightened, and by them the loops *t, t*, are twisted across each other, and the ends of the horsehair band approach each other. The ratchet keeps the peg from turning back, so that any desired tightness can be given to the band. For loosening the band, the peg is slightly withdrawn, the edges of the peg's shoulder escape over the ratchet, and with the turning of the peg back the cord is unwound from it and slackened. When the band encircles the head, the ends of the cord *T, T*, keep the crossing of the loops *t, t*, as a fixed line, like the front line *r*. The front and back line being fixed, there can be no horizontal shaking of the hat backwards, forwards, or sideways, while, as before stated, it is firmly suspended on the head against depression or lifting off.

This construction gives us a cap bearing all the weight, and a band embracing the head by contracting from all points towards a common centre, and yet with no horizontal shaking of the helmet, which it carries at a clear distance from the head of one-third or half an inch all round.

There are no intervening props fixing the band rigidly to the crown, and pressing hard against the head. The band remains perfectly flexible and free to take the very varying shapes of different heads, with all their protuberances, and to be expanded or contracted to suit any size of head within a certain range. Two or three lengths of band and corresponding sizes of helmet or hat would fit all the heads in an army.

There is a further and main advantage in this construction. While any ordinary head-dress has to be at all times as tight and distressing when a man is marching at leisure as during the rare occasions when he is engaging the enemy, this expansible band enables him to wear his hat comfortably loose, and yet he can in a moment tighten it if he pleases without distress to a degree he could not endure in the former case of hard and unequal pressure. I cannot see why a man should be compelled to wear a hat at all times as tight as may be needful during occasions of action. If the point of suspension, the draw cap, be above the centre of gravity, with a loose chin strap against accident, there can be no reason why the soldier should not wear his head-dress, be it helmet or hat, *quite loose*. A body of men whose heads had been thus at ease during a long march would undoubtedly engage at much advantage an equal force which had been marching an equal distance with their brows constricted by tight hats of rigid form.

I beg to call the attention of the Commissioners to the last provision in this helmet, which I place on my head in order to draw these down over the eyes.

2862. That contrivance is intended, I presume, as a guard for the eyes?—Yes; it is a screen for them to keep off glare. They who have experienced

the effects of glare in the arid districts of India, who have themselves been distressed by the glare and heat reflected from all objects, bright roads especially, and from the very air itself, under a tropical sun, will best appreciate such a provision. Not only the natives themselves, but Europeans also, are liable to experience, through exposure to such glare, a damaging of the sight, and more or less of *nyctalopia*, or night blindness. There can be no question also that glare, acting upon the brain through the eyes, aids the action of the sun upon the head and body towards inducing apoplexy. Furthermore, when modern fire-arms of power and precision require distinctness of vision for half a mile, it is surely desirable that the retina should not have its sensibility seriously blunted by repeated exposure to Indian glare.

As a preventive of the serious injury to the sight and health through glare, I request your attention to this pair of eye screens lodged in the ventilating space between the forehead and the inner crown of the helmet, which can be drawn down in a moment over the eyes. Or either of them may be drawn down singly over an inflamed or weak eye when there is not any such glare as to distress the healthy eye. These screens are not made with wire gauze, which is too brittle for durability, and too heating for India, but of two or more leaves of a fabric of horsehair which I have had wove for me, as open as gauze. This horsehair gauze is, you will observe, enclosed round its edge by tough but flexible wire, gimped with silk, which forms a frame to carry the gauze. The ends of these wires are bent into rings, which slide upon long wire staples fixed to the inside of the hat. Thus the eye screens can be pushed up out of sight or drawn down for use in an instant.

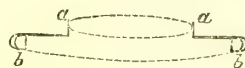
2863. (*Chairman.*) What is your opinion as to its durability?—Such eye screens as these would possess ample durability; they should last as long as the hat itself, and a regimental tailor or shoemaker would be the man who could, in case the cords gave way, replace them.

2864. You attach very little importance to the weight; but can you state the precise weight of that hat?—No; but I will add that to my evidence.*

2865. Probably you have no means of judging of what the cost of constructing hats of that kind would be?—None whatever, from the cost of the few I had made for me. For instance, I paid for that brass rim half a guinea, but I am sure the whole helmet with every provision ought to be made for twice, or at most thrice that sum, and that similar coronet rings to this with slide could be made in Birmingham for a shilling a piece.

2866. Is the external material of the hat felt?—Yes; and it is stiffened with shellac.

I now request you to look at this figure, XIII., and this with the helmet, in section No. XIV. It is a helmet made in steps, in order that all its surface shall lie either in a vertical or horizontal direction. It is proposed more especially for cavalry use, or for other mounted persons, or indeed for men on foot, where riders would not be so close to them as in looking down upon their hats to be distressed by any rays reflected from the horizontal parts; for this head-dress is intended to have a bright metallic surface. The body of the hat may be of felt or cane, lined with wadding interiorly, and over that tin-bronzed paper, and coated exteriorly with very thin hard-rolled sheet brass, or, still better, German silver. I would advise that the vertical portion or sides of the hat should be coated with separate bands of such metal, and the flat or horizontal parts with disk rings of such metal, stamped so as to leave such a section as this:—



the edge *a, a*, to slip underneath the cylindrical metal

* The pattern helmet of largest size, with the double crown and coronet, double brim and peak, suspending cap and horsehair band, with ratchet and peg, also with sliding eye-guards and white outer cover, weighs one pound and a half and half an ounce.

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band of the part above, and the lower edge *b, b*, to cap over the metal band of the portion below. The bands and disk rings need not then be soldered together. This would not only save much expense, but would allow of much more play from blows without bruising, and would admit of each part being removed for being hammered flat, if bruised, or for repair. Thin hard metal so placed would not be easily bruised. A wire ring is enclosed by the edge *b, b*, which protects the edge, and would afford much protection against sword cuts.

You will observe that this hat has only one crown or shell. That reduces its bulk considerably, by saving not only the thickness of the interior shell, but also the free space for convection, marked *A, A*, in Fig. XIV.; for unless that space be free, at least one-third of an inch wide, I cannot set much value on the double crown. If you close up the mouths of two hats with stuffed spheres occupying the position of the head, and allowing no ventilating current round the head in either, and if they each present to the sun a faulty dark surface of felt, and if one of them has a single shell of felt, while the other has two, but under one-quarter of an inch apart, you will find a thermometer placed inside the latter, just above the head, to rise nearly as high as one similarly placed in the other, and with no great difference as to time. Any comparative trial made between hats with their interior cavity open to the air, allowing it to circulate freely, must be obviously defective. The double hat, with a trifling intervening space, or a single shell of double thickness, not being quite so quickly (though as surely) penetrated by heat as the other, will be relieved of heat by the capacious flow of air around its open cavity more nearly as fast as the heat penetrates than will the single shell, and it will appear to give a still better result than it deserves.

This hat is given a single crown or shell, in reliance upon the great power of bright metal to throw off the sun's rays.* It is given this peculiar form to ensure at the base an ample space round the head for a ventilating current; but to reduce the size above the brow, that it may not be top-heavy nor present a large surface to the wind at top, and at the same time to present to the sun only horizontal and vertical surfaces from which no rays can be reflected to persons on or near the same level with the wearer.

I have suspended vertically, at different heights near the level of the eye, a row of surfaces in a line, each a foot square, some bright metal, others white paper and cloth, cloth of different shades to nearly black. On viewing them at different distances, the metallic surfaces were the least visible of any, much less visible than very light or very dark colours, far less so than bright colours, and especially less than white, which was the most visible of any. A cloth of that pure whiteness which approaches towards metal in its power of throwing off solar heat is very dazzling to an unprotected eye, while such metal surfaces in a vertical position (and in proportion to their brightness) are little seen.

2867. With the sun upon them?—Yes; especially at that time. The brighter the sun and more cloudless the sky, the more striking is the contrast between a white and a metallic face in favour of the latter.

2868. (Colonel Durand.) The visibility, in fact, depends upon the angle at which the rays of the sun strike the object?—Yes; and if the surfaces are either vertical or horizontal, that angle is sure to be such as will throw the rays below or above eyes anywhere near the same level.

* Upon this point I have dwelt fully already. I may here remark that in the case of heat radiated from bright fuel the effect of polished metal is still more remarkable than against the solar ray. I have repeatedly determined this by thermometric experiments, and in a remarkable degree, in the action of the burnished reflector of a grate (mentioned in my work on the army in India), contrived for burning anthracite and coke in open fires. The reflector placed inclined immediately above a fierce fire reflected its image so brilliantly that it not only appeared like a second fire above the other, of equal brightness, but was certainly equal to it in radiant or heating power, so that the hand could not be kept for a few seconds at a distance of two feet from the front of it. Yet during the whole day the metal of the reflector was so little heated that the hand could be placed upon the back of it, although it was not one-quarter of an inch thick. But if paper, especially dark paper, were placed over the bright face, a frying heat was instantly transmitted to the back.

2869. That mode of construction would reduce the size very much, would it not?—Yes, and the weight; and therefore reduce the expense.

Military fashion may be opposed to this form, but it ought to be recorded as one possessing important advantages.

In civil life, settlers or others may at some time desire to avail themselves of it.

2870. (Sir R. Martin.) Altogether you would give a decided preference to a polished exterior?—Assuredly, if these conditions as to position of surface are observed, a metallic exterior—the more polished the better (though metal no brighter than tin-bronzed paper is very effective)—will be found to surpass any other for protection, for not distressing the eyes of comrades, and for being least visible by an enemy at all distances; and at all times excepting a few minutes after sunrise and before sunset; white is of great reflective value, if it be truly white, but directly it becomes discoloured, as when you come to pure buff, you lose the virtue of it rapidly; yet the convenience of white, in the article white cotton, and the possibility of employing it, though dazzling, in hats of all forms, may in general prove conveniences prevailing over the many higher recommendations of metal.

2871. (Chairman.) That head-dress, I suppose, would not be very durable, and not bear much rough usage?—Yes, I think it would. These felt hats are pretty durable; though, as I will immediately explain, I would not select felt, even though covered with metal or white cloth.

2872. (Sir P. Cautley.) Although it might be durable it would not stand such rough usage as a common shako?—No, felt would not; but then this must be made with a tougher material.

2873. (Sir R. Martin.) Bearing that principle in view, it might be made of different kinds and many materials?—Yes; I think you will find that the horsehair band within the hat is very durable, and the attachments of wire links, to leave both much strength and durability.

2874. (Sir P. Cautley.) A man can throw down a shako without doing much injury to it, but he could not afford to throw down that description of hat?—No; but then if you save one life by the use of such hats, leaving other considerations out of view, you will be able to pay for a great many of these hats; and as I have said I would not have the hats or helmets made of felt. It was employed in this spheroidal helmet only as a pattern of the form and construction, and not as the texture. As I have stated it was supplied me by Messrs. Christy. At the same time, covered by a white or metallic surface, felt would be very serviceable.

I now request your attention to one other form of hat, Fig. XV., of which, like that in Figs. XIII. and XIV., I regret there should be no made pattern forthcoming. Fig. XV. is a helmet of a single shell, to be encased by a well fitting white cover stretched over it, which can be readily turned inside out when the upper surface is discoloured, and as readily exchanged for a fresh cover when both surfaces lose their true whiteness. With this provision, and with an ample free way around the head for a ventilating current, with ample outlets for the current at top, and with the cool and porous horsehair band around the head, and net-like cap over it, a helmet of a single shell may suffice for protection, even though it should not have a metallic exterior. But such a hat must have a diaphragm or partition *E, E*, near the summit, to part off a chamber *B, B*, so that while the partition *E, E*, has central holes in it *e, e*, facing upwards, to give passage to the ventilating air, the chamber *B, B*, shall have exit holes *b, b*, facing as nearly sideways as the shape of the hat will permit, to let the current out to leeward on any side. But as such holes will lie obliquely, owing to the curve of the hat, it would be prudent to place above them all round a flat ring or case of metal *i, i*, to guard them from the intrusion of rays which might shine through into the inner holes *e, e*, and heat the interior, if not strike the head.

These outer holes *b, b*, ought to be three-eighths of an inch in diameter, and they may be commanded either by an encircling band of metal, like the coronets, Figs. XI. and XIII., but made conoidal to fit over that part of the hat, or the current may be regulated at the apertures *e, e*, instead. This will be readily done, as shown in XV *a*, which is a view from above of the circular partition *E, E*, in which the holes *e, e*, &c., are made oblong, and have over them a plate of thin metal *g, g*, similarly perforated. By drawing the cord *h* which hangs out of one of the front holes, *b*, of the hat, the plate will move forwards and leave the apertures *e, e*, under it quite open or partially open, while, by

drawing the back cord *h'*, the plate will move back, and its blank surfaces will close the apertures. There is one other way by which the same object may be effected, and perhaps preferably, shown in XV *b*, in which, like the common circular movement of a fan ventilator, a circle *g, g*, perforated in radial sections, revolves over a similarly perforated fixed circle in the centre of the partition *E, E*. The circle *g, g*, may be turned either way by pulling either side of the cord *h*, which hangs outside of the hat. The ends of this cord passing through two of the holes *b, b*, Fig. XV., and crossing each other within the hat, are attached to opposite sides of the circular plate *g, g*, XV *b*. Or this

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Fig. XV.

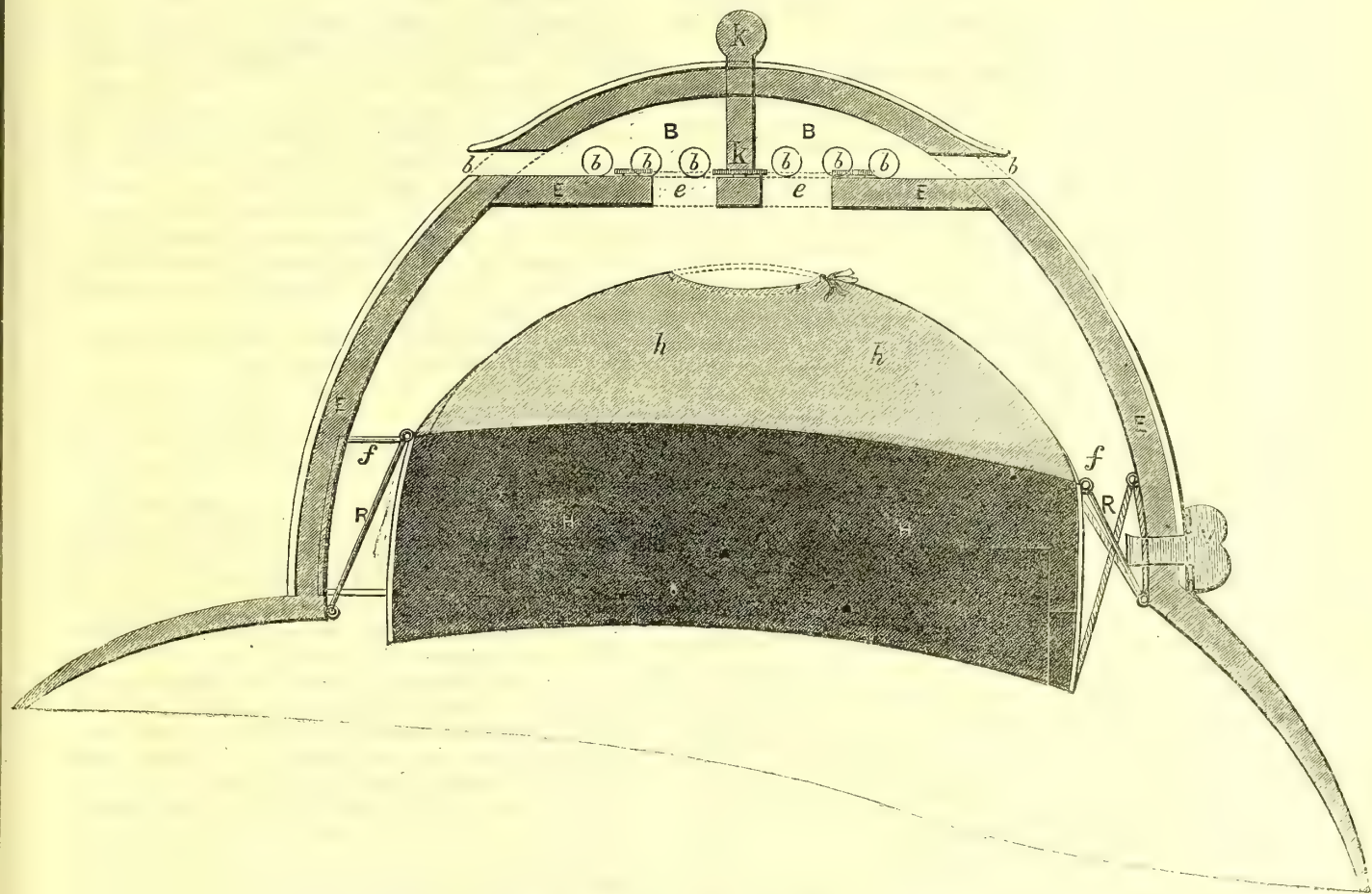


Fig. XV *a*.

Fig. XV *b*.

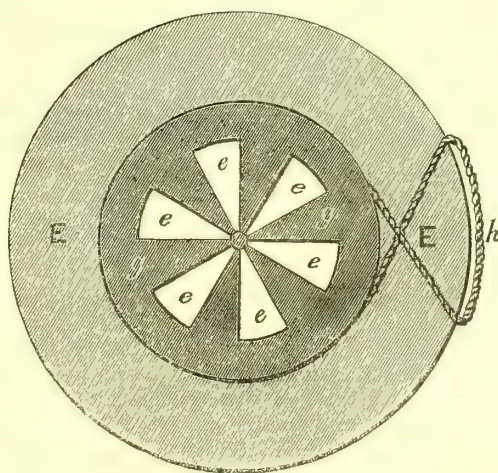
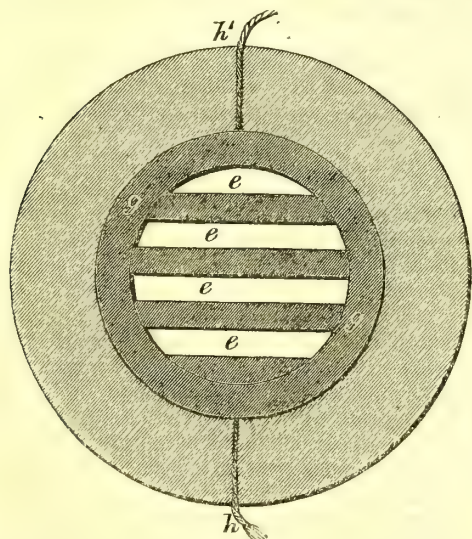


plate may be turned by means of a central rod *k*, Figure XV., rising through the top of the hat, and there turned either way by means of a button or ornamental thumb piece.

I will conclude the subject of head-dress by a few remarks upon the *fabrication* of a hat or helmet.

For cheapness and resilient toughness, which would cause it to yield to and recover from blows, and confer upon it the greater durability, I do not think any structure will surpass the following, which is nearly allied to the first helmet I made in India, viz., one of split rattan canes, or the outer coat of young bamboos,

A a

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platted over a mould into the desired shape, and then lined with a padding of cotton wadding or of the pith "*sola*" quilted up in cotton cloth, to prevent exterior compression from breaking it up. This lining should be between $\frac{1}{4}$ and $\frac{1}{2}$ an inch thick, according to the size and weight which are admitted by those in authority; and it should, by all means, be lined within with tin-bronze paper, pasted inside of it. Gold-leaf paper would no doubt be still better, but too costly. This aluminum leaf with which I have had the helmet I have shown you coated internally might surpass the tin-paper, but in too trifling a degree compared with the extra expense. A halfpenny worth of tin paper would line the hat. Exteriorly, such helmets should be covered either with removable white covers stretched over them, or, where the case admits of it, with the thin rolled metal I have described, or even with metal-bronzed cloth.

In all cases the inner ventilating current, both very free and always under control, must be provided for. Also the porous and flexible band and cap for carrying the hat, and variable to suit the size and comfort of the head, ought, I consider, to be jealously maintained. Such a cane hat, when of a single shell, and made like Fig. XIII. or XV., ought not to cost, in England, more than 15s., or at most 20s., and in India half that sum.

There is one more form of hat which I once contemplated making, as convenient to travel with. A thin spiral wire winding round and sewed down to the inside of a flexible shell of cloth and wadding, would stretch it laterally into a due oval shape, but allow it to be pressed down vertically like an opera hat. To stretch it vertically, a single arch of slight flat steel would suffice, crossing the interior of the hat from side to side, and hinged to its sides near the base of the hat, while above, it would carry a peg long enough to press against the middle of a thin steel or whalebone cross at the top of the hat. By shifting a small pin or hook the arch could be turned down backwards, and the hat be compressed. Such a hat could and should be lined inside with tin-bronze cloth, but would have to carry a white cover outside. I am happy now to have done with the subject of head-dress, except that I think all hats should carry a curtain to protect the lower part of the neck, which is not sheltered by the deep and descending brim such as that of the helmet, Fig. XI., of which you have examined the finished pattern, unless a curtain for the back or a tunic is worn which reaches up to the hat, and on which I shall beg to offer some remarks.

2875. (*Dr. Farr.*) What is the common name in India for "solar apoplexy." How was it entered in the army returns?—I do not remember any other term.

2876. You are, perhaps, aware that the words "solar apoplexy" do not occur in the army returns—they use the word "apoplexy" alone?—That I was not aware of.

2877. I suppose that when men are struck down in this way it would generally be classed as apoplexy by the army surgeons?—Yes, I should think so; solar apoplexy, I should think.

2878. It is a disease much more common in the army in India than in the army in England?—Very much more so, I presume.

2879. That has fallen under your observation?—Certainly, so far as India is concerned. I have not served with the army in England, but presume it is much the same as in civil life, that apoplexy does not occur at the period of strong manhood in a tithe of the cases it happens in India, especially where men are exposed to the sun. I remember when in charge of a large number, about 800 Europeans for several months proceeding up the river, their wilful exposure of themselves led to very numerous cases of solar apoplexy, many of which proved rapidly fatal, while all cases of sun-stroke left more or less effect upon the constitution; subsequently to this I have at different stations observed that whenever Europeans

were much exposed, apoplexy, or a state verging upon it, was induced in some of them.

2880. It is a disease so common in India as to attract everybody's attention like cholera, although not to the same extent?—Certainly.

2881. Besides killing men you think that it produces certain effects upon their brains, and upon their character?—Certainly.

2882. You think that the effects of it remain long after an injury has been done which has not been fatal?—No doubt; many of our soldiers who were engaged in the mutiny must have so suffered; numbers are certain to suffer in that way by exposure in India, and a greater number to have the foundation of destructive disease laid in their constitutions.

2883. I have here a return of the deaths from apoplexy in the Bengal army during the 16 years between 1830 and 1845; the aggregate strength was 213,192, and the deaths from apoplexy were 570; that is at the rate of about three in 1,000 annually; while from the same disease in England the deaths were not two in 10,000?—Large as that difference is, the return must have had reference to periods of peace chiefly; clad and tented as our troops have for the most part been, the immediate effects of the sun upon the brain must have amounted, during any hot season campaigns, to a vastly greater proportion than 3 in 1,000. In particular instances it has amounted to 50 in 1000, I believe.

2884. In England it is not a disease that is common at all to soldiers?—I believe not.

2885. So that its prevalence in India is evidently attributable to solar radiation, and that you think would be obviated to a great extent by some such construction as that which you have laid upon the table?—Yes.

2886. When a man requires the utmost protection, and the greatest efficiency is required in him, that is the time when solar apoplexy is most injurious and fatal?—Yes. While entirely assenting to the opinion that the head is the portion of the body which most needs protection, I would on no account omit this opportunity of repeating views I have elsewhere* strongly urged that it is absolutely necessary, for anything approaching to that immunity which I believe might be conferred upon troops under sun-blaze in India, that the trunk of the body, more especially the spine, should be duly protected.

Unpleasant as it may at first feel, I think flannel, of a soft and open texture, next the skin, from head to foot, should be worn by all. Not only will it guard against sudden chills—the cause of so much illness, but it will husband the perspiration—a point of great importance to all, to those especially who have a tendency to dryness of the skin in an arid atmosphere.

I have repeatedly ascertained the temperature of the skin, in hot and dry weather, to be much lower under flannel, with a cotton dress above it, than under the cotton alone.

The flannel moderating the evaporation keeps it moist and cool, the cotton permits a rapid and chilling evaporation, which overtaking the power of supply, is soon followed by chronic dryness and heat of skin in a hot wind. The outer dress should, I conceive, be white cotton.

Permit me here to offer in evidence the strong convictions of experience in this form. Had I to invite out to some undertaking in India a number of my countrymen, I would not consent to their going until I had, after an ample experiment, provided them not only with the most protective head-dress I could, without consideration of cost, but also the most protective tunic or aprons, one for the back at least. I would know that, whatever its material, it must be suspended at some inches distance from the back, and that this could easily be done. I would know that the most effective material for such aprons would be small plates of sheet tin stitched down upon

* "British Army in India," Longmans and Co.

very open canvas, that the inner face of the metal might be slow to radiate upon the body the small quantity of heat which its outer face failed to repel.

Such a curtain of the thinnest sheet tin, $2\frac{1}{2}$ feet long by $1\frac{1}{2}$ feet wide, need not weigh altogether more than a pound, and, hanging 4 inches from the back, it would be highly protective. At the same time it could dazzle no one by its reflections who was not actually lying on the ground. Next in efficacy to this would be aprons or curtains of white calico, also hanging at a like distance from the body; but the white cloth would be less effective and far more dazzling than the metal. A tin-bronzed cloth, if not crumpled, but rolled up like a map when off, might answer well. The sheet tin curtain, if lapped together when removed, like a folding map, ought to last a long time; and, as such metal is to be purchased for 2*d.* the square foot, the chief material of the curtain would cost 6*d.*

There would be no difficulty in producing pattern curtains of each kind, if any practical benefit would result from it. It is very gratifying to learn that the Commander-in-chief in India has ordered white tunics to be provided for the troops. It is only to be wished that they were set out from the back by a spring behind the shoulders. A tape, hitched and acting like a bow-string when the tunic was on, would keep the spring and cloth arched backwards. A free circulation of air between the cloth receiving the brunt of the sun's rays and the body would greatly increase the protective power of the tunic. A ploughman's smock frock, made to hang clear of the body, both in front and behind, by means of two slight springs slipped through loops in it close under the armpits, and bent by means of tapes, so that their ends and the smock would press close against the side under the arms, while their bows, projected one in front of the chest, the other behind the shoulders; such a smock, made of very white cotton or linen, and of very close texture, would impart, I believe, an invaluable protection to the trunk of the body. For the exit of the rising current of ventilation enclosed within a smock, tunic, or curtain, there ought to be lateral vents at the shoulders, produced by propping the cloth over the shoulders a couple of inches above them. The soldier's use of his rifle would not be interfered with if the smock or curtain were rightly made.

Any padding pressing close to the body, if thick, would, in the end, I fear, do harm. It would not only suppress the evaporation of the perspiration far too much, causing it to soak the fabric, but it would also become a magazine of heat, which would soon be conveyed into the body in a continuous stream.

2887. (*Chairman.*) I believe that you have been led by your experience to form an opinion favourable to hill stations for European troops?—Yes, from an early date. In the year 1824, the year after I went to India, I happened to be residing at Kurnool, and having but imperfectly recovered from a severe illness of the previous year, I obtained leave to visit the Himalayas, and spent six months there, making observations on the climate of mountain heights and of valleys, having brought with me from England a variety of philosophical instruments. At that time there was a strong prejudice existing against residing in the higher hills, except during the hot and dry months of the year; against residing there during the rains, the prejudice was great. I had many discussions with the resident medical officer at Subathoo on the subject. He endeavoured to dissuade my friends and myself from residing in the rains at a greater height than Subathoo, under the impression that the humidity of the rainy season at greater heights would prove prejudicial. The apprehension was not unreasonable; for although experience has shown that even the rainy season had far better be spent by most Europeans in many localities in the hills than in the plains, there are constitutions in which at a higher elevation than about 4,000 or 5,000 feet they prove trying, as in many cases of rheumatism, and in con-

stitutions saturated with mercury, and others greatly exhausted by the climate of India. Indeed at places on the first height, and of considerable elevation like Darjeeling, where the rainfall is prodigious and almost unremitting for some months, and the dampness extreme, I do not think troops could with advantage be permanently quartered. But I do not speak of such localities from personal observation, for where I was in the hills, even at such a locality as Simla, no European had spent the rainy season, on account of the dampness of the atmosphere with the low temperature; but relying upon what appeared to me to be corrective of such influence and to promise benefit to enfeebled skins and obstructed viscera, namely, the circumambiance of an atmosphere of diminished pressure, we spent up at Simla the first rainy season tried there by Europeans; it then had but one solitary house. Further observations showed mountain heights, especially ridges, to possess an unparalleled equability of climate, while it was the reverse with valleys amongst mountains. These observations having been extended over a wide district up to a height of 16,700 feet amongst the passes of the third range of mountains, I felt justified in publishing a condensed view of what appeared to be the sanitary advantages promised to suffering Europeans by a continuous residence of one or more years in the hills at a height between 6,000 and 8,000 feet. The attention of the Government was drawn to this publication by the medical authorities. The subsequent formation of stations at Simla, Mussoorie, &c., established the character of the climate. At the same time I have thought, and early expressed the opinion, that too great heights should be avoided for continuous residence, and that it would be well to have stations at, at least, two different elevations, say 4,000 or 5,000 feet, and at 7,000 to 8,000 for invalids suffering from different forms and states of disease.

2888. I think you have given it as your opinion that as large a proportion of European troops as possible, compatibly with military and financial reasons, ought to be quartered in the hills rather than in the plains?—Yes; and with that view I have been very desirous of inviting attention to this particular construction for barracks which I have described, viz., a double casing of thin sheet iron over a frame of fir planking, as an easy means of housing troops in the hills comfortably.

2889. Have you formed any opinion as to the expediency of going far into the hill ranges rather than remaining upon the borders of them where they touch the plains?—Exactly so; you would escape the heavy downfall of rain in proportion as you go inwards.

2890. (*Dr. Farr.*) What further advantages do you expect to derive?—I do not know that there are any others; but that is a considerable advantage. The fault of the hill climate is no doubt the dampness in the rainy season. In the first hills, as for instance at Darjeeling, the rain is prodigiously heavy, and it is very heavy above Nynee Täl, and wherever you rise up a considerable height immediately over the plains.

2891. (*Sir R. Martin.*) Wherever these heights are in the front ranges receiving the brunt of the south-west monsoon; but in the rear of such localities you will find others in which the rain-fall is very different?—Yes, much less; in fact, upon the first mountains there is a great precipitation of water.

2892. (*Dr. Farr.*) Is there any range of hills in Bengal which you think might be used for locating troops except the Himalayas?—I have no present knowledge upon that point.

2893. You cannot suggest any other station that would be so useful for troops as the Himalayas?—I do not know of any but the Himalayas themselves. We know that both in the Bombay Presidency and especially in the Madras Presidency there are places highly spoken of, especially on the Neilgherries. There are the ranges beyond Darjeeling, only they are not in our territory, but if you pressed further on into the Sikkim territory, you might find, no doubt, ranges much surpassing Darjeeling in

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choiceness of climate. My impression was so strong that our European soldiers were suffering in body in consequence of their suffering in mind, and all the consequences of that, and that indeed their position was not only lamentable in a moral point of view, but dangerous politically speaking, that so long ago as the year 1826, when I was staff-surgeon in Cawnpore, it occurred to me that it would be very advantageous to employ the men in occupations interesting to them. The thought struck me first at Agra, when constructing some ventilating apparatus I obtained the services of an artilleryman who had been a sawyer; the delight that he evinced upon being permitted to come to work with me was great. He offered indeed to work for nothing, if he might come when off duty. Afterwards, when staff-surgeon at Cawnpore, and subsequently, this idea impressed itself upon me with much force, that when you meet with men who have been accustomed to some kind of industry in England, and that is the case with nearly all, it would be highly expedient to give them occupation in their familiar lines; some might be employed upon experimental farms and field-gardens, and manufacturers might be employed in their several arts by having workshops. It struck me also after I had prosecuted many inquiries into the native arts, that it might be made instrumental for the purpose of introducing a good deal of improvement into native art; for example, by letting a soldier have a dozen native boys apprenticed to him, who would benefit by the work that was done. The boys then would go forth with some English notions of activity and of the importance of proper implements and suitable plans. They would learn improved processes in their several arts, in lieu of the very rude and defective ones everywhere prevalent. I have employed labourers in so large numbers in native arts of various kinds that I may venture to speak with some authority on the subject. The state of the useful arts in India is such as, I think, to invite the commiseration of all persons who have information to impart.

2894. When you speak of the useful arts, to what arts do you refer?—The ceramic arts in the first place, then the metallurgic and the chemical arts, and nearly all the mechanical arts. There is no such thing as a firebrick in India; the natives have no idea of the proper art of smelting, or founding, or of firing porcelain or stone pottery, and they cannot forge iron beyond a certain thickness. They have no such thing as proper forge bellows, and foundries in a proper sense they have none; they cannot cast iron and they never attempt it; and even the mode of casting brass is very operose; it is a mode which, in England, would excite ridicule, and the reason is that they have no firebrick, no furnaces that will stand great heats at all. It is not that the country does not produce the material, for after incurring a great expense and trouble, I produced, myself, firebricks of various kinds, one kind of which when tested with the best Stourbridge bricks surpassed them in every property necessary for perfection in a fine brick. I made between fifty and a hundred thousand of these practically indestructible bricks, and a much larger number of an inferior kind, which answered for less trying purposes.

2895. (Sir P. Cautley.) Were those bricks made at Futtyghur?—Yes.

2896. You did not, I think, get the clay from Futtyghur, but it was brought from Banda?—I brought it from Bundelcund, from the Rewah district, and then had to devise a way of compounding it; everything depends upon that. English fire-bricks would be far superior to what they are if like pains and plans were employed in the construction of them. I say construction, for it amounts to that.

2897. But you do not contemplate that all these various mechanical operations could be performed by soldiers living in a barrack?—Perhaps you will allow me to explain what led me to so many inquiries in India, and to the proposal that our troops should be

given an interesting employment of their abundant leisure in promoting the advancement of the useful arts there. To prosecute inquiry in science in so ample a field as India, and to render it practically useful, was a strong inducement to me in seeking an appointment in the Company's service. I went out well supplied with philosophical apparatus, chiefly chemical, and amongst them not less than 30 thermometers of different kinds, and a determination to engage in no commercial undertakings, though drawn into them largely afterwards. I had an early ambition to improve the native arts, on observing in their prosecution the absence of all science. Though firestone might abound in India* as it does in England, the purposes to which it is applicable are limited. All the arts of life, even the mechanical, are either directly or indirectly dependent upon the *fire-brick* for their perfection. India had produced none. In a genealogical tree of the arts, fire-bricks would form the root, the stem would be composed of furnaces and kilns, smelting, reverberatory, cupola, pottery, glass, enamel, annealing, boiler, gas, &c.; this stem would throw out its branches, a main one of vitreous pottery, porcelain, and other ceramic wares in all their variety, another of glass, &c., others of each metallurgic art, the largest of them iron, and so on. These larger branches would divide, giving out others—as all the secondary arts, as the emphatically chemical and the mechanical—as the production of sulphuric and the other mineral acids and the alkalis, and from these would ramify all the countless agents in the arts of dyeing, bleaching, colour-making, and pharmacy. In short, to diffuse the use of an indestructible fire-brick in India would confer upon her a very great benefit, one surpassing the discovery of a gold mine.

Again, without vitreous pottery and glass, both dependent on fire-bricks, and a similar material in the form of glasshouse pots, the mineral acids and alkalis could not, if possessed, be kept and used; and on these substances rest all the chemical arts. Now, in works I established, both vitreous pottery and glass were produced of thoroughly sound quality and in large quantity. In pottery the natives have no better a body than can be produced by a common red heat—a porous substance little better than a tile, though often hidden under a crazy glaze. Their only passably good glass vessels are made from broken English phials and table glass. Their own glass, "*kanch*," is no proper glass, and on being ground and mixed with water undergoes a rapid decomposition. It is a mere frit mixture. The only sulphuric acid they have is made much as it was in early time in England, and costs, if I remember right, 3s. or 4s. an ounce. Nearly one thousand miles from Calcutta I found it possible, after successive experiments, to plant underground, like an ice-house (and thereby to give it a productive equality and lowness of temperature) a sulphuric acid chamber of the size of a large room, which was brought at last to yield from a given weight of sulphur quite as much of the acid as is commonly obtained in England. This acid, when concentrated, cost a penny or three-halfpence a pound—about one six-hundredth of the price of the native acid. On turning to the arts of agriculture, an equally lamentable backwardness was found. No ploughs, properly so called, exist; the land has therefore to be turned over with the pitiful substitute from 5 to 12 and even 15 times. Having ascertained the depth of the water from the surface in most of the western provinces, and the expense of raising it, and made trials with the different instruments in use, I found that a very great waste of labour took place. This led me to try two modifications of the Persian wheel, which brought up water with a manifest and large economy of bullock power. I also tried a simple windmill on the horizontal, and another on the vertical principle (the former for the sake of extreme simplicity), but the wind was too

* Sir Proby Cautley informs me he discovered a good firestone, and employed it in his operations with success.

much obstructed by vegetation and too unsteady at that season. How important to the Government would be any improvements in agriculture introduced by experimental farms, managed cheaply by the soldiery, may be judged from the fact submitted to the Government of India, as the result of these inquiries, that the cost of irrigation alone exceeds in the western provinces the whole land revenue.

I mention all these as some of the many proofs that our troops might be most beneficially employed in advancing native art and rendering labour more productive, and while so doing, enjoying the inspiring feelings of success, of being useful, and of having put by for them part of the fruits of their labours. With the mind filled with these convictions, I laid before Lord William Bentinck, in Calcutta in 1833, a proposal that schools of useful art, managed by soldiers, each in the line he had been practised in, in England, should be established at all European stations—that each such soldier should have a number of native boys of the respective trades apprenticed to him, who when their time was completed should go forth well equipped to carry a better art into the towns and villages of the country. His lordship viewed the plan very favourably. It is probable that at that early day some step might have been taken, but I was compelled by ill-health to return to England, and the question was dropped. I have fully discussed it in the work on the British army in India, published in 1858. It is very gratifying to learn that Sir Hugh Rose has adopted the view, and has, it is said, decided on a commencement of affording to the troops such a recreative employment of their time.

2898. (*Sir R. Martin.*) You would desire that they should be employed in their respective trades?—Yes.

2899. (*Dr. Farr.*) In what arts do you think particularly the soldiers might be employed?—I think in all those I have named. In the ceramic arts and glass, in the cold season, as well as in trial farms, especially with a view to the introduction of some light plough for India, and of improved apparatus for well-irrigation; also in many chemical arts, especially tanning and dyeing. Indian leather is most faultily made. The hide is rotted by the process; and though India is the land of indigo, the natives cannot make a proper indigo dyer's vat. The dye is not properly deoxidated for solution. Silk-dyeing and wool-dyeing will be very beautiful on account of the readiness with which the silk and the wool take the dye, but cotton and linen they have not the power of dyeing at all equal

to ourselves. The natives have not got the chemicals, nor proper chemical vessels.

2900. Would not all these arts be better taught by artizans from this country than by the soldiers?—They would be, but then you would have to send the artizans out, a measure I have long since advocated in vain; but I think this at least might be done. One commission to an ensigny in each regiment might be given to young men who had taken leading positions at the middle-class examinations in science, and who had been ascertained to possess also original and inventive powers of mind, and an acquaintance with the arts, and to have visited many manufactories. I laboured under the disadvantage of having visited none, and had no practical acquaintance with any when I went to India. I had to teach myself everything I attempted, having to contrive processes, either from want of acquaintance with those in use, or because those described in books I found often inapplicable to India. For the especial duty of directing the regimental schools of art or workshops, such officers should of course have a distinct staff allowance. The more liberal it was the better would be the talent commanded and the greater result, and therefore the economy. The great success which is stated to have attended the meritorious exertions of a medical officer in Madras (whose name has escaped my recollection), who, I believe, has chiefly devoted himself to the introduction of superior pottery and chinaware, affords further and recent evidence of the benefits to be expected from regimental schools of the arts, under Government support, which I am happy to think has been afforded to him. Under the guidance of commissioned officers, qualified as I have proposed, a large measure of success would, I believe, prove certain. I do not propose this plan as the most perfect, either for benefiting the soldiery or for promoting progress in India, but as what appears to me the best substitute for a far grander measure—a measure, however, which cannot be advantageously propounded without the support of a mass of evidence drawn from different quarters—evidence which must have power enough to unloose the bands of prejudice and customary impressions in which the minds of all of us have been swaddled from infancy.

2901. (*Sir R. Martin.*) Do you think that it would be beneficial to the health of the soldier, and conducive to his happiness, if he were allowed to do for himself whatever he could do, without injury to his health and discipline?—Yes.

The witness withdrew.

Saturday, 27th April 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

The Right Hon. LORD HERBERT.

Sir PROBY CAUTLEY, K.C.B.

Sir RANALD MARTIN, C.B., F.R.S.

J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.

Colonel GREATHED, C.B.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.

JOHN SUTHERLAND, Esq., M.D.

Sir JOHN LAWRENCE, Bart., G.C.B., Member of the Council of India, examined.

2902. (*Chairman.*) I need hardly ask you whether you have had considerable experience of European soldiers in India?—I have seen a good deal of them.

2903. With regard to the barrack accommodation, is that, in your opinion, in a satisfactory state?—All my experience has lain in the Bengal Presidency, or at all events, mainly so. I saw a little in Sind, and I should say that there, the new accommodation afforded by the barracks, which have been erected within the last fifteen years, was very good indeed. There are some things upon which there might be differences of opinion, but taken as a whole, I think

the barrack accommodation is very excellent; the old barrack accommodation was not very good.

2904. There has been, I believe, a very great improvement in this respect during the period of your service in India?—Yes; in the last fifteen years particularly.

2905. In what respects has an improvement been effected in ventilation?—The barracks are better with respect to ventilation; there is more accommodation provided, more cubical space allowed for each soldier; they have been more careful in selecting the sites, and the buildings themselves are better constructed, in fact, in every respect there has been great

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Julius Jeffreys,
Esq., F.R.S.

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improvement ; all the accessories of the barracks are much better, the cook-houses and out-houses, and everything connected with them. I should say that they were twice as good as they were formerly.

2906. Taking the various stations in the Punjab, do you think that there is any room for complaint there, as to the nature of the accommodation afforded ?—No ; I do not think there is any room for complaint ; if I had been called upon to give an opinion as to the barrack accommodation, I should say that the only defect I ever saw was this, that they build a barrack too large, and put too many men into each barrack ; I do not mean that they give too little accommodation, but, for example, that they build a barrack for a whole company, say of 100 men, and I think that it would be better if they had a barrack constructed for half a company or a quarter of a company.

2907. (*Lord Herbert.*) Do you mean in detached buildings ?—Yes ; I think that there is a disadvantage in the other mode ; but there is an abundance of room, more than is necessary.

2908. (*Chairman.*) What do you conceive to be the advantage of small detached buildings, as compared with larger barracks ?—I think, in the first place, that if anything like an epidemic broke out among the men, it is much more manageable, and I think, moreover, that for the men, both morally and socially, it is the better to be together in moderate numbers than in greater numbers, for I believe that if there are half a dozen troublesome men among them, they will disturb the whole of the men. They built some of the barracks in the hills of two stories, one company being above, and one below ; and the noise of those who were above, if the others were unwell, would be very great, and I have heard the men say that they were not nearly so nice. At Subathoo the new barracks were very fine, and yet the men preferred the old ones, because they were more snug, and less noisy than the new.

2909. I suppose they feel more at home in a small building, they are quieter ?—Yes, a small building is more quiet ; I think that the officers object to small buildings, for they say that the sergeants cannot look so well after the men. I spoke to several leading officers on the subject, and they all said that it was better to have them in large barracks, because the sergeants could look after them better, but I think that barracks of a limited size are better for the men.

2910. The trouble of supervision is greater, but that falls upon the non-commissioned officers ?—Yes ; but the way they put it was this : that they could not look after the men so well ; they did not say that it gave them greater trouble.

2911. (*Lord Herbert.*) Is the barrack for a company undivided ?—Yes ; but there is an opening in the wall like a good large door ; in fact, a doorway without a door. There is a blank wall with an arch, but the noise will pass in there.

2912. I am referring more to the supervision ?—The sergeants can easily go from one to the other. I think that the barracks which they began to build in the Punjab were unreasonably good. I refer to those which Sir Charles Napier advocated at Seal-kote. They were begun there, and were immensely large—unreasonably large, I think—they were 25 feet high, besides the height of the pitch ; the walls on each side were 25 feet high ; and, in fact, they were so large and airy, that they were cold and uncomfortable in the winter.

2913. (*Chairman.*) Was it not an idea that was rather a favourite one then with some commanding officers, that it was better to build a barrack of a very large height, so as to give great vertical space, and so as to make overcrowding impossible ?—That was one of the things that Sir Charles Napier said ; but there is no danger of overcrowding, except upon an extraordinary crisis, when every other consideration would give way to the consideration of putting an increased force into a certain space ; for example,

if a fort or position was in danger, and it was important to accumulate troops in it.

2914. (*Lord Herbert.*) Did not great height give to the men the advantage of great cubical space for the purpose of ventilation ?—Yes, it did, because the area on which it stood was the same ; still the ventilation in a moderate sized barrack was ample.

2915. But the area was not so available to the men ?—A sufficient area would be available.

2916. Except that the air does not circulate to the same extent ; indeed you may be suffocated in a crowd in the open air ?—I think that it was an unreasonable and extravagant arrangement having these large barracks ; it led to enormous expense in building. Everybody cried out, you must not kill the soldiers, no matter how unreasonable the thing was that was asked for ; and at the same time the Government was doing everything it could to make them comfortable. In fact, the men had much better accommodation than the officers or merchants had, or civilians. The officers built their own houses, and paid for their own houses—they built them very economically—while the barracks for the men were all built by the Government. Great attention was paid to the comfort of the men. Everybody was calling out about them—Medical men, Officers, and Generals, and the Commander-in-Chief too—but the men were, in point of fact, extremely well off as regards accommodation.

2917. (*Chairman.*) With regard to the construction of barracks is there anything that you consider defective, or any improvement that you can suggest ?—The only thing that occurs to me to say is, that I think it would be better to have small barracks for few men than large barracks for a number. I do not know that there is any other suggestion that I can make ; I think that, perhaps, now and then you see little details in which improvements might be made ; but I consider that all the new barracks are very fine. I saw the barracks as I came down in Sind, which Sir Charles Napier had built at Hyderabad, and they were very fine barracks.

2918. (*Sir R. Martin.*) Are they raised on arches ?—No, I do not think they are ; but I do not think that it is necessary in Upper India. In Bengal, and in all the damp parts of India, it is of great importance that barracks should be raised, but in the upper provinces I do not think the same rule holds good.

2919. For example, in Peshawur ?—No, I do not think so ; I believe that the upper rooms are much hotter than the lower ones, and that it is more difficult to keep them cool. I think that perhaps the best plan would be to occupy the lower rooms in the day time, and to make them serve for libraries, and workshops, and dining-rooms, and then have the upper rooms to sleep in at night. I think that that would be a good arrangement, for in the day time the upper rooms are much hotter than the lower rooms.

2920. Would you recommend double roofs to shield the upper rooms from the power of the sun's rays ?—I think you might do very well without double roofs. With a little lath and plaster a ceiling might be formed which would have all the advantages of a double roof without the expense of it. I think that where you have flat roofs, the plan which the natives adopt is a good one ; they put a number of earthen pots on the top of the houses, which are very cheap, and just fill them up with dried dung and a little clay, and so forth, and they make a perfect second roof which serves as a non-conductor, and makes a great difference.

2921. You think that would answer for the purposes of a double roof ?—Yes ; and the expense of it would be merely nominal.

2922. (*Lord Herbert.*) With regard to drainage ; are the necessary precautions generally taken ?—I do not think that drainage has been cared for so much as it ought to have been ; it has, of course, been improved considerably of late years.

2923. Has proper care been taken with regard to latrines, and things of that kind ?—A great deal of attention has been paid to those matters, but I

do not think that the drainage at Peshawur was good; there were great differences of opinion about it, and there was a good deal required to be done; it required to be carried out to a very large extent.

2924. (*Col. Greathed.*) Do you think that the sites of cantonments have been selected with judgment?—I think that some have been extremely well selected, and some very badly selected; there is great difference in them.

2925. (*Dr. Farr.*) Do you think that the soldiers, on the whole, occupy better dwellings than the officers, although they may be in barracks, which, in fact, cost more than the houses occupied by the officers?—I think the buildings are much better in every respect, and I believe that any gentleman, as regards mere accommodation, would be very glad to have one of the barracks to live in, or say half a dozen gentlemen.

2926. Generally speaking, I suppose that the officers would prefer living in detached houses?—Yes, just on the same principle that I think it would be better for the men to be in small bodies.

2927. (*Lord Herbert.*) Are not quarters provided for the officers at the public expense?—They receive an extra allowance unless they happen to be in a fort, and they build their own houses. At Lahore, when we first occupied that country, quarters were provided, because the occupation was temporary, but they generally complained very much, and said that they did not like the arrangement; but when we changed the cantonment, and the country was permanently occupied and annexed, the cantonment was transferred to Meanmeer, about four miles off, and then every officer built his own house; after that I often heard officers say that they were sorry they had not the old houses which Government had provided.

2928. (*Chairman.*) Would it not very considerably increase the expense if you were to cut up each of these large barracks into three or four, so as to have a smaller number of men in each?—I think the expense would be quite inappreciable.

2929. Would there not be more outside walls required?—There might be, but very little, I think.

2930. (*Col. Greathed.*) Is it not the greatest possible advantage to be able to turn the men out with rapidity from a barrack on to the parade ground, in case of an alarm?—I think that you could turn them out quickly enough in a good corps, in a state of good discipline.

2931. But I meant rather with reference to the upper stories?—If there was any treachery afloat it would be an advantage, but I think that the men would have plenty of time to turn out. I never saw any case in India where the men could not have been turned out quickly enough; I think it is very easy in the double-storied barracks. At Rawulpindi Government was building double-storied barracks, and I thought the plan was very fine.

2932. Have you seen some of the barracks which they have been building lately in India, and in which instead of having the doors on the lower story by which the men could come out at once they have merely made three doors, and blocked up the rest, making them windows?—I think it would be better to open them, for when rain falls in the hot season it is a great thing to be able to throw open all the doors, and give a regular sweep of the wind from one end to the other. I think there is one advantage in double stories, which is this, that you can place your troops on a smaller amount of ground, which in particular parts of India is of great consequence, for when there is a disturbance the great complaint is that the troops cannot do this, nor do that, because they have so much ground to occupy. For instance, take the cantonment at Lahore, and the barracks which the 81st Regiment occupied: I should say at a guess that the front of their barracks was not less than a mile long, and it causes great fatigue to the men; the canteen and other conveniences were at one end, and the men had to go from the extreme right flank to the extreme left flank, a distance of about a mile. If there was a disturbance in the interior, and

it became necessary to march away 500 or 600 men, the extent of ground and number of buildings which the remainder have to defend becomes a serious evil.

2933. Suppose, for example, that the rebels got possession of a part of the barracks, might they not make a lodgment there?—Yes, and we are liable to such dangers in the case of large cantonments, where the buildings are dispersed over a wide space.

2934. Do you think, with reference to that point, that it would be possible to concentrate your barracks as you mentioned, and to bring the treasure and principal offices together, and surround the whole with a ditch, which might be made by the soldiers?—I do not think that the soldiers would like to make ditches; you would not get much work out of the soldiers; besides, I think the medical men would say that the ditch was very unhealthy. I think that the plan in a cantonment should be this: Concentrate the buildings as much as can be done consistently with sanitary precautions. At Rawulpindi the barracks are placed in a double row, and they occupy a very moderate space of ground, and are very easily defensible, and yet there is plenty of air. I think you should have a portion of the cantonment partially fortified, so that in troublous times you would occupy it with a small body of troops. There is no apprehension when all the troops are in the cantonment; it is when the best part of them are gone out to a distance; it is then that a panic pervades the people who are left behind, and the object would be on such occasions to occupy that part which was strong and defensible, and leave the other buildings empty, and in that case you could, by connecting walls, which might be constructed at very small cost, make the place thoroughly and easily defensible.

2935. (*Lord Herbert.*) You would make a citadel of it?—Yes; you would then just see to the women and children and valuable property, and bring them all within this circle. On the frontier there was no fence of any description; we wanted to put a wall round the cantonments at Peshawur, but it was objected to on various grounds. All the medical men objected strongly to a ditch; they said that water would lie in it, and that that would breed distemper.

2936. (*Col. Greathed.*) You forbid thatched roofs altogether?—We do not have them when we can avoid them. Sometimes they are run up at first in the temporary buildings; for instance, Umballa was full of thatched roofs, and the way in which these were burnt in 1857 was one of the signs that the mutiny was coming on; officers said that it was the country people burning the bungalows, in order to sell their straw, whereas it was the sepoys who were burning them; and they did that to shew that they were angry. Everybody, on principle, objected to thatched roofs, but the object was always to cover the troops as quickly as possible. It was generally at the end of the cold season and after a campaign that a new cantonment was decided on, and the paramount consideration was, to cover the troops, and these thatched roofs were temporary arrangements, but in the course of time, that which had been a temporary arrangement became practically permanent; those in authority were so long a time in making arrangements for the permanent buildings that these at length had a permanent character.

2937. (*Lord Herbert.*) You stated that, generally speaking, you thought the better plan was to use the lower rooms in the lower story as workshops; do the men work very extensively in the workshops in India?—No; I do not believe they do; I think that they hardly work at all, but I think that the object is to try to induce them gradually to do it, but I do not believe that the men like working in India.

2938. Would they not earn money by it in course of time?—Yes, a little; but that was one of the difficulties in getting them to work; it is difficult to sell what they produce; there is not a ready market for it; the natives can undersell them in almost everything. Carpentering, shoemaking, tailoring, the na-

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tives would do as well, if not better, than the soldiers, at half or quarter the cost; and the consequence is, that the men would not be adequately remunerated, even if you could induce them to work; it would be one of the inducements to do so to get them a sale for their produce. I think that would be a great inducement to them to employ themselves. The men do not read much as a rule; there is not one man in a hundred who cares about reading.

2939. (*Chairman.*) Notwithstanding the great improvement which has taken place in barrack accommodation, is it not your opinion that there is a very large and excessive mortality among European troops. —Yes, I think the mortality is very great; it varies in different regiments and in different localities, but everywhere it is very great.

2940. In your opinion, is not that to some extent preventable?—I think the mortality could be reduced considerably; it is a very difficult matter to manage, but nevertheless I think it could be reduced.

2941. I believe you have often expressed the opinion that want of occupation and the consequent ennui is one of the causes of the bad health of the soldiers?—Yes; I think that want of occupation and the habits of their lives, want of care for themselves, and the way in which they indulge themselves, particularly when they first go out, are very injurious to them. No man will believe the sun will hurt him, and even the officers will not believe it; the men of course are more careless in every respect than the officers, and their habits of life are very inimical to health in India; and that kind of life, which in Europe, or in a very cold climate, perhaps, would not hurt them, except by slow degrees, in India is extremely pernicious, and soon produces bad health and increased mortality.

2942. You mean with regard to exposure to the sun, and to indulgence, and drink?—Yes; and the way in which they live altogether; they eat too much animal food, and drink too much for the climate of India. The natives who are accustomed to the climate of the country eat very little animal food, particularly in hot weather, and they do not go out in the sun more than they can help.

2943. With regard to the food, do you think that the rations are excessive in quantity?—It is not the quantity of the rations, but, I think, that the men eat too much, and they eat too much in the hot weather in particular. I have often heard the medical men say that they eat meat twice or three times a day all the year round; I do not believe that any officer does, and if he does, he gets sick too.

2944. The rations are not chosen by the men, but for them?—There is a certain ration allowed, so much meat, and so much bread, and so much rice, &c.

2945. And the probability is, that the supply of food being taken out of their hands they will eat whatever is set before them if it is palatable?—But I think they like meat, and meat is bad for them in hot weather; I do not think they would like their rations if they had not meat; if they have any money you generally find that they buy bacon and pork, which is very filthy in India, being badly fed, and they thus add to the quantity of their animal food, and I think that that is bad for them, more particularly in hot weather.

2946. So far as there exist any defects in the diet they are attributable to their own neglect and not to any fault of the Government?—I do not think that they are to be attributed to the Government, but I think that it might try to induce the men, by varying the ration with reference to hot or cold weather, to take more to vegetable diet.

2947. (*Sir R. Martin.*) Changes in the diet might be made according to the several seasons greatly to the men's advantage?—I think very much so.

2948. For example, increasing the amount of fruit and vegetables in the hot and rainy season, and diminishing the amount of the animal food?—Yes; if you could get the men to like this it would be ad-

vantageous. I think that you must try to carry them with you.

2949. You think, with regard to occupations for the men, that they would not read; but do you think that they would take to trades?—They made, in the first instance, soldiers' gardens at a little distance from the barracks, but they did not work in them; people then said it was because it was a long way to go, 300 or 400 yards. At a greater expense they then made gardens close to the barracks, and spent large sums of money, still the men did not work. They said that they ought to be paid to work; they did not enjoy the thing, and they do not enjoy any kind of working; it is very difficult to get them to work.

2950. The plan of occupying the men in trades answered very well in the Bombay Fusileer Regiment during several years?—I saw the 1st Fusileers at Mooltan; that was during the mutiny, but I did not hear that there was anything particular in their system; but I do not think that any Englishman likes working in India. They like turning out, and throwing great balls of iron, and playing quoits, and football in cold weather; but I do not think they like work.

2951. They prefer amusements rather than occupations in trades?—Quite so.

2952. (*Col. Greathed.*) Do you think that prizes would have any effect in inducing them to work in gardening?—I should say that perhaps four or five men in a regiment might have a taste for it, and would have some ambition of that kind; but I have heard them say, if we are to be paid, we will work. I recollect at Peshawur, when we were getting up soldiers' gardens, three years ago, Sir Sidney Cotton was very strong upon it. He said that 40 or 50 of the men would work, if they were paid; it all depended upon that; but I think they would have done extremely little work.

2953. (*Chairman.*) The difficulty you have suggested is this, that if you are to pay the men it will be a loss to the Government, as you must pay them much more for less work than you would pay to the natives?—Yes.

2954. (*Lord Herbert.*) Does that apply to trades?—Yes; but if you got up trades in a regiment, so that the work in the regiment might be done by the men, it might answer. They might make their own clothes and shoes, and thus, in some degree, you might recover the outlay; but I do not think that it would be easy to make soldiers' work remunerative.

2955. (*Chairman.*) What kind of occupation do you think could be found for the men that would be in some degree remunerative to the Government?—I think anything connected with the regiment, such as making their own clothes, and their own shoes, iron work, and all those kind of things, they might do. The object should be to make the regiment self-supporting as much as possible, even if it cost a little more. I think the men would take more pride in that, and the officers would interest themselves in it.

2956. But it would be a losing business in point of money?—Yes; but I think it would repay you, if you could get the men to do it, and they would be more healthy, and more happy; for the men are not happy; they are restless, and they want to be at something else, or to get away.

2957. It is a life of great monotony, is it not?—Yes, and it must ever be so, and I think the more superior a man is, the more distaste he has for his duty.

2958. (*Sir P. Cautley.*) Do you think that the prospect of an increased pension after a certain period of service would lead to the soldier feeling more happy, and more comfortable during his stay in India?—I think it would have that effect on many of the men, but on a great many it would not.

2959. I mean as a general principle?—I should advocate it myself, for I believe that the more inducements to good conduct you hold out to them, the

more likely you are to induce them to take care of themselves, and behave well.

2960. (*Lord Herbert.*) Are not present advantages in the shape of money paid down much more considered than distant ones?—Yes, but on the other hand, they waste it; if a man gets more pay, he drinks more; but I think, myself, that there is on the whole an advantage in paying the men more. Very few men ever look forward for half a dozen years; I do not think they feel that they have anything to look forward to, and they are reckless and careless, and doubtless there is a great deal in the system to make them so.

2961. (*Chairman.*) There are some inconveniences which cannot be remedied; the uncongeniality of the climate preventing them from taking a great deal of out-door exercise, and the inevitable monotony of the life?—Yes. It is very difficult to understand them, for if you ask any one of them they will tell you that they like India better than England; and yet they are not happy there.

2962. (*Lord Herbert.*) Do you not think that they are fond of idleness, and like being waited upon?—Yes, they do not like to have to carry their kits and knapsacks. I saw some men of the 78th in Edinburgh the other day, and I spoke to them upon the same subject, and they said that there was not an old soldier in the regiment who would not go back again to India, if he had the option.

2963. (*Chairman.*) Connected with the question of occupation for the soldier is that of the hill stations, because it is probably only in the hill stations that any considerable amount of outdoor exercise or labour is possible for the men, do you think that it would be an advantage if a considerably increased number of troops was quartered in the hills?—If considered in its political aspect, you must regard it, not only as it affects the men, but as it affects the military arrangements of the country. I think, myself, that there is no doubt whatever that the men would be much healthier in the hills than in the plains, but at the same time there are constitutions among them which do not benefit by the hills, or but very little; there are some constitutions which the hills are not suited for, but, upon the whole, the men are much more healthy there than in the plains. I think there would, however, be great difficulty in putting a large number of troops in the hills, because for financial reasons, you must reduce your European force in India to as low a scale as possible, and if you do so, then you must put the bulk of the troops in the great strategical positions, in places where their presence would have a considerable influence on the country.

2964. You think that out of sight would be out of mind, and that if they were quartered at a distance from the great centres of the population, the influence of their presence would be diminished?—I am certain of that; for instance, one regiment would enable you to hold and keep in order a province which ten regiments would have a difficulty in recovering if lost; and if you put your English troops 300 or 400 miles from these important points disturbances might arise and assume very formidable dimensions; regiments might come down, and after an immense sacrifice of life and money recover the country, whereas if you had kept a certain portion of these troops down below you would not have lost the province, or it would not have been in danger. For example, take Delhi, you had not one company of Europeans in Delhi in 1857; you had three regiments in the Simla Hills doing nothing; but if you had had only half a regiment in Delhi you would not have lost it. Take Cawnpore again; you always kept a regiment there, but the year before the mutiny broke out you had not half a regiment there; but if you had left a wing of a regiment there you would not have lost Cawnpore; and if you had not lost Cawnpore, you would not have lost one of the out-stations of Cawnpore. Again, if you had not lost Cawnpore you would not have lost Oude. To say to the natives that the troops can come down, and beat

them, and recover the country is to appeal to the reason of men; and if they have reason they would not attempt to disturb the existing state of things.

2965. (*Sir R. Martin.*) Would not open field works at such places as you have spoken of suffice for the purposes of the Government, with minimum garrisons armed as they would be now with superior implements of defence?—That is supposing that you hold these places as defensible posts. I am not a soldier, but I may say what strikes me about this matter, that you should hold your cantonments in strength sufficient to meet all comers, and to go out and take the field when it is necessary to do so. If you put a small body of men in a defensible post, no doubt that arrangement will have a considerable influence on the country, and in some positions a sufficient influence; but then all intelligent men will see that those men are not an offensive power; they are not sufficiently strong to maintain the position and supply a force to act in the field. Thus an affair which at the commencement might have been easily put down, by delay assumes a dangerous aspect. You might gradually lose all control over the country, and eventually find your troops hemmed in within their fortifications.

2966. Against *émeutes* of that kind would not the native irregular corps always prove more serviceable than the heavy armed and accoutred Europeans?—Yes, indeed they would walk round the Europeans; but nevertheless it would not do to shew to the people of the country that your European soldiers are only there to hold defensible posts; you want in serious cases to be able to move them about, and let the country know that you can take the offensive when you please. If you are ready to do a thing you may never have to do it. On the other hand, if you be not in a position to act vigorously this defect may entail loss of life, great expense, and great difficulty. In short in India your arrangements should be such as to overawe and control the country. We should never forget for a day that we are few, at a long distance from our resources, with many who may rise up against us at a few hours' notice.

2967. Would not the troops in mountain stations within call be effective for all such purposes as the protection of stores and treasure?—Suppose you put the mass of your British soldiers in the hills, and there is a call for their services, what is the nature of it? Some great difficulty and danger has arisen, and there is a kind of panic all over the country. Supposing that between your hill station and the point you are to move to the intervening country is in a state of insurrection; your communication would be cut off, and you would have all kinds of difficulties to encounter; the troops would have to hasten down, suffering from great exposure and meeting with great difficulties. When the mutiny took place in India, the British regiments were hurried down from the hills, and I heard officers say, although there were only 40 miles between Umballa, Kussowlie, and Subathoo; the men came down in such a hurry, and had such difficulty about carriage, that many men were left behind, and they had to send off camels and every kind of conveyance to bring them up. Now, suppose the people of the country had been hostile, every man of those who were left on the road would have been cut off and destroyed.

2968. Are not all these dangers that you speak of very much diminished by the general disarming of the people, which has been in operation for some time past?—They are; but you do not know what may arise. A little cloud no bigger than a man's hand may arise, and if you do not pay immediate attention to that, you do not know what may happen. There are great chiefs in the country in different directions, with considerable power, although that power in times of danger is much exaggerated; and in such times the less people know of the matter the more they exaggerate it. But take such a place as Agra; if there was anything like a commotion in its vicinity people would say that the Gwalior chief was

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connected with it. Then if it occurred near Sealkote, they would say that the Cashmere chief was concerned in it, and thus a kind of panic would arise, and affairs become more complicated than it is easy, sitting here quietly, to conceive. Then, again, if you have native troops, and there is any great reason to apprehend a commotion, people will say, "the native troops are going again;" and then the precautions that are taken to guard against such a contingency excite the fears and passions of these soldiers, which again reacts on your own countrymen. But if you keep your European troops down in the plains in healthy places you keep everything straight; such an arrangement is a kind of backbone to everything—the natives do the work of the country and behave well—everything goes right, and the Europeans are not called out, but remain quietly in reserve in their quarters.

2969. Would the extension of railways at all modify your opinion upon the question?—There is no doubt that it would to a certain extent, but still I think that it is wrong to suppose that you could afford to have that amount of railroads in India that would enable you to do what many people say you could do; that is to say to keep the bulk of the European troops upon the hills and hold the plains with your Native troops. I believe that you would lose the plains, and having lost them that you would not easily recover them when everything was disorganized. My idea is that you should take all the weakly men, and delicate men of your regiments and send them to the hills every year, and keep all the strong serviceable men down below, or the men whose constitutions would not benefit by the hills.

2970. But the hills have not been found beneficial for the cure of disease, except fever; they have been found most effective in the preservation of the health of regiments previously healthy, sent thither from the plains, but men who have been suffering particularly from bowel complaints have hardly been benefited at all by removal to the hills?—Just so; and those are the men whom I would not send to the hills. I think that as a man continues in India, there is no doubt that his constitution grows weaker, and he becomes more delicate, and requires a change. Such men I would send to the hills. When English soldiers first go out to India they suffer as much from folly and ignorance, and from reckless exposure as from anything else, but they do not require a hill climate; gradually, however, as their constitutions become enervated, they benefit by a change to the hills. Now supposing you have 1,000 men in a regiment I think you might have 200 or 300 in the hills, the remaining 700 would hold a station quite as well as the whole body, and do all that was required to be done. If there was an emergency you would be able to turn out 500 or 600 men, and leave 150 men in the cantonment, and that would do very well. If there were any protracted hostilities, then you might let the rest of the men come down from the hills; two thirds would be fit to go on active service with the regiment, and the rest would help to occupy the cantonments, and you would then have something like an appearance of strength in the country, while the flower of the regiment were employed at a distance. I do not mean to say that you could not send some part of the regiments to the hills, and in some presidencies you could spare more than in others.

2971. (*Chairman.*) In Madras, when the railways in progress are completed, will there not be great facilities for concentrating a considerable part of the military force upon the hills?—I do not know much about the Madras people; but I have no doubt that the people there are a much milder, and more gentle race than in northern India, and there is not, therefore, the same necessity for keeping a large number of Europeans at strategical points.

2972. (*Lord Herbert.*) And the healthy positions are nearer, are they not, to those points which ought to be held as strategical positions?—Yes.

2973. (*Chairman.*) Taking the country with which you are familiar, and such places as Delhi, Lahore, and Agra, do you think that those great capitals must be held by European garrisons in considerable strength?—Yes; they are not only great political capitals, as connected with our country, but also great strategical points as connected with the territories beyond our borders. For instance, Agra is not only our capital, but it watches the whole of Gwalior. Delhi, again, that is a place of great political importance. Meerut was only 40 miles from it, and you had 2,000 troops at Meerut, and yet you lost Delhi.

2974. (*Sir R. Martin.*) That was from the mismanagement of the force at Meerut?—That is very true; but still it is on the cards to have anything mismanaged. You would not have lost the arsenal at Delhi, if you had had half a regiment there in spite of the mismanagement at Meerut.

2975. (*Chairman.*) Taking Lahore, what is the nearest hill station to which troops could be sent from Lahore?—There is one hill station which I see they are going to try for troops, and that is Dalhousie, but the nearest one in use when I left India was Dhurmsala, near Kangra.

2976. Have you at all considered what proportion of the troops could be spared, say in the Punjab, for the comparatively healthy stations on the hills, and what proportion it would be necessary to keep in the plains?—I have not considered the proportion exactly, but I can state where the troops are. They have hitherto had three regiments in the hills at Subathoo and Kussowlie out of about 11; I do not think that they could spare more for the hills. I think, however that the best arrangement would be to have all your regiments in the plains, but two or three hundred of the men of every regiment in the hills.

2977. You look upon the hill stations as available as sanatoria, but not, generally speaking, as quarters for European troops?—Yes; supposing it was laid down by those in power that the greater portion of your British regiments were to be in the hills, and if you refer to the map and observe how the Himalaya range lies, it would be difficult to arrange how to hold some parts of the country. There are European troops now in Peshawur, and if you were to put those regiments in the adjacent hills I think they would be extremely unsafe among those warlike tribes, who are very hostile to us. On the other hand, if these troops were in the hills *cis-Indus*, how, in the event of sudden insurrection, could you bring them rapidly to bear on the menaced point? I think that you might lose the whole of the Peshawur valley in twenty-four hours. I think people would gradually see that the country was at their mercy, and they are very warlike people—a very resolute and very energetic people; they see every thing and observe everything, and they draw their deductions from everything, while our people suppose that they know nothing.

2978. Do you think that there are many persons amongst them capable of calculating the chances of an insurrection, and who would appreciate the advantages which such a distribution of our troops would give them?—No doubt there are many. So long as there is no pressure from outside, and no discontent among our own native troops and subjects, the advantage of the presence of English troops is scarcely appreciated; but it is not possible to foresee when and how danger may arise, and therefore we should always be thoroughly prepared.

2979. (*Sir R. Martin.*) But with sufficient garrisons at the principal stations, do you not think that these dangers would be very much diminished?—Yes, if you had a sufficient number; but the question is, what is a sufficient number if you want to hold India with as few Europeans as you possibly can? If you hold India with 80,000 Europeans, you might have 20,000 of that force in the hills, with 70,000 you might have 10,000 in the hills, and if you brought them down to a very much smaller number, by very

excellent management we might still hold the country, but you would hold it then more by prestige and the mercy of God, than by wise and prudent arrangements. The better your arrangements are, the fewer Europeans you want; but under the best arrangements it is wise to have a certain number, and those must be in the best strategical positions.

2980. When railways shall have been constructed, will not they of themselves dispose much of the strategical question?—I think I could damage a railway so as to impede its use in two or three hours, and that an engineer could do it in still less a time.

2981. (*Lord Herbert.*) You would have so to place the Europeans as that they should first of all overawe the native population, and, secondly, the native troops, in case of any disaffection among them?—Yes, I would endeavour to prevent disaffection, by good management of the native troops, and population; but with the best arrangements in India you still want power; the better the arrangements are, of course, the smaller the power will be that you will require.

2982. (*Sir R. Martin.*) Would not an effectual and more general disarming of the population prevent the natives from thinking that insurrection was practicable or possible?—I think that up to a certain point you can disarm effectually; but beyond that point it is difficult to disarm without a great deal of inquisition and annoyance, which would be very injurious to your administration. Then again, you cannot justly disarm the people in the independent states; you may treat with the great chiefs to do so, but you must leave the whole of their country to them, and let them administer it. You have always considered it politic to do so, and you cannot then say to a chief, "You must disarm your people, and if you do not I will walk into your country and do it." You may through the chiefs diminish the number of arms in the country, and in any particular case of aggravation you might insist in a certain tract upon the arms being taken from the people; but they would gradually recover them, and it would require an amount of interference with them which I am afraid would do away with the advantages which you desired to attain by treaty, if you insisted on their disarming their subjects. For example, you made a treaty the other day with the Gwalior chief, in consequence of his good conduct during the mutiny, and then you readjusted his frontier. Of course after you had done that you made him feel extremely contented and happy, and then did the same thing with the Nizam. But suppose that two months afterwards you said, "I insist upon you disarming all your people, and if you do not do it I will do it." He would naturally say, "This is very strange treatment; this is the reward that I get for my fidelity;" and everybody who saw you act in this way would say, "This is a mere excuse; this is all humbug; they do not want merely to prevent disturbance, but have something in the background; the disarming is preparatory to doing something worse." Now just suppose that in the Punjab I had proposed to disarm the whole of the population in the Cashmere and Jummoo territories, consisting of 50,000 square miles, including hills, mountains, and valleys, why I should have required half the army to do it. No doubt you can disarm to a considerable extent, and when we disarmed the people in the Punjab we took a great many arms, but yet it was only by looking after them in consecutive years that we succeeded in getting the measure thoroughly carried out. I think that if there had been any general discontent the people would get arms from across the border. Of course, there are great advantages in getting the arms away; but it requires to be done with a great deal of tact, management, and consideration. You must consider the size of India, the length and breadth of it, see how it is broken up, look at how difficult the country is in parts, and then people say, "You must have roads and bridges; it would be a capital thing to have them." But how are you to get them? Where

are you to get the money from to make them? This must be a question of time, of peace, and good management. There are much greater difficulties than people have the least conception of in dealing with all these questions in India.

2983. (*Chairman.*) There are warlike races in Central India, are there not, in the Nizam's country?—Yes, but they are nothing to compare with the northern races; the most warlike races are those which come from the north; the people of the Nizam's country are not very warlike; but large bodies of mercenary soldiers are to be found scattered over it, who sell the use of their swords to any who can pay for them.

2984. (*Dr. Farr.*) The people on the hills have, I believe, invariably conquered the people on the prairies?—The early conquest of India was made by people coming down from the west, from Central Asia.

2985. But generally the people in the hills are more vigorous and warlike than those in the plains?—The people in the Simla hills are not warlike.

2986. I mean in the upper provinces, are not the people more vigorous, warlike, and energetic than the people on the plains of Bengal?—Incomparably so, but the people in the plains in the Punjab, and in the north-west, are more warlike than the people on the adjacent hills.

2987. Generally is it desirable to place European troops in those stations where the native population is the most vigorous and warlike?—Yes, as a rule.

2988. Is there not a danger if we kept a large proportion of European soldiers upon the low plains of Bengal, that they might suffer not only from increased mortality but by a certain decrease of efficiency, so that ultimately their character as troops might be destroyed?—I think that in Bengal you require very much fewer than in the upper part of the country, of those that you do require in Bengal a certain proportion might be in the hills; we formerly had very few troops in Bengal.

2989. It would be necessary, would it not, to keep a certain number of troops there to defend Calcutta?—Yes, that is true, as that is the seat of the empire, and also being on the seaboard, but beyond that I should not say that you required a great many. I should say with reference to the character of the people, that 5,000 European troops in Bengal would go further than double that number in the upper provinces.

2990. By returns which have been made it would appear that the mortality is less as you ascend the Ganges and go into the upper provinces than it is in the lower parts on the plains?—No doubt of it; but some of the stations in the upper provinces are perhaps as healthy as the hills. Rawulpindi, for instance, is such a cantonment.

2991. (*Sir R. Martin.*) But they are elevated stations?—Yes, but still they are in the plains. Rawalpindi is 1,500 or 1,600 feet high.

2992. (*Dr. Farr.*) There are the stations at Kirkee and Poona?—Yes, Poona is just above the Ghauts.

2993. There are a great many troops stationed in Bombay and other stations, where they have experienced very heavy mortality, and they have been obliged to abandon certain stations on account of their losses. The troops are now placed in Kirkee and Poona, and not more than 2 per cent. die, whereas the mortality was 8 per cent. before, in the lower parts?—In the Bombay Presidency I should say that Poona or Kirkee as strategical positions, would be better than Bombay, and troops in such places would control the upper part of the country above the Ghauts where the more warlike population are to be found, and if there was any emergency in Bombay you could send them down in a few hours by railway.

2994. Of course it cannot be supposed for a moment that we can lose sight of those great positions, such as Delhi and others, where troops must, under all circumstances, be kept, but it would appear that, generally, we have not paid sufficient attention to

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circumstances which are favourable to the health of the troops, and there are many stations apparently not very distant where troops might be placed, and where the mortality would probably be not half what it is now?—In Sindé I think that would apply. Formerly they had troops at Hyderabad, and at Shikapore, but now they are all at Kurrachee, and I believe the general opinion is that Kurrachee is sufficiently near for all military purposes, and much more healthy. I think that in Upper India it is more difficult to make these arrangements.

2995. There appears to be no difficulty in Madras, nor in Bombay; what arrangement should you suggest for placing the troops in the upper provinces, so that they might be in healthy localities, but still within reach of these important strategical points; do you think it is impossible to place them at the great distances which some people seem to think is desirable?—I do not see how you can do it; I do not think it is possible to put the majority of the regiments in the hills, and still hold the important positions.

2996. Another point is to make these stations, such as they are, as healthy or as salubrious as you can under existing circumstances?—I think, of course, by having fortifications, or something like fortifications, so that the place could be more easily defended than in open cantonments, that you could economise your troops to some extent.

2997. (*Sir R. Martin.*) You mean open field works?—Yes.

2998. (*Lord Herbert.*) Is there any difference in the cost of maintaining troops in the hill stations as compared with the cost in the plains?—I think it is more costly in the hills.

2999. I suppose more costly because you have to create additional accommodation?—Yes, but not so much that—for if you had not accommodation already below, you would have to make it. I do not think that there would be any difference in the hills in that respect; some things are cheaper in the hills.

3000. How is it with respect to food?—Food is considerably dearer, and the great bulk of the food must come from the plains.

3001. (*Col. Greathed.*) Do you think that the beer they brew in the hills would do for the soldiers?—I have not had great experience of that. I am not a beer drinker, but I have heard the officers say, that the beer, a short time after it is made, is very fair, but still that it is nothing like English beer; it would not stand carrying into the plains, and keeping for any length of time.

3002. And it would always be a very expensive thing to bring to the hills?—Yes. But if you had railways up to the foot of the hills, it might then be taken up.

3003. Your objection to a very extensive removal of the troops to the hills is founded much more upon military than financial reasons?—Both military and political.

3004. (*Dr. Farr.*) Do you think that those large cities, such as Delhi and Lahore, which are now unhealthy for troops, might not be made more healthy by sanitary arrangements?—No doubt they could to a certain degree, but I think that they will always be unhealthy. At Lahore the troops are not in the town, but five miles from the town.

3005. Are there any sanitary arrangements in Lahore?—Yes, there are; and it has been very much improved; since we got possession of the country we have cleared the streets which were full of filth to the depth of four or five feet, which had accumulated in ages; we have paved the streets, and made drains, and very considerable improvements have been made; but still the streets are very narrow; in this way all native towns will be more or less unhealthy. In Lahore, as I said, the troops are five miles from the city; there is only about one company in the fort, and the fort is separated from the town by a considerable space—a kind of glacis—but there, I think, the sanitary arrangements are very fair.

3006. If any great epidemic, such as dysentery, or cholera broke out at Lahore, it would be likely, I suppose, to be communicated to the camp followers, and in that way to the troops?—I do not know; when cholera comes, I think it comes more in the cantonments than it does in the city. In the cantonments of Meanmeer, near Lahore, I saw the cholera raging, the year before the mutiny broke out, in 1856, but it was very trifling in Lahore itself.

3007. We know that generally fever and dysentery and other diseases of that character, are much more prevalent in unhealthy crowded cities than in the open country.—I think so, but it is very curious that sometimes this is not found to be the case. Take Delhi, for instance; I have heard old officers say that the troops were more healthy in Delhi in the old lines, on the banks of the river, than they were in the cantonments, which were three miles out of Delhi, beyond the ridge which we held during the siege. Now they have got the troops again in Delhi, and they occupy the fort, which has a large area; it is like a little city in itself, and I think that the troops would be more healthy there than in the old cantonments; it is a high bank 40 feet above the river. It is difficult outside to select a place within any reasonable distance of these great towns; the whole of the country there is rotten and decayed, full of the remnants of old buildings.

3008. (*Dr. Farr.*) I asked you whether you did not think that, by improving the sanitary condition of such cities as Calcutta, Lahore, and Delhi, and the large cities of India, thereby improving the health of the natives of India, you would not be likely also to improve the sanitary condition of those stations, which we must occupy as strategical points?—Of course that would be the case, but still I think you would have great mortality amongst your troops in the plains. No doubt all those places could be improved, but still those improvements at Lahore would not affect the bulk of the troops who were five miles off.

3009. (*Chairman.*) As a general rule European troops who are employed in garrisoning great towns are at some little distance from them, so that they are not exposed to the unhealthy influences operating in a vast population concentrated in a small place?—No; sometimes, however, you have a fort adjacent to a town, which you hold with a company, or a company and a half of men, and they will be more or less affected by the sanitary arrangements of the town.

3010. If a plan were adopted, which has been often proposed, of surrounding European stations with a fortification, could that be done in a manner not to interfere with ventilation, and a free current of air through the buildings?—I think so, but I do not think that it would do to surround a whole cantonment. I think, as a rule, it would be ruinously expensive; for instance, there is hardly a cantonment where we have a European regiment of infantry, and a battery of artillery, that does not occupy a space of four miles long by a couple, or $1\frac{1}{2}$ miles deep, and if you surrounded this with fortifications the cost would be very large.

3011. But suppose only a part of the cantonment to be so surrounded, for instance, where the magazines were?—You might do that, I think, without militating against the health of the cantonment; but it must be done with care and judgment; you might so arrange that the barrack formed a portion of the defences, and that would be an advantage.

3012. (*Sir R. Martin.*) A kind of open field work?—Yes, something of that kind; it would not stop the air, and you do not want much height, but just a sort of thing that could not be carried by a rush; then the great bulk of the troops would be outside of this in all ordinary times. A great deal depends upon the actual site on which you put your troops; for instance, it may be necessary to put troops within a certain latitude and longitude, but within that latitude and longitude there is scope for selec-

tion; a few miles on this side or that would not signify. Officers may choose a spot which they consider very suitable for troops, and yet it may prove the very reverse. Oftentimes a good position apparently may possess objections which were not at first sight obvious.

3013. Climate being purely a matter of locality, the great point is to select a good locality?—Yes. In India one great point upon which good health depends is the water; our people very seldom look to the water, but the natives always look to the water in choosing a locality.

3014. (*Dr. Farr.*) I believe that the troops drink an immense quantity of water mixed or unmixed?—Yes.

3015. Therefore it is important that the water should be of good quality?—Yes; I think that there is very great scope for improvement in the selection of sites in that way.

3016. In England we find that the water has a great deal to do with the mortality in cholera?—Yes; I have seen positions which were considered unexceptionably good by Englishmen, but if you asked the natives about one of them, they would say that it was very bad on account of the bad quality of the water.

3017. (*Col. Greathed.*) I believe the cantonments in India have generally arisen out of standing camps?—Originally they were so.

3018. They were in the first instance military positions?—Lord Hardinge selected Jullundur, and it has proved a healthy position. At Lahore the cantonment was in the first instance just outside the walls. Subsequently it was removed to a distance of five miles. Ambhelch was selected for troops after much inquiry. It is a fine open spot, but has been often visited by cholera. Kurnool was originally the most salubrious cantonment in Upper India; subsequently a British regiment was located on the banks of the canal, and suffered greatly. The cantonment was then abandoned at a great pecuniary sacrifice.

3019. (*Sir P. Cautley.*) The canal being an old one?—Yes. If they had put the European cantonment a mile and a half from where they did they probably would not have suffered at all.

3020. (*Dr. Farr.*) Has that occurred in any other instance?—There was the case of Delhi. But I think that a great deal depends upon the committee appointed to select the site of a cantonment, because the authorities may say, or the Government may say, we must have a cantonment on a certain locality, and if there is considerable scope within that locality for selection, then they have a committee, and of course it depends upon who the parties are on that committee. If you put carefully selected men upon it, a very intelligent officer and a medical man, who had turned their attention to the subject, and a civilian, who knows the country very well, they can communicate readily with the intelligent natives, and that committee would very likely make no mistake, but select the best site to be attained. But on the other hand, if you take a committee by roster, and put anybody upon it, the chances are that one man entirely guides the rest, and that man may be one who feels no real interest in the matter under consideration, when, of course, the result will not be satisfactory.

3021. I believe at present the committee consists of a certain number of men who, by their official position, keep the accounts, that is to say, an engineer is one, the quartermaster is another, and the medical officer is a third, and they are appointed without any reference to their particular ability, and only from their official position that they are selected to form the committee?—Yes, and they add one or two officers by roster; but I think they are not carefully selected men on the committees. Take for instance the cantonment of Nowshera; they put the cantonment there on the banks of the Cabul river, and it was well known that 20 years before that very site had been submerged, and several hundred people had

been destroyed, but in spite of that they put the cantonment there, and when the river rose about two years ago the water was six feet high in the barracks, and all that might have been avoided if a carefully selected committee had been appointed.

3022. (*Dr. Farr.*) It is to be abandoned now, is it not?—It was talked of, but I see now that they are going to put the cavalry there.

3023. (*Sir P. Cautley.*) How would you select a committee; would you leave it to the Government to select men who were notoriously capable of giving a good opinion?—I think it is difficult to select a good committee, but I would make it a rule that no man should be upon it by virtue of his position, and every man should be carefully selected; for instance, the chief medical authority should select the medical man, no matter who the man was, or what distance he went for him in his district, but he should be the very best and ablest man that he could find. Thus, in the same way, the General of Division would select a man, and then I think the Governor of the province should nominate another who would bring to bear all the civil and local information that could be obtained. The Governor General, and the Commander-in-Chief of India would then finally decide; but every effort should be made to ascertain the real character of a place before spending large sums of money on it.

3024. The committee you think ought not to be formed of men taken from the spot, but men selected from the whole country?—Yes, a man may go to a place, and say, "Here is a nice pleasant place, let us have the cantonment here." Another one will say, "No, that is a bad place; there is the proper position." Then, again, it will be urged "What a horrid, wretched-looking place that is; there is not a tree upon it, no verdure," and so the position will be rejected, whereas it may turn out that that was the right place. This is not done intentionally, but officers do not like dreary arid looking sites, and will not readily believe that they may be the most salubrious.

3025. (*Dr. Farr.*) You would recommend that such an arrangement as that should be made for the selection of future sites?—Yes, I would do everything I could to secure the very best sites for cantonments.

3026. Do you think that a careful revision of the present sites would be advisable?—If a place was extremely unhealthy I would give it up; but you cannot give up lightly your sites in cantonments after spending, perhaps, a million of money upon them.

3027. But where you were losing thousands of lives, you would, I presume, carefully consider whether you could not save them?—If I was losing hundreds of lives in a place, I should consider it my duty to give it up, but a spot may not be the most healthy available, and yet one would not like to give it up after vast sums have been expended on it.

3028. That of course would be a great element in determining that question. I find that in the returns the mortality varies from double what it is in England to five, seven, and eight in a hundred?—No doubt, and where a place was thoroughly proved to be unhealthy I would give it up at any sacrifice, but I would have a thorough scrutiny beforehand before I sacrificed the place, after spending a great deal of money.

3029. Do you not think it is desirable to obtain the best information as to the sanitary position of a station and its effects upon the health of the troops?—Yes.

3030. In order to see whether you could not improve it?—Yes; for very often a little care might make a great change.

3031. (*Sir P. Cautley.*) Do you think that planting trees upon a road near to a cantonment is a good plan?—So long as they are mere trees, so that you can cut off the lower branches, I think that they do not do any harm, but it is the underwood that does the harm. I think that we were very

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inconsistent in some of the cantonments; for we cleared away all the gardens, cut down all the gardens of the natives in every direction at a great sacrifice, and entailed a great loss upon them, on the plea of sanitary arrangements, but at the very same time we left gardens to grow up in the cantonments themselves, and allowed those gardens to be flooded with water, and a great deal of jungle gradually grew up, and I think that that was very unreasonable and very unjust. I think that trees make a place look pleasant, and that they have some effect upon men's minds; they serve also for shade, and I think also that they attract rain; but on the other hand I think that the jungle gives facilities for filth to accumulate, and stops the circulation of the air.

3032. There is something to be taken into account with regard to planting trees, which is, that in planting them, you generally have to make a ditch round them, and those ditches, it is considered, do the very thing which is objectionable, that is to say, water is collected in them?—I think that if you made those little circles round them, just to keep the cattle off, although water would accumulate to some extent, this would not do any harm, and after a few years you could do away with such ditches, or you might put up a fence, as in this country. I think that a place without trees has a wretched and miserable appearance, and has an effect upon men's minds. I think that every enjoyment which you can give to the eye, consistently with health, is beneficial.

3033. (*Dr. Farr.*) What other circumstance do you think would contribute to diminish this great mortality amongst the troops in India?—I think that as long as the character of the troops is what it is, that in a hot climate they must be unhealthy.

3034. But in the same climate in different places, there are great differences in the mortality; for example, in one station, there are as many as 100 in a thousand, and in others only six or eight?—Yes; but I think that the same habits of life, which, in England, do not increase the mortality, do increase it very materially in India; and then, the same condition holds good between the very healthy and the comparatively unhealthy positions; that is to say, if the men are very sober and temperate the mortality would not be sensibly increased; but with men of peculiar habits, I think it is influenced very much; for instance, if you took any of those places to which you have alluded, you would find that the civilians, and merchants, and the clerks, and the ladies, meaning the English part of the population, do not suffer in anything like the proportion that the soldiers do; therefore, the natural inference from that is, that there is something in the habits of the soldiers which renders them peculiarly liable to be influenced by the climate.

3035. You think then that an improvement in the habits of the soldier would be a great element in the success of sanitary measures?—No doubt. I saw the cholera raging at Murree, in the hills, 7,000 feet above the sea, in a magnificent climate, a beautiful site, and fine barracks, and there was nobody else sick but the soldiers; none of the officers had the cholera; none but the men had it.

3036. (*Sir R. Martin.*) But, as a rule, the hills have been comparatively exempt from cholera, as compared with its ravages throughout India, have they not?—Yes, no doubt they have; but still there is a good deal of cholera in the hills. In Cashmere, there is a very great deal of cholera; and all through the hills, from Cashmere to Kussowlie cholera at times prevails, but it does not affect much those who are cleanly in their houses and abstemious in their habits.

3037. (*Col. Greathed.*) I believe the soldiers and their families in India are in the proportion of about 48 to every 100, taking a man, and his wife, and two children; have you considered what would be the best way of lodging them; I mean the married people. Would you prefer a separate hut for them to the barracks?—I think that the plan now adopted

in the Bengal presidency is very good; they have a little row of cottages, about six or eight.

3038. Did you see those cottages that were built near Sir Charles Napier's barracks at Hyderabad, with a cookhouse and washhouse attached?—Yes, I did, and they have the same in the Punjab, at Calcutta, and Lahore.

3039. And separate as between each other?—Yes, no doubt, it is no great expense; but I do not think it is absolutely necessary to have each married man in a separate cottage.

3040. What was done as to female hospitals in the Punjab, in Bengal, at Agra, and at Jullundur in the female hospital?—The women were placed in the first instance in one of the hospitals intended for the men. They ought to have separate hospitals where the arrangements have been completely carried out. I think there was always that provision made in a plan.

3041. Do you think that a European matron should be appointed?—Yes.

3042. (*Dr. Farr.*) Is the health of the women and children in the upper provinces much impaired by climate?—Immensely. I do not think, however, that among the women it is so much as with the children; the latter die at a fearful rate.

3043. Do you think that European children would not be able to live there?—I do not think they would. I have heard medical men say that they never saw a third generation of pure blood grown up in India.

3044. In the upper provinces, you do not think that the English race could thrive permanently?—No; I have made inquiries amongst the women, and almost every woman will say that all the children are dying. I spoke to a woman about the families in Peshawur, and she said that nearly all the children died.

3045. Would that include the children of the officers?—No; the officers send their children to the hills or to England.

3046. Do the children thrive in the hills?—Yes; they flourish there, and indeed I think the mortality in the hills is less than in England.

3047. (*Chairman.*) Is there accommodation now for a considerable number of children in the hills?—There is for 500 at the Lawrence Asylum at Sunnawur, and they are building a new one at Murree, out of private subscriptions made in England, and in Calcutta, and in Lahore, to my brother's memory. The subscriptions were put together to make a new Lawrence Asylum at Murree; they have got one at Aboo, and the children there all flourish.

3048. At how early an age are the children received?—At the age of about 4 or 5, and they keep them until they can do something—till either the girls marry, or the boys can go out to do work for themselves.

3049. And during all that period do they enjoy good health?—Wonderfully, and they look like English children. I went over the Sunnawur Asylum with one of the native chiefs, and I asked him how he thought the children looked, and he said that they looked like lion's cubs.

3050. (*Dr. Farr.*) It is found in England that the children are the best test that can be obtained as to the influence of a locality upon health?—Yes. The children on the plains all look pale, pasty, and wasted, with no breadth and no depth in them, and they all wither and die.

3051. If the fathers were placed in the same situation as the children in the hills, I suppose they would enjoy equally good health?—I think, as a body, they would of course enjoy much better health in the hills than in the plains; but I think that the children in the hills flourish more than the men do. I do not think that the soldiers flourish so well in the hills, or so well as may be supposed; they do not like going out and knocking about; and there are great difficulties in the hills as to communication. The hills are all steep, and there is not much flat ground; the cantonments are built on very limited plateaus, where the

fall is very steep, and a very few roads, and if you go off a road you have to undergo intolerable fatigue; for if you go down to the bottom of the valley, it will take you all day to come up again. You find the men huddling over the fires in the hills, and not going out, and ranging about, as you would suppose they did; and I used to go and look at the men, and try to get them out, and I found the convalescents lounging about the fireplace.

3052. But that does not apply to the hills in the south of India, where there is a wide range of undulating ground?—No; that would be very much better.

3053. (*Sir R. Martin.*) Where there is plenty of table land?—Yes; where you can take exercise without fatigue; the men feel fatigue very much.

3054. (*Dr. Farr.*) In England it is found that wherever the children are healthy, the adults are healthy, unless their occupation interferes with their health?—I have no doubt that, as a principle, that is quite right; but I think it is a fact that the hills are more healthy to the children than to the adults, for the children are running about all day long.

3055. If those children were to live there, and grew up as adults, you think that their health would remain good?—As long as they ran about, and took exercise. I think it would; I think that the soldiers do not take sufficient exercise.

3056. Do you think that, by means of those children, an English colony could be formed?—Yes; if you had the means of supporting them; but then what could they do there—there is very little arable ground. I do not see how you could make the place self-supporting. In the Neilgherry hills there is an extent of table land, but in the Himalayan ranges there is very little indeed, and the chief ground that the people cultivate is in the valleys which are extremely unhealthy.

3057. (*Sir R. Martin.*) At Ootacamund there is a considerable space of level ground?—Yes; I believe there is, but I was never there myself.

3058. (*Col. Greathed.*) Do you not think that the natives of the hills are very strong?—No; but that is because they work so much in the valleys.

3059. (*Sir R. Martin.*) The Nepalese are powerful and muscular people, are they not?—They are; but they are a very limited race. I have heard my brother and others say that they doubted whether they could turn out 20,000 men. If you take all those hills from Cashmere, and all round to Simla, you will not find the races anything to compare with the people of the plains in physique; one Sikh could thrash three of the hill men.

3060. They are a different race, are they not?—Yes; the fine hill men are to be found across the Indus.

3061. (*Dr. Farr.*) They are ill fed, are they not, in the hills?—I think they are poorly fed; but still the people of the plains eat very little meat. It is astonishing how abstemious the men in the plains are; but for the hill men the valleys where they work so much are injurious to them; they build up their land into terraces, and those terraces are flooded with water. There is a good deal of rice cultivation in those valleys, and a great deal of miasma, and the people have a very sickly and pasty look.

3062. (*Sir R. Martin.*) Those valleys are infested with very bad fevers, are they not?—Yes.

3063. (*Chairman.*) Is there anything further that you wish to suggest with reference to the questions which have been put to you?—If you want to improve the condition of the soldiers in India, you should bring moral influences to bear upon them. I think that if you could get men into the ranks who had more thought and care for themselves this would influence the mass generally. As the men become more thoughtful and educated they would take more care of themselves. I think also, that if inducements were held out to them to care for themselves by giving them advantages in the shape of pensions when they left the service, and pensions when they were

wounded, and that we did everything that would induce the men to look more to the future than to the present, I think it would have a good influence upon them, and benefit their health. I think also that if more of them were allowed to marry that would have a good effect. I believe that a great deal of the unhealthiness arises from their being unmarried. I have heard many of the officers and medical men say that an immense amount of the disease in a regiment arose from immoral causes, and I think myself that the married men are more careful men, and more likely to be steady men.

3064. (*Col. Greathed.*) I dare say that you have heard that there is less crime amongst the married men than amongst the others?—I think it is the case; and I have observed always myself among Europeans that those who are married were better and more steady fellows, more manageable, and less likely to get into scrapes and mischief than the unmarried men; the women have a good deal of influence in keeping them straight, and I think that that would naturally be the effect. I think also that where the men die in the service, or are killed in the service, that something ought to be done to help their wives, so that a man going into the field would feel that something would be done for his family in case he died or was killed; we do better for the native troops than we do for the English in this respect. Again, if the husband of a woman dies in the service, at the end of six months she must, according to the regulation, marry or do worse, and I think that the consequence is, that she marries any fellow, and that causes a great deal of unhappiness, and that unhappiness leads to crime and to demoralization. I think that the women ought to be taken care of. They would then bide their time, and marry when it suited them. I have met myself several of these women, and very good women among them, most respectable women, and who had got into considerable misfortune owing to having bad husbands, and I generally found that it arose from that necessity which compelled them to marry the first man who would have them, and, of course, that affects the children.

3065. (*Dr. Farr.*) How do you think that the more general marriage of soldiers could be facilitated?—I think that you might give them, for instance, a sufficiency to enable them to support their wives.

3066. The pay to a single and to a married man is the same?—Yes; you just allow a certain number of the men to marry in a regiment, and I think you demoralize the regiment very much; for example, you send your troops on foreign service, and they are allowed to take with them only a certain number of women, and then what is the consequence? Every married man who is beyond the number is obliged to leave his wife behind, and he begins by throwing his wife to the dogs, and, of course, that cannot make him a better man or a better soldier; you make him break the dearest and holiest tie in the world, and it makes him reckless and good for nothing.

3067. You would be inclined to raise the pay of the soldiers and give them leave to marry?—Yes, and I would take care of the wives and children of the soldiers who went into the field. I would do what the natives do. When a regiment is going on service, the first thing that respectable natives do, is to go to the officer and make some arrangement by which their women are to be looked after, and taken care of, and we ought to do that; it is constantly the case in a regiment in the service that there are women going to the bad for want of a little care. In a cantonment I would leave a picked officer to look after them, a married man who had a sympathy with the women, and I think that would have an immense effect. And then I think that great care should be taken that remittances are scrupulously made, and all that kind of thing.

3068. (*Col. Greathed.*) But the soldiers will not remit?—I think that you might have some system

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by which the men bound themselves to do so; I would treat them as so many children in that respect.

3069. (*Sir R. Martin.*) Something of the same plan that was adopted with the native troops going on foreign expeditions; a ticket was left in the hands of the paymaster, who secured a little remittance for the family?—Yes, in the height of the mutiny officers of native regiments at Delhi used to write to me to look after the wives and children of the men who were in the Punjab, and supposing that I had neglected them, it might have just turned the scale against us. I recollect an officer of the guides writing to say: "There are such and such women in Lahore belonging to the Guide corps, several of their husbands, men of rank," have been killed. "Mind you look after those women carefully, and do not let them be in distress." I did so just as if they had been some of my own people, and of course that went down to the corps, and the men all heard of it, and felt it very much. This you do with the foreigner and the stranger, why not do it with your own countrymen? It would not make any difference in the fidelity of the men, but it would make a difference as to the good feeling, or the ill feeling which they entertained towards you. The sum of all these little things would make a great difference, although each by itself does not appear considerable.

The witness withdrew.

Saturday, 4th May 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.
Sir RANALD MARTIN, C.B., F.R.S.
J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.
Colonel GREATHED, C.B.

Colonel DURAND, C.B.
WM. FARR, Esq., M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

Colonel EDWARD HARRIS GREATHED, C.B., examined.

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3074. (*Chairman.*) Will you be so good as to state how long you have served in India?—11 years.

3075. At what stations?—I have served at Poona, Bombay, Kurrachee, at Hyderabad in Sind, at Agra, and at Jullundur. I have also seen other stations—for instance Cawnpore, and Allahabad, I know pretty well, but I have not been actually stationed there.

3076. What comparison should you make as to the stamina of the men in the Queen's Army, and in the European Indian Army?—As far as I could observe the European Infantry worked better in the sun than the Queen's regiments.

3077. You mean the local Europeans?—Yes. I would mention the two regiments of Bengal Fusiliers.

3078. To what cause would you ascribe that superiority?—The only reason that I ever heard given was that when recruited the men were rather older. I merely give that as hearsay.

3079. Do you think that it is a greater familiarity with the requirements of the climate, consequent upon a longer residence, that gives them that advantage?—No. I do not think that; for the men, as a rule, in India are very careful; taking the soldiers throughout, they are very careful. I am speaking of the men with whom I served in India.

3080. Do you apply that remark to the privates?—Yes. I think that the moral tone in India is far higher than it is in England.

3081. By careful do you mean as to exposing themselves to the sun?—Yes; they obey orders very strictly, of course, with a few exceptions; there are always 20 or 30 blackguards in every regiment.

3082. (*Colonel Durand.*) You consider that the moral tone of the men is higher in India?—Infinitely so. I have not the least doubt of it; it occurred to me the first day that I landed in India, and so it did to

3070. With regard to everything, it is politic, is it not, to make the soldier contented with his lot?—Yes; to make him as happy as you can, and treat his wife well. If you trace back the history of a woman, who has perhaps become a nuisance in a regiment, you will often find that she was a decent body when she began her career, and before misfortune overtook her; and I do think that the practice of abandoning their wives when a regiment is going on service is very bad indeed, and produces terrible results.

3071. (*Dr. Farr.*) The mortality among the women and children in India would somewhat complicate the question, would it not?—I do not think that the women suffer so much as the children.

3072. (*Chairman.*) I suppose the young children can hardly be separated from their mothers before the age of five or six?—No, and there is no doubt that a great many would die; but beyond a doubt in India the women and children do not suffer in the same proportion; you can keep the children with much less danger up to the age of five or six. I did not send my own children to England until they were six or seven years of age, but after that you would see a great difference.

3073. (*Sir R. Martin.*) I suppose they begin to outgrow their strength, and get lank, feeble, and relaxed?—Yes.

every officer in my regiment. I belonged to a very good regiment, in which we lived very intimately with our men, and we all of us remarked the appearance of a higher tone amongst the men; and I think it is easy to understand it; there are no pothouses there.

3083. But are they not equally exposed to evil influences, in the bazaars for instance?—But that is not amongst men of their own colour, of their own race; it is not their society; there may be a great deal of vice, but it is not society; not the society in which they live.

3084. (*Sir R. Martin.*) There is no community between them?—None.

3085. (*Chairman.*) As a general rule should you say that the barracks in India are as good, or better, or worse, than the barracks at home?—I can speak positively about that; that the new barracks are very good, and that the old ones are very bad, as a general rule.

3086. When you say that the new barracks are very good, do you refer to those which have been built within the last half dozen years?—I can go further back than that. I can refer to those which have been built within the last 15 years; it was about the time when good barracks began first to be built, I think.

3087. At how many of the stations which you have already mentioned are there new barracks?—At Poona they are building some excellent barracks; they were building when I left, and I should think that they must be quite finished by this time; at Kurrachee they are also very good; at Hyderabad I was the first to occupy the barracks erected by Sir Charles Napier, and they were excellent, but they had one fault, which I will mention, which was, that they were constructed almost entirely of brick, and the heat of the climate is so tremendous that the sul-

phurous fume of the bricks came out in such a way that the smell is like that of a brickfield; the brick flooring of the outer verandahs particularly is excessively hot.

3088. (*Sir R. Martin.*) Even when they are plastered?—They do not plaster them.

3089. (*Chairman.*) Plastering would be a remedy for that would it not?—Yes; but the best flooring is that which the natives use, which is rammed earth washed over with cowdung; it is used in the barracks in Bombay, and in Poona, and the old barracks were always kept clean by it; it keeps away fleas and bugs better than anything else.

3090. But will it stand a great deal of wear and tear?—Very well.

3091. (*Sir P. Cautley.*) Do you find that brick floors when raised are accompanied with the same inconvenience as when they are laid on the bare ground?—The floors at Hyderabad were raised at least three feet from the ground, and they were very hot.

3092. (*Chairman.*) Will you favour the commission with your opinion in these respects, of the other stations?—At Kurrachee they built very good barracks, but at Deesa the barracks, when I was there, were bad. At Agra the new barracks were in course of building. I cannot speak as to them, but they were apparently very good; at Jullundur they were well planned, but they were constructed of very bad materials indeed.

3093. As a general rule, should you say that the Indian barrack rooms and hospital wards are spacious and airy, or the contrary?—The hospitals are universally so, but as I have said before, the new barrack rooms are good and the old ones are bad.

3094. How are they ventilated?—They are well ventilated; there is a great deal of air; there is always plenty of air circulating in the barrack room; they had what was called the box ventilators in the roof, which were exceedingly good.

3095. The closeness of the air in an English barrack room has been much complained of, but you say that that is not the case in India?—No, the doors there are habitually open.

3096. It is also a complaint made, that in an English barrack urine tubs are used?—We never used them, but the smell from the urinaries to which the men went in the rear of the barracks was a great objection to the barracks in India, and always most difficult to get rid of.

3097. (*Dr. Gibson.*) They are placed too near the barracks?—Yes, necessarily so.

3098. (*Col. Durand.*) At which barracks did you find the arrangements in that respect were the best?—They were all bad; that is the one fault. I am sure that the engineers did everything they could possibly do to improve it, but I do not think they ever succeeded in my time; they may have succeeded since, but those urinaries were always the great objection.

3099. (*Dr. Gibson.*) Was the construction of the latrines good?—Yes; the latrines were very good, and very well managed, but the arrangement of the urinaries was very bad. First of all they were nearer to the barrack; that was one disadvantage; but the smell was always perceptible in going through the barracks—as you ride through the barracks you go through those places in going to the general parade ground—and it is invariably most offensive, there is never any time of the day or night that you do not smell them.

3100. Is not the urine carried away by drains?—They remove the whole of it generally speaking, but the draining might be very much improved in that respect.

3101. (*Chairman.*) How often are the walls and ceilings of the barracks and hospitals cleaned?—There are certain periodical cleansings under the direction of the executive engineer, but there is no difficulty in a case of emergency in getting an order for cleansing.

3102. From whom?—From the general of division ultimately, but in a case of emergency the executive engineer will execute anything under the orders of the brigadier commanding the station, but the general of division is the person to whom it is ultimately referred.

3103. With regard to repairs, have you ever experienced any difficulty in getting them executed?—No, where the thing was feasible; I think every officer who has served in India must bear witness to the way in which the engineers assist one on all occasions.

3104. What is the usual course of proceeding when repairs are required?—What is called an indent is sent in, but it is done generally speaking so regularly by the executive engineers themselves that commanding officers have no reason to make any extra demands.

3105. With regard to drainage, are the stations generally well drained, or is there much water lying on the surface of the soil?—The stations are generally surface drained; when there is a heavy fall of rain it is very commonly not carried off as well as it might be, but much more attention has been paid to that lately in the Punjab.

3106. Is there any reason to complain of the dampness of the floors in either barracks or hospitals?—They complained of the dampness of the floors at Jullundur at one time, from the badness of the brick flooring which had given way very much, and had not been well executed. I remember great complaints being made of it there, but not in any other station.

3107. What provision is made for cleanliness in the way of ablution rooms and baths?—In almost every station that I have been at there are plunge baths, which are provided for the men and the non-commissioned officers, in which they can bathe as much as they like; there are generally two attached to each barrack, and where gardens are provided for the troops, the waste water runs off to supply the gardens. The ablution rooms in the barracks I think are generally imperfect, and the provision for ablution in the hospitals is very imperfect indeed for the comfort of the inmates.

3108. (*Dr. Sutherland.*) How often are those baths filled with water?—They are always full; there is always a surface water running through them.

3109. Are they much used by the men?—Very much, but some men will never wash if they can help it. I think myself that it would be a good thing if a general order was issued in India that the men should have bathing parades, as they have when on the shores of the sea, and at other places; to my knowledge there is no general order to enforce it at present.

3110. (*Chairman.*) A soldier, if he likes it, may go without washing from one year's end to another?—Yes.

3111. You do not think that there would be any feeling on their part that it would be interfering with their habits to compel them to wash themselves?—I do not think so. I would have it done under a subaltern, and march a company at a time; the officers of the companies must do it, and be responsible to the commanding officer; the soldier is accustomed to obey orders, and he does not question these things.

3112. Are the means of washing the bed and body linen sufficient?—Yes, I should say so, they have four changes of raiment a week.

3113. (*Col. Durand.*) With regard to the deficiency of the arrangements in hospitals for washing purposes, have you any recommendation to make, or have you considered any plan of improving them?—I did recommend a plan at Jullundur, but I believe it was not sent on, nor do I attach any blame to any body, as we were moving at the time, and nothing could be done; but I recommended that the men in hospital should have basins arranged on a shelf easily

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reached, for I had observed that the only way in which the men could get at the basins was by sitting on the floors, and there was great discomfort and difficulty about the whole thing. I believe that there are no warm baths attached to the hospitals. I have seen a bath brought by men into a ward, and a man was put into it, but it made a slop, and dirt, and mess, and I think it was disliked.

3114. You think that they ought to have a warm bath room attached to each hospital?—Yes, I think so; there was universally a want of comfort, because a poor sick weakly man could not wash, and probably would not.

3115. (*Chairman.*) Every good private house in India, I believe, is supplied with a bath room?—Every house.

3116. And that is what you would suggest in hospitals?—Yes.

3117. (*Dr. Sutherland.*) I find that the Director-General, and Sir Ranald Martin, are of opinion that there should be bathing parades every day in India during the hot and rainy seasons especially, and in the cold season, every other day they think would be sufficient; do you think that that is practicable with the present means?—No, certainly not for a whole regiment; you might bathe, perhaps, two companies, or you might bathe four companies, but a plunge bath is not bigger than about the size of this room.

3118. (*Sir R. Martin.*) It could only be well done on the banks of great rivers or on the seaboard?—No, there it would be perfectly easy, and there it is done as much as possible.

3119. (*Dr. Sutherland.*) By doubling the accommodation do you think it could be carried out?—It is a very expensive thing to fill those baths, because you must always keep bullocks at work, and you have to pay the men who work the bullocks; it is a matter of expense. I think that every day it would be a difficulty, and that it would interfere with the parades. Perhaps it might be done twice a week.

3120. (*Chairman.*) What means are generally employed for the surface cleansing of a station; by whom is it done, at whose cost, and what becomes of the refuse?—There are in all stations establishments kept for this purpose, the whole of which are under the brigadier commanding, and he is responsible for the cleanliness of the station. The different officers act under him; the executive engineer and the bazaar superintendent, who are the two principal persons; there is also the quartermaster for the week, whose business it is to see that the orders with regard to the station are carried out as far as keeping the hedges low, and the trees clipped, keeping the ditches clean, and seeing that there is no dirt of any sort about the cantonment; he has to make a report to the field officer.

3121. What becomes of the refuse?—The refuse is carried out, and I should say that generally it is buried; but in some places I have seen it burned to great advantage in pipes; they burned it at Poona.

3122. (*Sir R. Martin.*) It is nowhere used for agricultural purposes, is it?—No, not that I have seen.

3123. (*Chairman.*) Is any nuisance experienced in barrack rooms and hospitals from privies and stables or picketing grounds?—Only from the urinaries attached to the barracks; not from the privies.

3124. Nor from the stables?—No.

3125. The responsibility of preserving cleanliness in stations, I suppose, rests with the officers commanding?—Entirely.

3126. Are there any printed regulations for that purpose?—There are regulations in every presidency of the most minute description with regard to the bazaars and with regard to the cantonments.

3127. What is the general condition of the bazaars as to drainage, cleanliness, and sanitary arrangements?—The bazaars themselves are kept very clean; the drainage is better in some than in others; and where they had introduced, I think they call it the saucer drain, a flat drain, all the bazaars were

very clean; in others, where they had the deep drain, they were not so effectual, but they were kept very clean as far as sweeping went.

3128. Who is responsible then for the state of the bazaars?—The superintendent of the bazaar.

3129. Are there any complaints that nuisances proceeding from the bazaars are perceptible in the barracks?—No.

3130. Are cattle for the use of the troops slaughtered at a sufficient distance from the barracks as to prevent a nuisance?—Yes, the offal is eaten up by innumerable kites and vultures.

3131. Are the horses and animals belonging to the camp followers kept at a sufficient distance from the quarters of the soldiers?—Yes.

3132. Do you think that in all these respects there is nothing to complain of?—No, the police regulations are very good indeed.

3133. At the stations which you have named what has been the state of the water supply, both as to quantity and quality?—At Poona the water was abundant and good; at Bombay, when I served there, the water was very short, but that is remedied now by the Vehar waterworks. At Kurrachee and at Hyderabad the water is procured entirely from the percolations of the Indus through the soil, as far as I know, there are no springs; it is very dirty, but it is very good water.

3134. Have any steps been taken to purify it for use?—The common way is to let it filter through three large jars with charcoal and sand, and it comes out very clear, or a little alum is used.

3135. Are you aware whether the water at any of the stations where you have been has ever been analysed, in order to ascertain whether it contained impurities?—I do not know.

3136. Will you state what are the component parts of the soldier's ration, how it is supplied, and at what cost?—The soldier's ration consists of bread, beef, or mutton, and vegetables, tea or coffee, rice, sugar, salt, pepper, and firewood. A certain sum is stopped from his pay to pay for the ration, about $4\frac{1}{3}d.$, and if the cost is greater than the fixed amount, the Government bear the loss; and if the cost is less, the difference is returned to the soldier.

3137. In what state, for instance, is the meat supplied to the soldier?—It is all cut up under the eye of the orderly officer of the regiment, the quartermaster, and the men of the different companies.

3138. Are there any articles of ordinary use with which the soldier has to supply himself?—No; he is very well fed; he may probably buy little things, but he is very well fed.

3139. With reference to the rations, is there any improvement that you can suggest?—None. It is entirely the fault of the officer commanding the regiment if the men are not perfectly well fed.

3140. (*Dr. Farr.*) Is that so in every station?—Yes, it is universal. Under Lord Dalhousie's last regulation by which regimental committees were made final, the soldier was enabled to get perfectly well fed. Before that, when the regimental committee had condemned any meat, it sometimes happened that the commissariat officer objected to their decision, and the matter would be referred by the brigadier of the station to a station committee, who might upset the regimental decision, and after hours of delay the meat which had been objected to in the first instance was returned for issue to the soldier. Lord Dalhousie earned the gratitude of every regimental officer and soldier in India for this regulation.

3141. At what date was that?—I think in November 1854.

3142. (*Col. Durand.*) As a general rule should you say that the meat provided for the soldiers is tolerably good?—It is very good; it is the best grass-fed meat; that is what the contractors are bound to supply, and both the beef and the mutton, taking them generally, are perfectly good.

3143. (*Dr. Farr.*) Does the ration include fruit

or vegetables?—Yes, always; about eight ounces of vegetables; of course that depends upon the supply. In Sindé I have been almost entirely without vegetables of any sort for the men.

3144. I presume you attach great importance to their being supplied with vegetables?—Yes, as it prevents scurvy. We never had any scurvy in Hyderabad; but I think we were without potatoes for five months.

3145. (*Chairman.*) Could none be procured?—There were none grown there, and they did not come up from Bombay, because the crop had run short; that was during five months, I think.

3146. (*Dr. Gibson.*) What did you substitute for those vegetables?—We gave the men rice, and the natives always have some pumpkins.

3147. (*Col. Durand.*) There was a deficiency of native grown vegetables?—Yes; but Sindé is a bad part for vegetables altogether. At Deesa it is not so; they have excellent vegetables and in large quantities there.

3148. (*Dr. Farr.*) Are there the same facilities for obtaining vegetables in the hill stations as in the plains?—I think that the supply is rather scanty as far as I have observed; but I have never been stationed in the hills. I believe, however, that they were scanty in quantity when they did obtain them; but they must have been dearer, I think, for they do not grow there.

3149. What are the vegetables that they obtain?—Always potatoes, if any vegetables are to be got, but potatoes are the first of all vegetables, potatoes and onions.

3150. What fruit do they get in India?—They get oranges in abundance, and also plenty of mangoes in the season, and custard apples.

3151. (*Chairman.*) Will you state generally what the cooking arrangements are, and the utensils in use for soldiers in barracks and cantonments, on the march and in the field?—The Government gives a very liberal supply of cooking utensils, which are tinued once a month under the supervision of the quartermaster of the regiment; these are carried on the march in carriages supplied by the commissariat, and the cooking is performed entirely by native cooks, who are very good servants indeed.

3152. Do you think that any improvement in any respect is necessary?—No.

3153. (*Col. Durand.*) Do you think that even in camp they cook well?—They cook very well indeed. The men generally form themselves into a mess consisting of a certain number, and they agree as to what they will like, and they desire the cook to prepare it for them; they have the ration cooked just as they like, and they are fond of having pillau; that is a thing which I think the soldier likes better than anything, either that or soup; or they have the meat simply broiled; they live better than they do at home; there is no comparison.

3154. (*Chairman.*) How many meals do they have in a day?—They have three meals. They have their breakfast at 8 o'clock, consisting of bread and coffee or tea; coffee and tea are issued indifferently, just as the men wish; they have their dinner at one o'clock, supper at half-past four or half-past five, according to the season of the year. It requires a little care to be taken to prevent them from exchanging their rations for bacon; but by taking a little care that practice was entirely stopped. I mean that the men were inclined to exchange the rations provided for them by the Government; that there was a little difficulty in preventing them from exchanging them.

3155. What was the objection to their exchanging their rations for bacon?—Because the bacon was filthy that came from the bazaars; it was the flesh of the unclean animal, bad and poisonous, I should think. I might mention that a very good system was followed in the 8th regiment, and indeed in Bombay generally; the married soldiers were allowed to draw the ration money instead of having the rations issued

to them. Altogether I think that the men managed better with the money than they did with the rations.

3156. (*Sir R. Martin.*) And they were better pleased, I presume, to be so treated?—Certainly.

3157. (*Chairman.*) It might have given them a greater amount of independence, but do you think that they provided as well for themselves by having the money to lay out?—Yes, I think so, it was a liberal allowance.

3158. What is the practice in India with regard to supplying the men with a spirit ration?—There is no spirit ration properly so called. On the march a dram is issued once or twice a day, according to the discretion of the commanding officer; but in barracks it is to be obtained at the canteen only on payment.

3159. Under what regulations is it to be so obtained?—The spirit is sold in the canteens under very strict regulations issued under the authority of the Government, from which there can be no deviation.

3160. In your experience has intemperance been a common fault among European troops in India?—Certainly not, and I can give the Commissioners an idea of it. In a regiment upwards of 1,000 strong—my own regiment—I have known a fortnight to elapse without a single man being confined for drunkenness, which I never heard of before in England.

3161. (*Dr. Farr.*) In what regiment was that?—The 8th regiment, and this was constantly the case.

3162. (*Chairman.*) Do you think that there is a general knowledge among the men that it is dangerous for them to drink in India?—I think that the police of a regiment is remarkably good in India. There are certain men who will drink when they obtain liquor, but the regulations are so good that I think they are prevented from getting the liquor; there are always some 40 or 50 men in a regiment who drink, and the only way in which they can get it is either at the canteen or in the bazaars, but then only in the most underhand manner, for the sale of it is positively forbidden. The soldiers who are selected to act as the regimental police are of course selected for their sharpness, and they assist the cantonment magistrate in putting down the illicit sale of liquors, and generally speaking I should say with great success.

3163. (*Sir Ranald Martin.*) But a soldier with means may always purchase spirits in the canteen may he not?—Under certain regulations.

3164. The quantity being limited?—Yes, strictly.

3165. (*Chairman.*) Supposing that to be so, can he not obtain it from his comrades?—No, he must drink it at the bar of the canteen.

3166. They are not allowed to take it away?—No, they must drink it at the canteen.

3167. That I believe is in order to prevent their giving it one to the other?—Yes.

3168. (*Dr. Sutherland.*) Do they drink at the bar of the canteen?—Yes, as quickly as they can, they toss it off to make room for one another.

3169. (*Dr. Farr.*) What is the quantity that they take?—It is called a dram; eight of them go to a bottle.

3170. (*Dr. Sutherland.*) The men do not sit down?—No, there are no seats.

3171. (*Sir Proby Cautley.*) Does the abkarr-system at all affect the soldier, I mean the shops established by the civil authorities upon the outskirts of a cantonment?—No, they are so positively forbidden to sell to him that they can only venture to do so in a quiet underhand way, but at the same time I have no doubt that if they do so they are sooner or later hunted out.

3172. Is it not the habit of these abkarr shopkeepers to take up their position as nearly as possible to the cantonment so as to be within hail of the European soldiers?—Yes, there is a little of that.

3174. The prevention of that practice might probably be beneficial?—The more you can keep the abkarr within due regulations the better, for certainly there are some men who will get liquor in

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any way they can ; some of them will run ten miles to get it in a field when they know that they will find it there ; but such men as those do not amount perhaps to above ten in a regiment, and that is hardly worth legislating for.

3174. You think that there is always a certain number of men who are more or less addicted to drink in every regiment, but that the majority of the men are sober ?—Certainly.

3175. (*Sir R. Martin.*) Great improvement has taken place of late years in that respect ?—I am talking of 15 years ago when I first went to India, and I have seen no difference ; indeed I should rather say that the men were not quite so good as they were. When the Crimean regiments came out the men gave much more trouble in the field certainly.

3176. (*Colonel Durand.*) Do you consider that the circumstances in which soldiers are placed in India are favourable to maintaining a higher moral tone amongst them ?—Yes, with the great means which are put at the disposal of the regimental authorities by the Government in the way of libraries ; but there is one thing which was not carried out when I was there, and which I most earnestly hope will be established, namely, reading-rooms in the barracks.

3177. (*Dr. Sutherland.*) Has malt liquor been procurable at all the stations at which you have served ?—Yes.

3178. You have served at some of the most distant north-west stations, have you not ?—Yes, at Jullundur.

3179. Could malt liquor be obtained there ?—Yes.

3180. It has been stated that there is a difficulty in carrying the beer with an army in the field ; might not that difficulty be overcome by allowing a spirit ration to be supplied to the men in the field, while at the same time the consumption of malt liquor might be encouraged to the greatest extent at a station ?—The consumption of malt liquor is encouraged to the greatest extent in stations, and the Government take no profit upon it from the soldier ; on the contrary, they fix the price of the beer, and the Government bear any loss. But then you must consider if you do away with spirits, how you will provide for the canteen fund. There is now a most excellent fund in the shape of the canteen fund, which is obtained by putting on 1s. on every gallon of spirits.

3181. Is not the principle this, that you encourage the soldier to injure his health for the purpose of benefiting him in other ways ?—I cannot defend it, and I should wish beyond everything to see the practice of supplying spirits in canteens abolished.

3182. (*Chairman.*) Would you prevent the soldier from getting spirits at all ?—I would if I could.

3183. (*Dr. Farr.*) What would you substitute for spirits ?—Beer.

3184. (*Chairman.*) Would that be practicable, or would it not lead to a great many attempts being made to evade the rule, and to obtain spirits illegally, especially in the case of regiments coming from other parts of the British empire, where the same rule was not enforced ?—Yes ; I think there would be great difficulty about it.

3185. You say that the soldier derives a certain pecuniary benefit from the canteen fund, will you explain to the Commissioners how that arises ?—It is from the enhanced price at which the spirits are sold, —8 annas or 1s. is imposed upon every gallon of spirits, and that in a very short time creates a fund which supplies the wants of the soldier without any expense to himself ; for instance, the canteen fund, under the regulations of the Government, pays for the cap covers of the men, which are very necessary, and a constant expense ; it also pays for all his amusements,—the fives court and the theatre ; the skittle ground and the gardens, and in fact any reasonable request which the commanding officer makes is always granted.

3186. When we speak of the Government providing soldiers with a fives court, or other means of amusement, we mean that in point of fact the soldier

provides these for himself by the tax which is levied on spirits, and which is levied on spirits exclusively ? —The fives courts are always parts of the barracks ; the theatres are certainly maintained by the soldiers, or by the regiment ; the men subscribe to them. The theatre at Jullundur was bought ; we paid 300*l.* for it, and that money was paid out of the canteen fund entirely ; that the Government did not give at all, and in fact, everything connected with the amusements and comfort of the men is paid for out of the canteen fund.

3187. (*Sir P. Cautley.*) Is it not the general rule rather to keep up these places than to build them ?—The fives courts are built.

3188. But what do you say as to the skittle grounds ?—I have seen very few of them, but theatres have always been bought.

3189. (*Col. Durand.*) I believe that the acting of the soldiers takes place in an empty barrack, or in some available Government building ?—Generally there is some building for the purpose which has been purchased out of the canteen fund, and a large subscription from the officers.

3190. (*Sir R. Martin.*) Does not the large amount of the canteen fund imply that a large consumption of spirits takes place ?—Yes, of course ; but still a very fair fund can be kept up, and yet the men will be very moderate in drinking spirits. It accumulates in a wonderful way ; in fact the great difficulty in a regiment was to keep it down. After 3,000 rupees are accumulated the Government may lay its hands on the fund, and it is the object of the officer commanding the regiment to spend it as quickly as he can.

3191. (*Dr. Farr.*) Could you obtain all the money that you think might be advantageously used if the spirit ration were entirely abolished ?—No ; I do not see how you could get it.

3192. By a tax, for example, on any other article, such as a tax on beer ?—You cannot do that ; for you must give a man beer as cheap as possible if you take away the spirits.

3193. But if he did not incur an expense for the spirits might he not contribute the money it would cost towards other things for his amusement and advantage ?—No, certainly not ; you never could tax him.

3194. Not even for his theatre ?—No ; but I cannot defend it. Let the Government give the money and the thing might be done ; it is a question of money.

3195. (*Chairman.*) Is there much beer consumed by the soldiers ?—Yes ; a great deal.

3196. Is it of good quality ?—Of excellent quality. It is always examined by a committee of officers and a sub-committee of non-commissioned officers, and it is passed by them.

3197. It is very often rejected, is it not ?—Yes, when it is bad ; but the Government throw no loss arising from that upon the canteen fund.

3198. What is the price of beer in India ?—I hardly ever remember it to have cost more than 6*d.* a quart ; it is principally porter.

3199. With regard to the attempts which have been made to brew beer in India have they hitherto succeeded ?—The beer that was made at Mussourie, and which I tasted, was pleasant to drink, but it was very heady beer, and I believe that it will not keep.

3200. Do the men like it ?—No, I think not ; they like English beer better certainly ; they never would have drunk that beer in preference to English beer.

3201. You have spoken favourably of the English troops in India. Generally speaking, should you say that the amount of disease and mortality and invaliding had diminished within the period of your experience ?—No, it has not been diminished. It was remarkably small when I first knew India, 15 years ago.

3202. Speaking of the last 15 years, you do not think that there has been any improvement in that respect ?—Not that I know of ; not within my own experience.

3203. (*Col. Durand.*) Would you attribute that to

the nature of the service, and the greater exposure in consequence of that service, or would you attribute it to any difference in the habits of the men, or to discipline?—No; I think it is accidental. I could not see that there was any difference in the habits of the men, or in their treatment, or in the care that was taken of them by the medical officers, or the habits or the discipline. It seemed to me to be accidental. In the hottest station, Deesa, where we were for three years, the mortality in the regiment was extremely small, and the general health of the men was excessively good. I mean to say that they were able to take the most active exercise there without suffering from the heat. We allowed them to go out shooting as much as they liked all over the country, and a man would go and walk 14 miles on foot from the barrack, and be back at night; their health and spirits were excellent, and there never was a single case of a difference between the soldiers and the natives in the whole of the three years during which time we gave them unbounded liberty; I mean, of course, to the good men.

3204. (*Sir R. Martin.*) The uniformity of the mortality during your experience, I presume, you would refer to some permanent causes existing in the country?—I cannot say that the mortality was uniform, because when we first went there the mortality was so extraordinarily low; out of 1,012 men, we lost only nine in 1847.

3205. Such instances occurring during one or two years will not affect the general results. I am speaking of your experience in 15 years. Would not that show the mortality to have been pretty uniform?—The mortality was pretty uniform. We had no epidemics, and we were certainly fortunate during the 15 years service, except at Delhi, where we lost men by cholera; but we never lost another man by cholera except at Delhi.

3206. What are the usual means of recreation and amusement which are provided for the soldier?—The great game for soldiers in India is what they call long bullets; that is the game they play at in all stations; it is more of the nature of golf than any other game, only it is played, not with a bat, but with the hand. They also play at quoits, cricket, and fives; those are the usual games; but the best of all recreations was this; we encouraged them to go out shooting when it could be done with safety, and we found the best possible effects from that.

3207. You do not think that there is any objection to that on the ground that the men might expose themselves by taking too much exercise in the sun, and getting into marshes?—No; I never saw the men much hurt by the sun.

3208. They probably liked that kind of amusement better than any other?—Yes; and the liberty was never in any single instance abused; it was quite a point of honour with the men to behave well.

3209. Did they ever get into any difficulties with the natives?—Not in the least during the three years that we were at Deesa, when they had very unusual liberty to go to any distance they pleased. There was never any difficulty with the natives; it is just a question of discipline.

3210. What kind of provision is made in the way of libraries and regimental schools?—There is a regimental library, which is kept up principally by the Government; they provide the books entirely. A very small subscription is taken from the men; I do not exactly recollect what, but I know that we had 440 subscribers in the regiment to the library. The schools are also kept up by the Government partly, and partly by small subscriptions from the soldiers. There are normal schoolmasters employed; and all the children, both boys and girls, are obliged to attend school, and also all the recruits, who receive instruction gratis; and the non-commissioned officers and adult soldiers receive instruction for a very small subscription, and a very considerable number attend.

3211. Are they generally willing to avail themselves of these opportunities?—I think that during

the whole time we were in India we had about 260 men attending school who had to pay, besides those who were obliged to attend. It depends extremely upon the schoolmaster; if he can make himself pleasant and agreeable to the men; if he carries on his instruction in a kindly way they will attend in large numbers. It depends, of course, also upon the encouragement which is given by the commanding officer, who has a great deal of power in his hands; in fact, the commanding officer of the regiment and the chaplain carry on the management of the school.

3212. Are there many soldiers' gardens at the stations at which you have served?—There were soldiers' gardens at Poona, at Deesa, and at Jullundur.

3213. Do you think they are appreciated by the men?—They did not succeed upon the whole; the men did not take much interest in them.

3214. Do you think that there would be any great advantage in making them more general?—No; I do not. I wish that it could be done, for it is excellent employment, and occupation for the men; but upon that point the idleness of the soldiers comes out remarkably, they will have nothing to say to it; the fact is that they can get everything they want; they buy everything very cheap, and they do not like working. Lord Frederick FitzClarence was more successful in carrying out gardening in Poona; by giving prizes to the men he managed to get up more feeling in its favour, and he had the gardens very near to the men's barracks, but there certainly was a difficulty about it that we never could get over; it is a fancy with the men; the men that Lord Frederick FitzClarence was so successful with were Scotchmen, and they took to it more easily from their previous habits; but our men were Englishmen, and they did not care for it.

3215. (*Dr. Farr.*) Do you know whether the native troops work in gardens themselves?—No, the high caste Brahmin sepoys would not.

3216. How are they employed?—They did just what they liked.

3217. (*Chairman.*) Are there workshops in which to employ the men at the different stations?—None that I have ever seen.

3218. Is no kind of mechanical work done by the men?—They are not employed in the public service at all; the men employ themselves very much indeed in their private trades, such as shoemakers, tailors, watchmakers, and that sort of handicraft, and they may make a good living by it; but generally speaking the men do not work at their trades. There was a great attempt made in the year 1855; Sir William Gomm sent round to see what could be done about it, but he did not succeed; the men required to be supplied with tools, which could not be done; of course it would have taken away their independence too much to have given them the tools, and besides they might have sold them. That was another thing that failed; and I believe that the reason, as I said before, for all these things is that the men are, generally speaking, tolerably well off; they can live, and put by money in the savings banks, if they chose.

3219. Then the general result of your evidence upon this point is, that the men are willing enough to take advantage of any active amusement for which opportunities are given to them; that they are not unwilling generally to make use of the regimental libraries and schools, but they do not like working in gardens?—Yes.

3220. (*Sir P. Cautley.*) Are there any gymnasia used in the European regiments?—None. I wish there were.

3221. They are attached to every native regiment in the Bengal service?—Yes. And I am perfectly sure that that they would be the very best thing to introduce for India.

3222. With tennis courts and skittle grounds?—No. I mean the real gymnasia, such as you see in London.

3223. I mean in addition?—Yes; and it should be made a parade.

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3224. (*Col. Durand.*) As it is among the French troops?—Yes; I believe it would be the best thing that was ever introduced into the English army, because it is a thing that you could make the soldier do; of course for gymnastics a man must be loosely dressed; he must not be obliged to parade stiffly; it would amuse the men, and excite emulation amongst them; and little prizes go a long way in those matters.

3225. You would strongly advise, wherever circumstances were favourable, that they should be allowed to have as much field sport as possible?—Yes, certainly; we had a long experience of that, and during the whole time we never checked them; they were obliged of course to have passes which were given to the best behaved men.

3226. Deesa is a dry country I believe?—Yes; but at Poona they did the same, and in Sind; in fact wherever we were we allowed them to go.

3227. (*Dr. Farr.*) It was chiefly I suppose in the higher parts of the country, and not in the low ground?—No, it was in Hyderabad; but there is no shooting at all in the very hot times of the year; it is only in the cool seasons, and then the climate is very good; when the very hot winds came on we made them stay in the barracks; but we never kept them in the barracks a moment longer than we could help; we took away from them as much as possible the idea of their being confined.

3228. Do you think that the system could be carried out universally in India?—Yes; I see no reason why it should not be; the soldier who does not read much, and does not write, must be a very miserable fellow if he is shut up in a room; tell him that he may go out, and he will not go out.

3229. There is no place in the hot season except the barracks where the men can stay?—No, and I think it would be the greatest possible advantage to add large sheds to the barracks, if that could be done with anything like economy, where the men could go during the day; hardy men do not care for the heat; they do not care for punkahs, although they like tatties, but the tatties are not of any use; they always have the doors of the rooms open. I was never in a barrack in my life where the hot wind did not come in as freely as it liked, and you cannot get soldiers to care about these things, and as for punkahs, they would rather have none at all.

3230. Have you any suggestion to make as to the best means of giving additional occupation and amusement to the men, in the rainy season, and in the hot weather?—I think that a great deal might be done by having good reading rooms, which, to my knowledge, do not exist at present.

3231. Did you not state that the soldier was generally very indifferent to reading?—He likes to be read to, because he does not read easily himself. I said that they did not read and write, but if a man will read to them, they will listen to him.

3232. Because it is less trouble to them?—Yes.

3233. (*Col. Durand.*) As a general rule, I believe the men do not read fluently?—No.

3234. And where there is a fluent reader they enjoy it?—Yes, and they like men to tell stories to them.

3235. You have suggested gymnasia as a good means of recreating the men?—Yes, under sheds, they might practise gymnastics, of course, under the sheds at any hour of the day, when you could not carry on drill.

3236. (*Dr. Farr.*) So that there are many ways of giving the soldiers muscular exercise in order to keep them in health?—At present I think not. I think that what you want in India is to keep up the muscular power of the men by forced exercise, because there are always plenty of lazy fellows.

3237. But in the way you have suggested, the men could go through enough exercise without making them work at any trade?—Yes.

3238. (*Chairman.*) Do you consider the present

dress and accoutrements of the soldier suitable for the climate of India and the service the soldier has to go through, or can you suggest any improvement in any part of them?—The dress is excellent, and I cannot suggest the slightest improvement in that. The soldier now wears habitually a khakee tunic and trousers, and a helmet made of wicker work; the collar is made to fasten with a hook and eye, he wears no stock except in the cold weather, and he carries no knapsack.

3239. (*Sir P. Cautley.*) What should you say as to the shoes?—The shoes have always been made in England, and they should always be English boots, ammunition boots if you can have them, for marching.

3240. What is the plan adopted in serving them out; is it not very different from that which is pursued in France, where they have a greater number of sizes than we have?—I think the plan might be very much improved as to the boots; the clothing is remarkably well done by the quartermaster, but the fact is, that the boot as given to the soldier was never used by him; it was what they called “made over.”

3241. As nothing wears out a human being more than a bad shoe or boot, if a greater number of sizes were served out to a regiment, I suppose, as a matter of course, that there would be a greater number of shoes or boots that would fit the men properly?—Certainly, and I think that an improvement might be made in that respect, but at the same time I am bound to say that the way in which the men march in India without packs is not to be beaten in any country, with good management, when the men have got into training, they do not care about 17 or 18 miles a day; the effect of it never seemed to be perceptible on the march; I have seen after a march 30 or 40, or 50 of them go out shooting the whole day, and begin again the next morning.

3242. (*Chairman.*) Was that during the excitement of active service?—No, on ordinary marches.

3243. You have stated that the boots, as they were delivered to the men, did not give them satisfaction?—No, they never used them.

3244. What then is done with them?—They are taken to the shoemaker's shop, and then they are taken to pieces, and made up again to fit the soldier at a certain expense.

3245. As delivered they are made without any reference to fitting the person who has to wear them?—They do not fit them well enough evidently from that being done.

3246. (*Col. Durand.*) When they are made up again, do they undergo any process for the purpose of softening the leather?—They always oil them on a march; that is the best thing to do; the men always wore their boots until they were pretty comfortable, and then they grease them, and kept them by them for a march.

3247. With regard to the stockings of the soldiers, what do you think of them and what use does the soldier make of them?—He uses the woollen sock in marching; some soldiers grease their feet, but I cannot speak much as to that; I did it myself. I should mention one thing, which is of the greatest possible importance in marching, and that is, to have a halt after the first half-hour's march, to allow the men to put their shoes to rights; it is always in the first half-hour that the men find out the pinch, and that halt, after the first half hour, is one of the most important halts of the day.

3248. (*Chairman.*) Is it not in a man's power to fall out, if he is chafed or galled?—Yes; his captain marches in the rear of the company, and a man falls back to his captain, and asks his leave to fall out; then he comes on again; but it is extremely important to prevent anything like that if you can possibly avoid it, and by good arrangements you may always do that entirely. I have seen men march—in fact, I have marched 300 miles with men, when there has not been one straggler on the line of march.

3249. There is nothing, I suppose, in which men

improve so much as in the practice of marching, after a few days' march?—Yes; but they must be trained to it.

3250. Officers as well as men?—Yes; everybody.

3251. With regard to the rules and regulations, do you think they are susceptible of improvement?—No. All that is required is, that they should be acted up to with the strictest attention.

3252. What is the usual routine of the soldier's duty in India?—At gunfire, he goes to parade, and, as a general rule in barracks, he gets his breakfast at eight o'clock; at half-past ten, he parades again in the barrack, when the officers go round the barracks, to see that they are clean. Then there is a roll-call again at dinner-time, and a roll-call at evening parade; then he has his supper. After that time he is free till tattoo, which is at eight or nine o'clock, according to the season. There are roll-calls during the night in all barracks, if men are supposed to be absent; it is done by the serjeant-major, and that is by what is called the check-roll; if there are two or three men absent the check-roll is called.

3253. Does not that mean that the whole barrack is disturbed?—Yes; but it does not often happen.

3254. For how many consecutive hours is the soldier on guard?—For 24 hours.

3255. Does the practice in India differ from the practice at home in that respect?—No.

3256. How many nights a week is a soldier in bed?—It varies occasionally; he is from 13 to 15 nights in bed very commonly; that is to say, that he does not come on guard above once in 13 or 15 days.

3257. You mean that he is 13 nights in bed for one night out?—Yes.

3258. Do you think that the amount of duty performed in India is greater or less than that which is performed in England?—It is less; there are no fatigue duties, or very few, compared with what they have in England; for instance, the fatigue duties of sweeping out the barrack-rooms, cooking, and carrying dinners to the men on guard, which is the most cruel thing upon the men at home, of all the duties thrown upon the soldier. That the soldier has nothing to do with in India, because his cook always goes with him.

3259. In fact, the men in India are waited upon instead of waiting upon themselves?—Yes; they are.

3260. Do you think that that is a practice to which they attach any importance? Do they like it?—Yes; I think that all men like it; but we got rid of that entirely, except in matters that were necessary. You must have sweepers; you must have cooks; you must have washermen; and you must have water-carriers; those four you want, but you do not want any more; not barbers, nor men to clean accoutrements, or boots; in fact, the more you can get rid of the followers the better.

3261. You have, no doubt, considered the question of quartering troops on hill stations. Do you think, as a general use, that that is advantageous, or not?—There is no doubt about the men in the hills looking better than they do in the plains; they are more rosy; but yet, looking at the returns, there does not appear to be any difference in favour of the hill stations, but rather the contrary.

3262. (*Dr. Farr.*) What returns do you refer to?—Those returns which are before you. I see by them that at Deesa and Poona, the mortality was precisely the same, 26 in 1,000, while at Subathoo, Kussowlie, and Dugshai, it varied from 36 to 39.

3263. But ought it not to be considered, whether the mortality is not affected by the practice of sending invalids thither?—No. I am talking of regiments which have been quartered there.

3264. You have referred to Poona, but would it not be better to compare Poona with Bombay, which is near, and then take the mortality in Bengal separately, and if you compare Dumdum and Calcutta with Umballa, or compare Bombay and Poona, you will find the mortality much less in the hill stations than on the low grounds?—No doubt, because one is

an excessively bad station, and the other is a good one; but taking the stations in the plains of India, in the flat country; for example, take Umballa and Julundur, I think you will find that the difference in the mortality is rather in favour of the plain stations; as for the difference in the appearance of the men, nobody can have a doubt about it.

3265. The mortality varies in the different hill stations as in the plain stations, but you may, I think assume, on the authority of these returns, that the mortality is generally lower in the hill stations than it is on the plains?—I looked very attentively at a good many of those returns, and it appeared to me that it was not so. I know that the 32nd regiment was sent to Kussowlie under circumstances when it ought never to have been sent there at all; it was weakened by fever coming from Peshawur, and it was sent up there, and the men died like rotten sheep of fever and dysentery. They have, no doubt, in the hill stations a great many bowel complaints, and they suffer very much from them.

3266. (*Sir R. Martin.*) Especially if bowel complaints have prevailed during their service on the plains, they would be aggravated by removal to the hills rather than benefited?—I dare say they would. The great objection that I saw to the hills, and those which I know best are Mussoorie, where there is no table land at all, was the filth of the stations which lies very much under the houses, and there is great difficulty in carrying out any sanitary arrangements with the natives; there are nuisances about in all directions.

3267. The habit of the natives being to throw the refuse into the ravines?—Yes, whereas in the plain stations in the cantonments the natives go out to a distance, and the nuisance is, comparatively speaking, very small indeed; but in the hills there is evidently more difficulty in that, and the consequence is that when a flood of rain comes down the nuisance is intolerable.

3268. (*Dr. Farr.*) That may account partly for the mortality experienced in the hill stations?—Yes, very likely, the station that I have seen where the men were perfectly healthy was on a table land, the station at Mahableshwur, that is the only one I have seen.

3269. To what stations do you particularly refer; in what presidency?—I speak more particularly of the Himalayan stations.

3270. Not the high stations in Madras, or in Bombay?—No, but you cannot keep them there during the rains, at Mahableshwur, for instance, from the great amount of the rain fall.

3271. (*Sir R. Martin.*) The station being too forward with reference to the south-west monsoon?—Yes, it catches it. There is great difficulty in the way of having the drills in all the present stations on the Himalayas from the want of level ground.

3272. But not so in the Neilgherry hills?—I believe not.

3273. (*Dr. Farr.*) With regard to questions affecting the health of the troops, whether at a station or on the march, supposing the medical officer to make a representation, and that the commanding officer did not think it necessary to attend to that representation, what power of appeal is there; to whom would the matter be referred?—The medical officer would report it naturally to his own superintending surgeon, who is in nowise connected with the commanding officer of the regiment.

3274. There is a superintending surgeon of the division?—Yes, under the general officer, not at all under the supervision of the brigadier or the officer commanding a particular regiment.

3275. In the event of any commanding officer neglecting his duty in regard to sanitary matters what remedy or what power of appeal has the medical man?—He would report it to his superintending surgeon who can bring it to the notice of the general of division immediately; he can do that without any further reference to the officer command-

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ing the regiment, or he can take the other course, which is to forward the complaint through the commanding officer to the general of division, but I should think that the other was the simplest and most easy course for him to adopt, as that would bring him less in collision with the commanding officer.

3276. He would address himself to the superintending medical officer, and he again would represent the matter to the general officer commanding the division?—Yes, to the supreme authority in the division.

3277. Who would then interfere on his own responsibility?—Yes, but as far as my experience has gone the suggestions of the medical officer were attended to very implicitly where it was possible to do it; of course sometimes in the service it is not possible.

3278. (*Dr. Gibson.*) Is it the ordinary course of proceeding on the part of the regimental surgeon in India that the representation he makes goes to the superintending surgeon?—There is nothing to prevent the medical officer, if he chooses, from bringing any matter essential for the health of the troops before the highest authorities. I have never seen any difficulty.

3279. Would it not be desirable to oblige the commanding officer to submit the suggestions of the medical officer to the higher authorities, if he himself disapproved of them, rather than leaving it to the regimental surgeon to make that appeal?—He would be obliged of course to do so. The fact is, that we are talking rather hypothetically, because I must say from my experience that there never was any difficulty between the commanding officer and the surgeon which was not very promptly set to rights; I have known difficulties to occur between them, but I have never known an instance in which they have not been promptly set to rights when they have come to the knowledge of the higher authorities. I have never known the opinion of the medical officer trifled with.

3280. (*Sir R. Martin.*) The usual course of proceeding is that the appeal of the regimental surgeon shall pass through the commanding officer?—Yes, it might be a very difficult thing for him to do, but he would certainly do it himself in case of need, for he is bound to look to the health of the troops, that is his first duty.

3281. (*Chairman.*) You do not attach much importance to the power of appeal from the commanding officer because you believe that in every case that has come within your own knowledge the commanding officer has been willing to attend to what was suggested by the medical officer?—Yes, certainly.

3282. Is it desirable for the health and efficiency of the troops that they should be removed frequently from one station to another?—No, I do not think so; I do not see any advantage in it.

3283. For what length of time would you keep troops at the same station?—There are many things to be thought of about that; in going to a station very heavy expenses fall upon the officers of the regiment. First of all they must buy a messhouse, and they have to be in debt very often for the money which is partly lent by the canteen fund; then they have to get up cricket and other things for the amusement of the men, and very often on the march things are thrown away, or are lost, and the consequence is that there is a heavy expense incurred on first going to a station, but I think that about three years will clear a regiment handsomely. There is a very good allowance made by the Government for a messhouse, and there is what they get from the canteen fund, and I think that three years will enable a regiment to pass through its service without being hampered by debt, for they must incur debt.

3284. You are of opinion that three years is the minimum period for which troops should be kept at one station?—I think so.

3285. Would there be any disadvantage in their

remaining much longer than three years, say seven, eight, or ten years?—No, because the health of the dragoons is extremely good, I believe, in Madras, where they are kept for an unlimited time at Bangalore.

3286. I presume that the principal reason for the suggestion that the troops should be shifted is because some stations are more healthy and much more popular than others, and it would be thought unfair that one regiment should be kept entirely at a station that was more healthy and more popular, and the others at stations of a different kind?—Yes, I believe that that is the main reason.

3287. (*Sir Ranald Martin.*) And also to prevent the men from domesticating by their length of residence in one place?—Yes, but in the Queen's regiments that hardly ever happened; in the Company's local regiments it happened a great deal.

3288. (*Colonel Durand.*) Is not a further reason this, that to move a regiment from one station to another after it has been for three or four years at a station is an advantage from the excitement of the change, and the change of scene to the men?—It is a great advantage in a military point of view, because a march is always a campaign in India.

3289. Do not the men themselves like a change?—I have never observed that they do care much about it; it gives them a little something to talk about, but I never observed that they cared much about it.

3290. (*Chairman.*) At what age should you say that a soldier ought to begin his service in India?—I think that that is a medical question, but I suppose that every man would think that he would be better if he had got to his growth.

3291. So that he should not go before he was 20 years of age?—No.

3292. (*Sir R. Martin.*) You are aware that in the French service 23 is considered to be the earliest period for active field service for a soldier?—Yes, I know it is.

3293. You would, I suppose, approve of such an age?—Certainly, if it could be managed; but you must enlist in that case later; and recruiting is so difficult as it is, that if you were to make the recruiting age much greater, you would find more difficulty in obtaining the recruits than you do now.

3294. (*Chairman.*) It is, I suppose, an easier thing to get young men of 18 to enlist than those who are of the age of 25?—Yes; a boy of 17 will call himself 18.

3295. (*Sir R. Martin.*) There would be no objection to that age if the youths were kept in a temperate climate until they had arrived at the age of 23?—But you cannot do that; you cannot afford to keep them; you have not men enough.

3296. (*Col. Durand.*) Suppose that the system of recruiting were different; for example, now, you recruit for a regiment; suppose you recruited for the infantry generally, and that you could then send out men of the age of 22 or 23, how do you think that would answer?—I do not think that would answer at all; I think that with boys, and the people who do enlist, there is a certain idea of having a choice which is very paramount with them indeed.

3297. You think that it would not answer to recruit for the infantry generally, instead of recruiting for particular regiments?—I do not think you would get the men.

3298. (*Chairman.*) The men take a fancy for a particular regiment?—Yes, they have a certain idea; for instance, of the 44th or the 43rd; they probably know nothing about it; but they fancy one or the other, and they fancy that they have a choice.

3299. Enlisting as they do for 10 years, and having the choice of a particular regiment, they obtain, at the same time, a certain choice as to the climate in which they shall serve; that is to say, if they enlist in a regiment which has gone to one station, and has been there, say, for six years, they have a certain choice?—Yes, if they think about it; but generally speaking, they enlist from necessity, but still they like a choice.

3300. (*Dr. Farr.*) Have you ever observed any difference in the health of the young men and the older men in India?—I cannot speak to that.

3301. Do the younger men not seem to suffer more than the older men?—No. We had very bad recruits sent out during the Crimean war, and they never did any good.

3302. But taking them generally, have you observed that?—No. I have seen recruits quite as healthy as the old soldiers.

3303. Is it not some advantage to have boys going to India early, so that the system may adapt itself to that extraordinary climate?—No, I cannot think that. I think that boys are more apt to indulge in follies, such as eating green fruit, and other similar trifling things, which filled the hospitals as much as anything, more than the older men do; but there is really very little difference. I believe that the medical officers will say that the longer a soldier remains in India, the worse he gets, and I believe there can be no doubt of it; I do not believe in acclimatizing.

3304. (*Chairman.*) For how many years should you say a soldier is fit for continuous service in India?—I believe that a soldier is found to serve practically well for about eight years in India, taking him all through; but I speak under correction. For the first five or six years a soldier is a very good man indeed in India, but after that he begins to break down, and he is not so good as he was.

3305. (*Sir R. Martin.*) That would apply specially to matured soldiers, and not to youths?—Yes; the youths might improve, but I do not think they do improve in India. A regiment goes down altogether in its physique.

3306. Does not it happen with respect to youths, that although the mortality amongst them may not be so great as amongst the older soldiers, the progress of deterioration among them is more rapid than among the matured soldiers?—I cannot give an opinion upon that.

3307. (*Chairman.*) Do you think that it is principally the inaction which belongs to the life of a soldier in India that causes the deterioration of which you speak?—I do certainly.

3308. And to some extent do you think it would be improved by the establishment of gymnasia, and by encouraging the men to take more active exercise?—Yes; particularly the gymnasia. I think that everything else is done by the officers of a regiment that can be done to make them take exercise, and give them employment.

3309. With regard to the marriage of European soldiers in India, in your opinion is it practicable to increase the permission given to the men to marry?—I think it would be, and that it would be a very great advantage to have a certain increase, that is to say, 25 per cent. The number now permitted to marry is 12 per cent., and I have not often seen this number complete. There is a very great objection to increasing the number of women, when you come to think of forming them into dépôts, when the men go on service; it is very bad now. If the women were properly cared for when they were left behind, and had money enough given to them to provide themselves with food, a great deal might be done to remedy the present evil. It is very bad as it is. Married men as a rule are certainly much more free from crime than the others.

3310. (*Col. Durand.*) And more healthy?—I cannot say.

3311. (*Dr. Farr.*) The married officers do not experience so high a mortality as the unmarried officers in India?—No.

3312. (*Chairman.*) You think if it were possible, in a pecuniary point of view, that it would be an advantage to give greater facilities for the marriage of soldiers, but that it would be of no avail unless better arrangements were made?—I do, but not unless better arrangements were made for the maintenance of the wives. Then another question arises when a regiment goes home so encumbered with women, how

you are to get rid of the women, for it does not appear that the married men of the regiment volunteer in the same proportion as the unmarried, that is to say, not in so large a proportion as the unmarried men.

3313. That is to say, the climate does not suit their wives who have children to bring up, and they prefer coming home?—Yes; when a woman is living with her husband, and with her children in a hut, she is much more comfortable than she can be in England; but they do not volunteer. They always say that they are better off, but they do not volunteer; they say so when they come home.

3314. (*Col. Durand.*) Does not that partly arise from the loss of their children?—Yes, I dare say it does.

3315. (*Dr. Farr.*) Do you think any advantage attends the location of married soldiers in detached dwellings?—The very greatest, the married soldier will forego any comfort to obtain privacy; in the married barracks each family has a separate division and punkahs, and tatties are provided, but the children cannot be kept apart, and their squabbles bring the mothers into the field. In the separate huts the women are able to rear fowls and turkeys, and thus add to their earnings. The best huts are at Hyderabad in Sind, in the barracks built under the orders of Sir Charles Napier; in those barracks every married soldier has a separate hut with cookroom, wash-house, and privy attached. The system in Bombay, as regards female hospitals, has much advantage over that prevailing in Bengal. In the former presidency there is a separate ward for women and children, with a European matron and assistant; in Bengal no European matron is allowed for, and it is essentially necessary that one should be provided. In Bengal also the female ward is merely a part of the men's hospital divided off, but in the same building; this requires amendment.

3316. You heard the evidence of the medical officers as to the lock hospitals?—Yes.

3317. What is your opinion upon that point?—I think that if a medical officer chose to propose to the commanding officer of a regiment to establish those lock hospitals there could be no objection, but I do not think that a commanding officer would be justified in asking a medical officer to take charge of them, unless it was his wish to do so; I think it is the feeling very much, and I have no doubt that it would be a great advantage.

3318. It was I think Dr. Maclean who said that the Inspector General of Madras went round, and submitted a proposition to the Government to authorise the establishment of lock hospitals, not regimental lock hospitals, and my question has reference to the general establishment of such hospitals?—Yes.

3319. (*Sir R. Martin.*) You are aware that they existed in Bengal under the authority of the Government some years ago?—Yes, I have heard so.

3320. And that they were afterwards abolished?—Yes.

3321. Would you advocate the restoration of those institutions?—Yes. In one station in Bombay I know particularly the amount of venereal disease was dreadful, Belgaum in the Deccan.

3322. (*Col. Durand.*) You would corroborate the evidence of Dr. Maclean as to the extent to which the health of the men is consequently deteriorated?—Yes, but I think it is a very moot question. It seemed to me to be so extremely difficult to prevent a certain amount of tyranny being exercised over those unfortunate women by the native peons.

3323. (*Dr. Gibson.*) It would be essential, would it not, to have police regulations?—Yes.

3324. (*Dr. Farr.*) What is the general effect of a residence in India upon a European regiment?—I have stated that I think they deteriorate by a protracted residence.

3325. They experience a high rate of mortality, do they not?—I do not think that the mortality in my regiment was increased much; but it was the deterioration in physique, and also in the—I will not say exactly the morality, because the men behaved so

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well, but in the energy of the men; that the non-commissioned officers made in India were not so good as those who were made at home; the behaviour of the men is quite as good, but the non-commissioned officers deteriorate; it appears as if the climate affects their smartness and energy.

3326. And that injures the efficiency of the regiment?—Yes.

3327. Under the new regulations, I suppose the whole of the British Army will pass through India periodically?—Yes, but I do not think that discipline need be deteriorated in India in the smallest degree; and I think that, with a proper system in a regiment, a regiment might come home exactly as it went out. I spoke of the physique. I may mention my own regiment, which was one in which discipline was very strictly kept up, and it came home in very good order; the 60th regiment came home in excellent order; the 10th is another; the 22nd is another; and the 84th is another.

3328. The service they have seen in India, I suppose, will be always useful to them as soldiers?—Certainly; but it is a climate which does deteriorate the men; it makes them less energetic, and they require increased activity on the part of the officers.

3329. If the whole of the British army passes through India, and remains there for a considerable time, in unfavourable conditions, it might have an injurious effect upon its efficiency?—If you send a regiment to India, and tell it that it is only to stay there for 10 or 11 years, I do not see why it should deteriorate more than if it went to Ceylon, or to Jamaica.

3330. The mortality in the first place would be enhanced. The mortality now in India is from six to seven per cent., so that in the course of eight years, there would be a large loss in a regiment; for of 80,000 men, about 8,000 are constantly sick, and they experience twice as many attacks of sickness in India as in England?—Yes.

3331. Under all these circumstances, the health of the soldier must be seriously affected?—Yes.

3332. The loss by the mortality among the soldiers is enormous.—To what do you chiefly ascribe that, and the deterioration of the British Army in India?—I cannot attribute it to anything but climate. I have never been able to see why, when discipline was equally kept up, and when great attention was paid by the medical officers, the most active and intelligent care afforded to the men, and great liberality on the part of the Government, in all hospital management and comforts, it should be attributable to anything else; but there is one thing with regard to going into hospital; you are aware that the hospital stoppages in England are very high, while in India they are very low, so that a man may go in for a finger ache in India, but he would not do it in England.

3333. You ascribe it chiefly to the climate of India, and to the peculiar circumstances in which the army is placed there?—Yes; the mortality.

3334. And the sickness?—That may be influenced greatly by the low stoppages; a man gains money in India, but he loses it in England.

3335. We see by the returns, that the sickness is of such a character that it terminates often fatally, so that it is evidently more severe in its nature than in England?—Yes; the climate in India is various, and the mortality at the different stations is not the same, so that if you had the power of selecting a climate, you would naturally choose those parts of India where the sickness and mortality were the least?—Certainly.

3336. Can any improvement be made in that respect in the position of the army in India?—It is very difficult to say; take Goojerat, for instance, or Deesa, which is an excessively hot station, where the thermometer was occasionally 114° at night, and yet there is very little mortality; then go to Ahmedabad, which appears to be exactly the same sort of climate, and yet there the men are sickly.

3337. So that it is not mere high temperature which affects the health?—Certainly not. It appears to have nothing to do with it. At Hyderabad, in Sind, which is excessively hot, where the thermometer stood in my room at 98° for eight months, during 1850, from January to November, we did not lose a single man out of about 500 men.

3338. Then it would seem to depend upon other circumstances, which probably might be discovered by experience. You found at Deesa that the mortality was low?—Yes.

3339. It is an object to ascertain at what stations the troops are healthy in order to place them there, rather than in other stations where they are sickly?—Yes.

3340. The mortality at Jullundur which you mentioned I see is between three and four per cent.?—Yes; and I believe scarcely as much as that.

3341. It appears to be between three and four per cent. At Dinapore, lower down the river the mortality is about six, and generally near the Ganges the mortality is from six to seven per cent.?—Yes, the valley of the Ganges I fancy is all unhealthy.

3342. From what you have observed do you think that the hill stations, particularly those on which troops can be exercised, are more healthy than those in the valley of the Ganges?—Yes; but the only hill stations I have seen where troops could be exercised were the hills of Mahabeshwur on the Western Ghats in Bombay; they were very healthy indeed.

3343. Can you suggest any better stations for troops in the Bengal Presidency than those which they now occupy?—No; I do not know any at present.

3344. Do you agree with Sir John Lawrence that it is important to keep bodies of troops at the main strategical points?—Yes; I consider that that is the first thing to do.

3345. A moderate proportion of 60,000 men in India would be sufficient to occupy those essential points?—When you have 60,000 men all over India you have not got a great many; you have not nearly the proportion that the French would have there.

3346. Not so many as they have in Algeria?—Nothing like it.

3347. Would the danger appear to arise from the employment of native troops?—Yes, certainly; you always have to watch them.

3348. As we have the power of distributing them as well as our own troops we should have some control over the possible effect of placing our own troops in the hill stations which might be healthy, and yet at some distance from the strategical points, should we not?—The placing of troops in India must be a matter for the Commander-in-chief, with the military authorities to decide.

3349. In ascribing the excessive mortality to the climate, do you think it is not in a great degree referable to the temperature, but to other circumstances more or less under control?—I think it is less due to temperature than anything, speaking from my own experience and of my own regiment.

3350. The mortality might be reduced if we had the power of selecting healthy sites?—If you could do so in a political and military point of view with equal advantage it would be a great thing to have the men in the hills; everybody knows that it is much pleasanter than in the plains, where they are in a miserable state of exhaustion from the heat; but then how are you to move the troops from the lower ranges of the Himalayan Hills, and bring them down quickly into the plains without a system of railroads. If railroads were run up to the foot of the hills, and the roads made very good, which might be very easily done, you might then bring the men down; but I think you ought not to neglect the plains.

3351. (Col. Durand.) In fact the primary considerations are of a political and strategical nature?—They are.

The witness withdrew.

Vice-Admiral Sir JAMES STIRLING, K.C.B., late Governor of Western Australia, examined.

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3352. (*Chairman.*) I believe you once commanded on the Australian station?—Yes, I did.

3353. How long ago was it?—I was naval commander-in-chief from 1854 to 1856; but I was governor of Western Australia from 1829 to 1839.

3354. A suggestion has often been made that Western Australia would be a country available as a sanitarium for invalided European soldiers from India; have you at all considered that subject?—Yes; latterly I have considered it with some degree of interest. I believe that it has advantages over almost every other place for that purpose in point of position, and I think in point of climate.

3355. First of all, let us consider the question of its accessibility. What distance would it be from Calcutta by steam at the present rate of communication?—In point of time, I think that auxiliary screw steamers would make the passage with great certainty in 14, 15, or 16 days.

3356. From Calcutta?—Yes.

3357. And from Madras in a shorter time, I presume?—Yes.

3358. From Bombay in about the same time, I suppose, as from Calcutta?—Yes, much about the same time. I do not speak with absolute certainty as to the time, but I think it would be about the time stated.

3359. In a sailing vessel, I suppose, it would take a little above 20 days on the average?—It would take much longer in a sailing vessel, and be somewhat uncertain with respect to the winds.

3360. If any sanitarium was established in Western Australia, at what part of the colony would you propose it should be established?—The finest climate is on the south coast, at King George's Sound. The southerly winds blow during the summer, and moderate the heat of the natural climate; but the most accessible position would be on the western shore at Swan River.

3361. Then in your judgment Swan River would be the most convenient station in point of access; but a station further south would be better in point of climate when it was once reached?—Yes, I think so.

3362. There would be about 500 miles of difference of distance between the one and the other?—Yes, about that distance.

3363. There are great heats, are there not, in the summer?—There are occasionally very great heats. When the usual sea breezes fail to come in, the heat is very great in summer, but never so great as to injure health. The summer climate is generally dry, which prevents the great heat affecting the health so much as it does in a moist climate.

3364. It has been stated in evidence that at Swan River the thermometer occasionally rises above 100° in the shade?—Yes.

3365. You do not think that that great heat prevailing for a time would be a drawback upon the sanitary advantages of the station?—The heat on those occasions to which I allude is extremely disagreeable; but there is no reason to believe that it affects the health, for the people labour in the fields exposed to that heat without sustaining any injury.

3366. (*Sir R. Martin.*) There being no malaria elicited from the soil by the heats?—No, the season of the greatest heat is the season of the greatest drought.

3367. As a general rule there is not much inconvenience felt from the drought in Western Australia. I believe less so than in any other part of Australia?—Yes, less so, I think. I have had very little experience in the other colonies, but a considerable quantity of rain falls upon the western coast of New Holland, and I believe it to be a more moist climate than any other of the Australian colonies.

3368. (*Chairman.*) It has been stated that at no great distance from Perth there is a range of mountains rising from 1,500, to 2,000 feet in height; are you acquainted with those hills?—Yes.

3369. Are they at all frequented by the residents in hot weather?—No, the colonists generally follow pastoral pursuits, and they prefer the plains beyond those hills to the hills themselves; but there are some few settlements.

3370. They would be available, I presume, for the purpose of a sanitarium?—They would be rather remote from the port, for the distance is about 15 miles from the landing place.

3371. I presume they are not approachable at present by any roads?—Yes, there are roads that cross that range of hills to the interior.

3372. Then they run north and south?—Yes, they run parallel to the coast.

3373. Have you considered at all what the cost would be of building; would it not be much higher than in most other parts of the world?—I am hardly competent to give an answer to that question.

3374. Is not labour of all kinds very costly in Western Australia?—There would be available, and at the command of the government, the labour of the convicts.

3375. We have generally heard that convict labour, when the results which it accomplishes are considered, is most costly there?—I believe it is, but their support must be provided for under any circumstances.

3376. Is it not a fact that the colonists complain that they have been disappointed in their expectations as to obtaining cheap labour; they imagine that convict emigration would have created cheap labour, and that has not been the case?—I understand that to be the case.

3377. Therefore the cost either of making roads or of building barracks in Western Australia would be more heavy than on the hills in India would it not?—The voyage is short, and there would be no difficulty in taking artificers from India to construct any buildings that might be required to any extent.

3378. Do you mean native labour?—I mean coolie labour.

3379. There is a good supply, is there not, of timber and also of stone in the colony?—There are abundant supplies of both.

3380. Is the access to Swan river good?—The port as used by merchant ships is not inconvenient; I cannot say that it is a very good port, but no great inconvenience is experienced.

3381. (*Sir R. Martin.*) For steamers the inconvenience, I suppose, would be less?—For steamers, the inconvenience would be less.

3382. (*Chairman.*) I presume that as regards the supply of food and vegetables there would be no difficulty whatever?—I consider that there would be none. There is a considerable amount of stock, cattle and sheep in the colony, and the means of producing more to meet any demand that might arise. I believe that provisions are not more costly there than they are in other colonies.

3383. (*Sir R. Martin.*) The capabilities of the colony for raising fruits and vegetables are, I believe, unlimited and excellent?—They are practically so.

3384. (*Chairman.*) Do you know what the force is at present, or what the force was in your time, that was maintained in Western Australia?—During the period I held the Government there were two companies of one of the regiments stationed in the eastern colonies; but I believe the number has been increased since the formation of a penal settlement there. I am not aware of the present number.

3385. Do you think that it would be possible to substitute for that garrison a garrison of invalids from India, sent thither to recover their health?—I should think that if there were a sanitarium established there, there would always be a considerable number of convalescents waiting for a passage back to India, who would be available for that purpose.

3386. Even if they did not wholly replace, would they in part replace the present garrison?—Yes.

*J. Stirling,
K.C.B.*
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3387. Supposing invalided soldiers to be sent either from Calcutta or from Bombay or Madras during the cold season, in January or February, what kind of climate would they find on arriving at Swan River?—January and February are the hottest months of the year, but the climate becomes extremely agreeable after that period.

3388. Might it not be so arranged that they should pass the cold season in India, and if they left India in February would they not arrive in time to find a mild and moderate climate at Swan River?—Yes.

3389. The climate of Western Australia is generally considered very healthy, is it not?—Very much so. The early settlers were exposed to great hardships and privations, but it was considered that there were very few cases of serious sickness amongst them. I believe it to be one of the most healthy climates in the world.

3390. It has been suggested by a witness examined before this Commission that in the event of transportation to Western Australia being discontinued the convict establishment at Freemantle might, without much expense, be converted and enlarged into a sanitarium; do you know that establishment?—It has been erected since I left the colony.

3391. Have you considered what would be the cost per man of removing soldiers from India to Western Australia?—The conveyance of emigrants from England to Australia costs about 15*l.* per head. The voyage is so much less from India to Australia, that you may consider two-thirds of that cost would be sufficient.

3392. Do not the vessels that carry emigrants carry cargo also, and does not the profit on the cargo diminish the cost?—They are not able to carry much cargo, because there is so large a provision of water to be taken when they carry a considerable number of emigrants.

3393. If they do not take out any cargo, they bring cargo home, do they not?—They generally go on to India from Western Australia; some come home with cargoes of copper ore and wool, but not a great number; the greater number that have touched there have gone on to India.

3394. If a steamer were sent with a ship load of invalids from an Indian port to Swan River, she would not be able to take back any cargo; she probably would not be able to take back any passengers to India, would she?—No; but if I may take the liberty of suggesting, I would say, that if an establishment were fixed in Western Australia, the vessels to convey the invalids from India to Swan River, and reconvey convalescents back to India, should be specially devoted to that purpose; the expense would be much less for such vessels than if you took the chance of sending them back by any casual opportunities that might offer.

3395. But the season which would be suitable for removing men from India to Western Australia would not be so difficult as for taking men back from Western Australia to India, and, therefore, the return voyage would be entirely without profit?—I have contemplated the establishment of vessels specially for the purpose, sailing on certain days in each month from the two points, one from Point de Galle, bringing down the invalids, and leaving, for instance, on the 1st of each month, and the other leaving Western Australia with convalescents, and returning to India at the same period. I believe that two vessels could accomplish the transport of the invalids in one direction, and the convalescents in the other, with greater certainty, and at a much less expense if specially employed in that service.

3396. What would you do with the vessels which, in the winter season, had taken away invalids from India to Swan River—at that time of the year you would not take back men, although recovered, to India; you would rather wait until the hot season in India was passed; therefore would not the vessels

employed to take the men from India in the winter season go back empty, and not turn the voyage both ways to account?—I think that that would apply only to a very small portion of the year; the climate of Australia would admit of their being brought there without much inconvenience at any season. Of course the temperature would be higher during the summer, and so far inconvenient, but there is no serious objection to their being landed in Western Australia, as to health, at any period of the year. I think, perhaps, that I may have given too favourable an estimate of the time that might be occupied in the voyage; it would depend so much upon the sort of vessels employed.

3397. (*Sir R. Martin.*) You referred, I presume, to steamers?—Yes; the distance is about 4,000 miles to Calcutta, and a little under 3,000 miles to Point de Galle.

3398. (*Chairman.*) Is there any other remark that you wish to make on this subject?—No.

3399. (*Dr. Gibson.*) You are of opinion that sick men from India would recover their health in all seasons in Western Australia?—Yes.

3340. Even in the heat of the summer?—Yes; the heat is never injurious to health, for the reason that I gave.

3341. Is King George's Sound very much cooler than Freemantle?—Yes, King George's Sound is a climate of wonderful equability. During the summer the southern winds, which blow from a cold region, blow upon the coast, and they reduce the natural temperature of the latitude.

3342. (*Sir R. Martin.*) So that your preference would decidedly be in favour of that special locality over any other?—With regard to climate certainly, but not with regard to the voyage.

3403. Not with regard to accessibility and convenience?—No.

3404. But the difference in the amount of discomfort would not be greater than a few days between Swan River and King George's Sound?—Cape Leuwin, which is the south-western promontory, is like the Cape of Good Hope, subject to violent gales; and the voyage would not only be increased, but the boisterous nature of it would be increased also by going round Cape Leuwin.

3405. (*Dr. Gibson.*) Have not the Oriental Company a coaling depôt for their steamers at King George's Sound, and do not the steamers touch there regularly?—Yes.

3406. Are they obliged to round the Cape?—Yes, but they are very large stout vessels, and they do not feel much inconvenience from it.

3407. In vessels of a sufficient size the invalids on board would not sustain any inconvenience?—I think not.

3408. (*Sir R. Martin.*) What difference in number of days would there be in the voyage to King George's Sound, as compared with the voyage to Swan River?—I should think three days.

3409. (*Dr. Sutherland.*) Will you be kind enough to state whether there are sufficient facilities for landing sick or convalescents at all times of the wind and tide without constructing expensive works?—There are jetties near the anchorage where they could be landed; what particular kind of accommodation would be required I am hardly aware, but I do not think that there would be any insurmountable difficulty in that respect.

3410. Do you consider that the present means of landing are sufficient?—I am hardly able to give a decided answer to that question in consequence of having been absent from the colony for some years, they do land cargoes and passengers now on the jetties which exist. At King George's Sound I believe there is every accommodation.

3411. The soundings and anchorage being good at King George's Sound?—Yes.

3412. (*Dr. Gibson.*) It is a remarkably fine harbour, is it not?—An excellent harbour.

The witness withdrew.

Saturday, 11th May 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.
 Sir RANALD MARTIN, C.B., F.R.S.
 J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.
 Colonel GREATHED, C.B.

Colonel DURAND, C.B.
 WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
 JOHN SUTHERLAND, Esq., M.D.

Dr. JAMES BIRD, F.R.C.P., late Physician General, Bombay Army, examined.

Dr. J. Bird,
 F.R.C.P.

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3413. (*Chairman.*) You have served, I believe, nearly 30 years in India?—Twenty-nine years and a half.

3414. Have you served chiefly with European troops?—Almost entirely.

3415. In the Bombay Presidency?—Yes. My first service was three months of 1818 with the European troops in the garrison of Tanna; then four years with the European horse artillery and H.M.'s 17th regiment of dragoons; then surgeon of the Fort artillery at Matoongha, in Bombay; then on the staff at Sattara and Mahableshwur; then five years surgeon of the European General Hospital at Bombay; then superintending surgeon of the Belgaum and Presidency divisions, and lastly in the Medical Board.

3416. Will you state at what stations you have served?—Chiefly at Bombay; but while superintending surgeon at Belgaum I was over a large division of the Madras army, 10,000 men; I served at Ahmedabad, and Kayra, in Goozerat, Bombay, and Tanna, Poona and Sattara; at Mahableshwur, Belgaum, and Kalladghi.

3417. Is there only one of those stations, which you have mentioned, that you consider peculiarly unfavourable to health from climate, local position, want of drainage, or other causes?—I consider that both Colaba and Kayra were particularly inimical to the health of Europeans; I can describe to the Commissioners all the stations, with the temperature, and all the variations, the rainfalls and the mortality.

3418. Will you be good enough to describe the two which you have mentioned; first Colaba, and then Bombay?—Bombay and Colaba from their low insular position, near the level of the sea, possess a warm moist atmosphere for eight months in the year, namely, from the middle of March to the middle of November. During the rainy portion of this period, from the middle of June to the middle of September, when there is an average rainfall of 75 inches, the climate is oppressively warm and damp. The dry and temperate period of the climate here, viz., from the latter part of November to the middle of March, is the most healthy for Europeans, with the exception of occasional outbreaks of epidemic cholera, which have prevailed at this season; occasional rainfalls happen in November, and during the cold months; the daily variation of the temperature is sometimes great; but the thermometer seldom rises higher than 88° or falls below 76°. During the dry season the prevailing and chief wind is the sea breeze during the day; this alternating during the night, and till an early period of the morning, with a weak and generally temperate land breeze. During the rainy season the south-west wind is the prevailing one, at which period Daniel's hygrometer usually indicates that the atmosphere is nearly saturated with moisture. In May, and the early part of June, when there are occasional rainfalls with electrical discharges, diarrhoea prevails, and cholera is both frequent and fatal. True dysentery and gastro-enteric cases of disease, with bronchitis, prevail in June and July. In August severe forms of rheumatism and gastro-hepatic disease, and of true hepatic inflammation, ending in abscess, are frequent. From September to the middle of November remittents and intermittents are the prevailing diseases. In a statistical Table which I drew up of the comparative mortality of European troops in the Bombay Presidency, from 1847 to 1857, I found that the ratio of mortality

at Bombay was 55·5 per thousand; Mr. Hunter, Surgeon, of the 2nd Queen's Royal Regiment, from 1831 to 1833, found it in that regiment to be 40·5, this I think is rather a low ratio. Poona and Kirkee, the one appropriated as a station for the European infantry, the other for the cavalry, though distant from each other somewhat more than two miles, may be described together as nearly at the same upland elevation, and in possession of an almost similar climate; both of them lie E.S.E. from Bombay, and are divided from each other by a junction of two rivers, the Moota and Moula, which unite their streams on the north-east a little way below the city of Poona. They stand at an elevation of between 1,800 and 1,900 feet above the level of the sea, and 60 miles inland, the barracks of either cantonment being built on a bluish grey broken down basalt, which is overlaid by a thin sterile soil of reddish clay and gravel. The surrounding hills belong to the trap formation. The average fall of rain is generally two-thirds less than at Bombay, and seldom exceeds from 22 to 25 inches. The climate, as contrasted with Bombay, is comparatively dry and temperate, particularly during the rainy season, when it is most healthy and agreeable to European feelings; the extremes of the thermometer are from 55° to 98°, the average range of the temperature being greater than at Bombay. The infantry station has its water supply from an aqueduct and wells; the cavalry one is chiefly dependent on the river and monsoon rains, but a pure hard water is procured from wells sunk through the solid rock, 26 to 30 feet. The chief mortality at Poona is caused by reliefs from the low countries; but separated from these, and considered among troops some time resident at the station, I found it not more than 10·7 per thousand. Mr. Hunter, of the 2nd Queen's Regiment, after the regiment had been three years in Bombay, found the ratio of mortality on an aggregate strength of 1,395, and among men of an average age of 30, to be 21·8, during the two years of 1834 and 1835. But, as a whole, the climate is little inferior to England, European fruits, as grapes and strawberries, flourishing well in this locality.

3419. Will you now give us a similar account of Belgaum?—Belgaum, which is 200 or 300 feet more elevated than Poona, near the Western Ghauts, and two degrees further south, has a somewhat lower, and steadier temperature, the annual extremes being 60° and 92°, with a rainfall of nearly twice the quantity of the other. In March and April, while hot winds prevail at Poona, here a soft breeze is found blowing soon after noon, assimilating the climate in a great measure at this season to that of Mahableshwur. The rains also, which begin here a month earlier, and continue a month later than at Poona, are generally more boisterous and accompanied by greater vicissitudes; dysentery, rheumatism, and hepatic diseases are worse here than at Poona, and in the table of mortality for ten years, which I before alluded to, the ratio of mortality was 19 per 1,000, approaching that of Bangalore, where hepatic disease is very frequent, and the ratio of mortality 23·3 per 1,000.

3420. (*Dr. Farr.*) What regiments do you refer to?—The regiments were principally the 78th and East India Company's 2nd regiment European L. I., and the Queen's 64th.

3421. (*Chairman.*) Are there any other considerable stations at which you have served sufficiently

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long, to have enabled you to state their peculiarities?—Mahableshwur I can describe; Mahableshwur, or Malcom Peth, of which the late Mr. Murray's published accounts are the best and most authentic, is elevated 4,500 feet above the level of the sea, has a mean temperature of 66·6°, a mean daily variation of 9·7°, and a rain fall of 254 inches. The temperature here, through the different seasons of the year, is neither that of excessive heat, nor inclement cold, being nearly that of the computed mean temperature of the globe; still the physical character of this cold temperate climate depending on elevation and not on latitude, and not associated with the same amount of atmospheric pressure as the last, is in a great measure artificial, and has not the same healthful physiological influence over European constitutions, or the like beneficial therapeutic effects on tropical diseases as have the latter.

3422. (*Dr. Farr.*) Are there any troops stationed there?—I have seen them there under Mr. Walker and Mr. Murray; but so many of the cases were badly selected that the Government ceased to send European troops there at all. I was there at a time when there was no house at the station, which was afterwards abandoned for European troops on account of the climate having proved less beneficial to sick and invalid soldiers than had been expected; but residents, civilians, and military men coming from the different stations debilitated, sick, and nervous, and suffering from various other causes of disease, were constantly sent thither, both during the month of October, and from the month of March until the beginning of June.

3423. (*Sir R. Martin.*) The instances of failure among the soldiers were chiefly in cases of bowel complaints, were they not?—The first experiment was of that kind both in affections of the lungs and bowels, which cases were improperly selected, and for which the climate is not fitted.

3424. (*Col. Greathed.*) Do you know what the effect of the climate was upon soldiers sent to that place, not as invalids, but on duty?—There was a small body of men there, and the climate of course would maintain their health; the question would be then, what would be the effect when they went on service in the plains; it is not the residents there who are not in health; no doubt they would remain perfectly healthy there, but the soldiers, like the natives in those climates, suffer more in proportion, or quite as much as the troops, on transference to the plains below; stating that from my own experience.

3425. And more so than if they had been stationed in the plains?—Yes, than in the upland plains. The air of hill climates, greatly elevated above 2,000 feet, is much rarefied and light, being deprived of nearly a fifth of its superincumbent pressure; the temperature in the shade is cool and agreeable, but absolutely and relatively great under exposure to the rays of the sun; the air feels unpleasantly dry during the fair season, and is surcharged with moisture during the rainy one, the climate being exempt from great and frequent vicissitudes of annual or daily ranges of temperature.

3426. (*Chairman.*) In the case of Colaba was the subsoil dry or damp or undrained?—The site of the Colaba barracks was not sufficiently drained, and the barrack floors not enough elevated from the ground. The diseases numerically the greatest were fevers, being sometimes, in October, 85 per cent. of all the diseases admitted. The monsoon of 1841, all over India, proved very unhealthy, and Her Majesty's 17th regiment were very sickly there; the troops of Her Majesty's dépôt were comparatively healthy, being in a better and more healthy locality.

3427. (*Sir R. Martin.*) Has not Colaba been very much improved since the time of which you have spoken?—I am not quite certain, but if they have acted upon the orders that were sent out by the Court of Directors, to build all the barracks upon arches, of course it will be improved.

3428. (*Chairman.*) But you have been speaking of the time when you were superintending surgeon of a division?—Yes; of 1841, 1843, and 1844.

3429. (*Col. Greathed.*) Have you any reason to know that those orders have been carried out?—No.

3430. (*Sir P. Cautley.*) Did the floors rest upon the ground at the time you refer to?—Yes; you might dig a well within three feet of the surface. The most inefficient site for any barrack is where the water is near the surface; it produces a large amount of sickness and a large amount of mortality generally.

3431. (*Chairman.*) Will you be good enough to answer now the same question with respect to Poona?—As Poona is on the trap formation and very dry, the rock being immediately near the surface, I consider it in every respect, endemically speaking, as one of the healthiest localities in India.

3432. Will you now describe Belgaum?—The formation of Belgaum, where the European troops were cantoned, is not quite so good as at Poona, there being several ravines and broken ground in the neighbourhood both of the hospitals and of the barracks. I consider the place where the European troops were cantoned is not quite so eligible as the fort of Belgaum, which is lower, but is free from the mischievous endemical topographical peculiarities that I have mentioned.

3433. Referring to the various stations which you have mentioned, will you be good enough to state the source of the water supply, whether it is good and abundant, and whether the tanks and wells are clean and free from vegetation or decomposing organic matter?—The water supply at Colaba was mainly in my time derived from wells built up from the ground with fire-burnt bricks, but since then I understand that a reservoir for the rain water has been constructed on the neighbouring island of Salsette, and will be brought from thence to Bombay by an aqueduct. Poona is supplied by an aqueduct and by wells; there is good river water. And also with regard to Kirkee I consider it in all respects very efficient, except that I believe the water drawn from the wells in the hot weather produces guinea worm.

3434. (*Dr. Farr.*) Have you analysed the water?—No; but the water has been analysed lately, and an account of it is to be found in the fifth volume of the Medical and Physical Transactions of the Society of Bombay; there is a complete analysis of all the waters in the Bombay Presidency, but I do not think it gives any great sanitary information.

3435. Do the waters contain much organic matter?—I think the waters of Bombay do generally, that is the supply from the wells. I may state that the constant dipping and splashing of the water carriers, in India generally, are sufficient to spoil the best water and are very objectionable, particularly on the coast, where the wells generally contain a very large amount of organic matter.

3436. (*Chairman.*) Can you suggest any improvement with regard to the water supply generally, as to the sources from which it is derived, the means of storage, and the means of distribution?—I think that generally, when the water for the troops is derived from wells, the system that has been always advocated and acted upon, from a very old time indeed, in military cantonments is that of having a reservoir built; from which a continued supply should be drawn into open troughs, regulated according to circumstances by stop-cocks; that I think is the best way, and that has been acted upon for many years, so far back indeed as the time of Marlborough; and I think that would still be very beneficial, because the constant splashing and dipping of the water carriers renders the water supply very foul in the wells.

3437. You mean I presume that the dirt is constantly stirred up?—Yes; and full of organic matter. In many cases it is very muddy indeed, and therefore in all cases where the water is derived from wells a covered reservoir should be built and connected with

exterior ones, and the supply of water to the water carriers in India should be regulated by stop-cocks.

3438. (*Sir P. Cautley.*) For drinking purposes I suppose you would filter it?—Yes, you might do that; the use of sand and charcoal would improve it very much.

3439. (*Dr. Farr.*) That is the course which you think ought to be adopted?—Yes; I believe that it would prevent guinea worm, and prevent a great amount of disease.

3440. Has that system been adopted at any of the stations where you have been?—No, early in my career, when I was surgeon of both battalions of artillery, and when I was at Matoongha, I wrote an account of the guinea worm, as it prevailed among the artillery, and I mentioned then that it was desirable that the water should be filtered through sand or gravel. I have no doubt, if it were so filtered, that guinea worm, which often produces at particular periods a large amount of sickness, might be greatly diminished. I think therefore it is very desirable that the system I have recommended should be adopted.

3441. (*Chairman.*) Will you describe generally the construction and materials of the barracks, and also of the temporary huts and tents used for barrack or hospital purposes?—I do not specifically remember the mode of construction; but the materials of the Colaba barracks, I think, are burnt bricks; I cannot speak positively; but this I know, that in the Bombay Presidency the barracks at Poona, Kirkee, and Belgaum are built in parallel lines of *pendals*, or in the form of a square, and are constructed of half-burnt bricks and lime, or mud and stone.

3442. (*Sir R. Martin.*) Are the angles of the squares open or closed?—They form three sides of a square.

3443. But are the angles of the squares open or closed?—The old barracks at Belgaum were closed, I think. There are long barrack rooms consisting of a single story, of which the floors are raised about two feet above the ground, and are formed of either gravelly clay or stone. The thatched huts in the rear are often built of mud and stone.

3444. (*Chairman.*) For what purpose are these thatched huts used?—For married men.

3445. (*Col. Greathed.*) Do you approve of the married men and their families being placed in those huts in preference to having barracks for married men?—If the barracks were differently constructed, I should prefer them; but as they are now constructed, I believe that the huts are even quite as healthy as the barracks, and more convenient for the married men.

3446. Do you not think that they attach great value to the privacy of the huts?—Yes, no doubt they do.

3447. (*Chairman.*) Are the floors of the barracks raised above the level of the ground; is there a free circulation of air beneath; and do you consider it of importance that in the climate of India there should be such free circulation of air?—I should say, as to all the barracks I have known on the Bombay side, that they are generally good, consisting of a single story; but they are generally too little raised from the ground, not more than two feet, and they have no circulation of air from beneath.

3448. (*Sir Proby Cautley.*) Is the space of two feet above which they are elevated hollow, or is it filled in with rubbish?—It is filled up.

3449. Then there is no circulation of air?—No. I should recommend that all barracks for warm climates should consist of two stories.

3450. (*Chairman.*) Do you mean that both stories should be inhabited, or that the lower story should be left as an open space, so as to obtain a free circulation of air?—I would recommend that the basement story should be divided into ablution rooms, kitchens, and even the means of washing under particular circumstances. I think that would be of great importance, and I am quite sure that the health of the men would be greatly benefited by it; indeed, I know that, in

this country, an elevated building is altogether better than a building of one story only.

3451. (*Sir R. Martin.*) Would you recommend that the roofs of the barracks should be double?—Yes; in India that would be a great improvement.

3452. (*Chairman.*) The roofs are not, as a general rule, double, are they?—No. Many of the barracks that I have known are ventilated by a kind of venetian opening in the roof, but that would not prevent another roof being elevated above that.

3453. Are the walls ever built double in any of the barracks that you have known?—No; generally there are verandahs on two sides of the barracks.

3454. Have you ever known the verandah itself used as a sleeping-place?—I do not think that I ever recollect the verandah being used as a sleeping-place, I have often known a part of a verandah walled off for an ablution room.

3455. Have you ever known the floors of barracks or hospitals damp?—I have already stated that at Colaba the barracks were invariably damp, at particular seasons, and I had occasion to report upon their unhealthiness under the Government of Sir George Arthur, and again afterwards when I was superintending surgeon.

3456. (*Sir Proby Cautley.*) Do you think that there is any objection to brick floors, or do you prefer the native cow-dung floors?—I should certainly prefer a brick floor.

3457. (*Dr. Gibson.*) In what respect do you consider the native floors objectionable?—I consider a mud floor under any circumstances objectionable.

3458. I suppose with regard to the difficulty of keeping it clean?—Yes. I think if a barrack is elevated, it would be better that the floor should be of wood, and next to wood I should certainly prefer brick.

3459. (*Sir Proby Cautley.*) The natives are very partial to the cow-dung floors?—Yes; but I presume they have never considered the subject philosophically.

3460. (*Dr. Gibson.*) Is the cow-dung floor very offensive?—No, I must say *not*; but I look upon it that a mud floor is most objectionable, and that the next best is a brick floor, and best of all no doubt is a wooden floor.

3461. Are the bricks sufficiently good?—You can get very good burnt bricks in India; the Government could always obtain them.

3462. (*Chairman.*) Have the men any opportunities of taking exercise in the heat of the day without exposing themselves to the heat of the sun?—In some cantonments they have; but there is no covered play-ground that I know of; they have a racket court at Poona, and all other means of amusing themselves; but I do not know of any covered place that they have.

3463. (*Dr. Sutherland.*) Are there not some barracks with single verandahs, and some with double verandahs, the inner one being closed, and which form of construction do you prefer for health?—I should say the single verandah.

3464. Are the barracks with double verandahs light enough inside, or is the only light derived from the archways?—All the ventilation and light in India are derived either from the venetian opening in the roof, or from the windows and doors; there is no other mode of ventilation, except where it is carried out scientifically. I think it is the best mode; the French consider it the best. Windows and doors with the power of ventilation are better than any artificial ventilation, generally speaking. I have been very familiar with St. Mary's hospital, which is one of the best artificially ventilated institutions in this metropolis; I believe there is no other so well ventilated in London.

3465. (*Sir P. Cautley.*) Would you recommend the use of large covered-in places for exercise and play-grounds?—Certainly. If such places are necessary for boys at school, as it is considered, I should say that they are still more necessary in a tropical cli-

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mate. Even at the Epsom Medical Benevolent College, of which I am a member of the council, we are obliged to give the boys a covered in play-ground.

3466. Do you think you could connect them by a long passage?—I think they might be separate buildings altogether, and open, excepting at the monsoon quarter, when they ought to be closed.

3467. It would be requisite that the men should be able to get into these large places without exposing themselves to the sun, and without exposing themselves to the rain during the monsoon?—It could be more easily done by having a space covered over, parted off from the barracks. I would not recommend it as a permanent construction; it would be better to be done annually, just as the rain was approaching.

3468. Such a place would be for the purpose of enabling the men to take athletic exercise?—Yes; for racket and other hand exercises, which the men indulge in.

3469. Would you attach a room to enable them to play at chess and billiards, and games of that sort?—Certainly. I think that a day room of that kind, to enable the men to leave the barracks, would be of the utmost importance to them, both with regard to comfort as with regard to health.

3470. Would it not be an advantage to have large barracks, to be occupied by European troops, constructed on arches?—Most certainly. I have already stated that a double storied barrack would be still better, and I also look upon warm ablutions occasionally as one of the greatest means of preserving health in India, and therefore they ought to be supplied with all these necessities if you want to bring the health of Europeans nearly akin to that which they enjoy in their native climate.

3471. With regard to ablutions in cases of venereal disease, would it not be very desirable that there should be a constant supply of running water from a reservoir, or other provision of that kind, so that the men could wash themselves and keep themselves clean?—Yes. I think that wherever aqueducts or rivers could be made available for that purpose, the water should be laid on certainly in that way. I consider it of great importance, and that is one reason why I stated that I preferred a barrack of two stories, where the lower basement story could be divided into kitchens and ablution-rooms.

3472. (*Chairman.*) Would there be no objection to the men living directly over kitchens, ablution-rooms, and places of that kind?—A washing-room where the steam would come from would be objectionable; but I would not go so far as that; I would have warm baths provided as well as cold water; but I should not recommend that there should be a regular washing establishment in the basement.

3473. (*Dr. Farr.*) Is there any objection to the men bathing in the rivers?—No, certainly not, if under medical and military superintendence. Squads of them might be marched down and bathed, and they are so.

3474. Would not your plan involve the reconstruction of nearly all the barracks in India?—In a great measure it would; but wherever new barracks were required, the Government should be impressed with the necessity of adopting *that* mode of construction, which seems preferable to any other.

3475. Do you think it is so important as to the health of the men, that the Government would be justified in going to the expense of reconstructing the barracks?—I certainly think so, for it would be a cheaper plan in the end. If they reconstructed all the barracks on such a principle, it would be a saving of money to the Government in the end, considering what every man costs, and considering that the life of every man is valuable.

3476. How would the Government save money?—From the number of men who would be kept available for service; so many would not be required to be recruited from home; they would not require so many fresh supplies of men.

3477. Are the barracks which you consider bad and objectionable calculated to produce ill health?—Yes, particularly in low localities. I cannot say that the barracks at Poona have ever been so much the source of unhealthiness, for the barracks *there* are not the main cause of unhealthiness. At good stations the barracks, even as they are, I believe are very little the cause of disease.

3478. Taking the stations generally, do you think that the barracks have anything to do with the great mortality which is experienced in many of the districts of India?—Comparatively little, except in the low coast stations.

3479. On that account it would not therefore be of so much importance to reconstruct the barracks?—Not in elevated positions.

3480. (*Col. Durand.*) You confine your recommendation chiefly to barracks in low situations, where its utility would be greater?—Yes.

3481. (*Dr. Farr.*) Such as which?—The lower part of Bengal, the whole of the lower part of Goozerat, and Colaba in Bombay.

3482. (*Col. Greathed.*) You were speaking of Kayra, and you mentioned the mortality there; did that arise from the bad judgment which had been exercised in the selection of the site of the cantonment?—I certainly think so; and I will describe the situation of that place. Kayra, or Ruttunpore, in Guzerat, where fine barracks and stabling were abandoned, on account of the great insalubrity of the station, indicates the injurious effects of swampy ground in front, with broken ravines in the rear, the horse artillery, of which I was the assistant-surgeon, being more healthy, from their more elevated and dry site on the north bank of the river, than Her Majesty's 17th regiment and the 4th dragoons on the south while stationed there. The barracks and hospitals were first-class buildings, and superior to any that I ever saw in the Bombay presidency. The Colaba barracks also showed morbid effects after wet weather, in producing similar effects as at Kayra.

3483. The civil station was on the same side of the river as the horse artillery barracks?—Yes, a little way from the cantonment, elevated, I should say, about the same height as the horse artillery barracks.

3484. Whilst the dragoons were on the south side?—Yes, with a very low swampy morass to the south and in front of them.

3485. (*Dr. Farr.*) Near the river?—They were to the south of the river.

3486. How far is Deesa from Kayra?—It is, I think, nearly 200 miles.

3487. It is low, is it not?—Yes; but I have no positive knowledge of Deesa myself.

3488. Is it more healthy than Kayra?—Certainly; it is the healthiest part of Goozerat.

3489. To what do you ascribe its superior healthiness?—To the absence of any very great amount of moisture or rainfall; the rainfall at Kayra is very slight, still it does produce fever just as water a very little below the surface does; surface water produces exactly the same effect in those countries as slight rainfalls upon the soil do. Fever begins to prevail as soon as the rainfall sets in both at Kayra and at Deesa, but much less at Deesa.

3490. It appears that the mortality at Deesa is 26 in 1,000; is that low?—I think it may be a little lower than that among troops sometime resident there; it was 49·6 from abstracts of Her Majesty's 6th and 40th regiments for five years, and on an aggregate strength of 4,393, and from Mr. Hunter's account; but I found it only 21·9 per 1,000 among the resident troops, but I do not think you can judge unless you separate the reliefs from the resident troops, and when I give that low rate of mortality, it refers to resident troops, namely, Her Majesty's 8th, 78th, 83rd, and artillery for ten years.

3491. (*Col. Durand.*) How would you define resident troops, after what period would you consider them resident?—I should not consider any man resident

under six or more years stay. My mortality is 21·9, but Mr. Hunter gives the mortality in his regiment, which was constantly changing, at 49·6 per 1,000; but those reliefs complicate the matter. I can give no accurate statistical results; they quite mislead you; and indeed I would say as to the whole of the statistics of the army, as they now exist, that there is no confidence to be placed in them, from the circumstance of their not being combined with meteorological as well as the medical observations of individuals, who have observed the diseases and know the results; no accurate opinions can be formed from statistics so constructed.

3492. (*Chairman.*) May it not sometimes happen that a very healthy station returns a very high rate of mortality, precisely because it has been selected as being a healthy station, to send troops to who have suffered from being quartered in a less healthy locality?—Yes, certainly, that is constantly the case, and as to statistics relating to India, in order to obtain accurate results, the statistics with respect to European troops in India should be wholly reconstructed, and the statistical results should be combined with the meteorological and medical observations of intelligent medical officers.

3493. (*Dr. Farr.*) What statistics do you refer to?—I refer to Colonel Tulloch's statistics.

3494. (*Sir R. Martin.*) But he never makes returns with regard to troops that have not resided at least twelve months at a station?—Very true; but that is scarcely sufficient to give you accurate results. You may obtain statistical results variously constructed, but unless these are combined with accurate meteorological and medical observations, they tell you but little; and I am sure that no medical man would believe that statistics can give you in an accurate or physiological manner the effects of the influence of climate, except by observations on disease connected with those statistical results: for after all, such results are but collateral proofs of more minute and searching medical observations and deductions at the bed-side of sick soldiers.

3495. But the returns which are prepared only to show the sickness and mortality are given with great accuracy, are they not?—As far as the results go; but they prove nothing, unless they are combined with physiological observations on the effects of climate, and medical observations on the nature of the diseases.

3496. (*Chairman.*) You do not dispute the accuracy of the figures, but you question the inferences which have been drawn from them?—Yes; I am opposed to M. Boudin's statistics with regard to the French troops in Algeria.

3497. (*Dr. Farr.*) The return before me gives the regiments, and the time that each regiment remained at a station?—That may be, but it is not sufficient.

3498. (*Dr. Sutherland.*) You would not accept mere statistical facts as a final solution of the question?—No.

3499. (*Col. Greathed.*) Do you think that any better conclusions could be drawn by tracing the history of a particular regiment in India rather than taking the general history of the different stations?—I think so.

3500. I mean tracing the regular history of a regiment through all its stations during its service in India?—Yes; and that has been done in a great measure by the late Mr. Hunter, of the 2nd Queen's regiment, although I must say still I cannot adopt his statistics as leading to accurate conclusions with regard to India, unless a regiment be resident six or eight years at a station.

3501. (*Sir R. Martin.*) And it was also done very carefully by Dr. Arnott, with reference to the Bombay army, and particularly the battalion of European Fusiliers, for he gives an account of the health of that regiment for seven years?—That would give a sufficient result to justify an opinion.

3502. (*Dr. Farr.*) Do you think that in an unhealthy station you could obtain fair experience of the effects produced at that station upon health, unless

you had the troops stationed there under observations for 8 or 10 years?—I mean to say that the results could scarcely be depended upon under that period. I do not recollect Dr. Arnott's statistics, but if the troops were resident for seven years under the observation of an intelligent medical officer, I should say that a conclusion might be arrived at with considerable accuracy.

3503. (*Sir R. Martin.*) When troops were frequently on the march, and going from place to place, it would render it difficult?—Yes; you could arrive at no accurate result.

3504. (*Col. Durand.*) You think it is necessary to eliminate all the disturbing causes, such as reliefs and marches, and so on?—Yes; in order to obtain accurate results.

3505. (*Sir R. Martin.*) But the Government has never kept any regiment very long at each station; the rule is that there shall be frequent periodical reliefs?—Yes, but there are certain stations at which European troops have been stationed for very many years, and we know what the results have been, for example, as to the artillery at various stations. The Queen's troops afford less accurate statistics in this respect than the Company's troops.

3506. But even the artillery of the Company was subject to frequent reliefs?—Detachment reliefs; not of the whole body.

3507. (*Chairman.*) I think you have stated that the means of personal cleanliness at those stations with which you are acquainted are not, in your opinion, altogether sufficient?—Certainly not in the barracks.

3508. (*Col. Durand.*) Are the means sufficient in hospitals?—No; nor in hospitals.

3509. (*Chairman.*) You stated that you would recommend ablution-rooms on a larger scale, and greater facilities for bathing?—Certainly.

3510. Do you think that these changes could be made without any very considerable increase of expense?—Do you mean in the buildings as at present constructed?

3511. Yes?—I think that a distinct ablution room might be constructed for the personal convenience of the men; but still it would not be so complete as upon a better organized plan for a barrack.

3512. Do you consider that the means of cookery in the barracks are sufficient?—The ingenuity of the native cooks supplies the defects in that particular, for there is no doubt, that they can, with very insufficient means at their command, prepare very many varieties of diet, but I cannot say that there is any very great or elaborate amount of convenience in any one barrack, or in any one establishment in India in that respect.

3513. (*Col. Durand.*) Practically would you suggest any alteration?—I rather think that what you want is this; I look upon the *dietetic* deterioration of the men in India quite as much as upon the *climatic*; for, if you do not consider the dietetic deteriorating influence, the climate of course becomes still more so, and therefore I think it is of the greatest importance that the men should be well dieted in India, and conveniences for cooking, according to the varieties of appetite, which is very capricious in India, should be supplied if possible.

3514. (*Chairman.*) There should be a greater variety of food?—Yes.

3515. (*Col. Greathed.*) You know, I dare say, what the diet of the troops in England is, and, as compared with them, do you think the troops in India are as well fed?—Certainly they are much better fed, and, as I stated, the ingenuity of the native cooks supplies the deficiency of the means at their command; thanks to their ingenuity, and they can do so also, even in the field: but then that does not do away with the recommendation which I think ought to be made, that more convenient means for cooking should be provided.

3516. (*Chairman.*) Do you think there is greater monotony in the diet allowed to the soldier than there is in the diet of the class from which the soldiers are

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generally drawn?—No, I do not think so; but then it must be remembered that the labouring classes have both exercise and pure air at their command, and that generally speaking there are not the same deteriorating influences exerted on their constitutions.

3517. (*Sir P. Cautley.*) But has not the soldier a greater variety of meat in Europe?—Yes; and he has perhaps better meat; the fact is that the beef in India, and the meat indeed altogether, is not of the same quality as it is in England, but still, with the vegetables and the spicery, and the other means which are used, the native cooks make it agreeable to their appetites. I believe that the Indian soldier has a greater variety in that way than the English soldier.

3518. A man gets good pork in England?—Yes, but I do not think that pork is ever admitted as part of the soldier's diet in India, unless the soldiers choose to kill a village pig and eat it, but it is contrary to the usual practice.

3519. (*Chairman.*) It is entirely forbidden, is it not?—Yes, unless the pigs be properly fed, which they are in some cases; but no soldier who knows what they are generally would like to eat a village pig.

3520. (*Sir P. Cautley.*) Whereas the soldier in England obtains pig meat of good quality?—Yes, but the pigs are differently fed in India, and that makes all the difference.

3521. (*Dr. Sutherland.*) Is there any reason why the quantity of animal food allowed to the soldier in India should be greater than it is on home service?—I think that the waste of the constitution in all tropical climates is considerably greater in many cases, and therefore if it is properly mixed up with vegetables, so as to be fitted to maintain the general functions in a state of health, I believe that the diet should be more nutritious in that respect, when supplied to the soldier who is hard worked.

3522. Do you think that a pound of meat in India is sufficient for a man?—I think so, except on his first arrival; it might then, perhaps, be diminished.

3523. (*Chairman.*) You do not share in the common opinion that Europeans in general, in tropical climates, do themselves injury by continuing to partake of the kind of diet to which they have been accustomed at home?—I think that nature points out to them that vegetable diet is preferable to animal diet in many respects, but the great cause of the deterioration in health is the continuance of the arrack ration.

3524. (*Dr. Sutherland.*) Suppose you feed the men on so full a ration as that which is allowed in India, and suppose that you then confine the men all day, from shortly after sunrise to nearly sunset, in the barracks, what is likely to be the effect upon their health?—That is a supposititious case, which does not exist; they are not confined to the barracks.

3525. (*Sir R. Martin.*) They surely are during the hot weather and the rains?—No; they have still a good deal of exercise, because they have the morning parade. At Poona, when I was with the horse artillery there, all the troops, including the infantry, were paraded two or three times a week before sunrise.

3526. But not during the rainy season?—They were paraded two or three times a week at Poona, where there is very little rain.

3527. (*Chairman.*) In what respects do you think that the diet of the soldier might be improved, having regard to his health?—I should say that at present the dram of arrack is derived from the Commissariat, as part of the ration that is issued, at a price somewhat lower than its ordinary retail price, and I should say that the abolition of both rich aliment and stimulating drinks for newly arrived Europeans in hot climates, and a prudent abstinence from the use of them, would greatly facilitate the acclimation of northern people to tropical latitudes, and scientific physicians have justly ascribed the greater mortality of the Dutch and English in warm climates, and the greater difficulty of these becoming acclimated to their conditions, to continuing habits and indulgences there that are only suited to cold climates.

3528. (*Dr. Farr.*) Would you deprive them of the

power of getting the arrack at the canteen?—I think that the abolition of the spirit ration is very desirable indeed in India.

3529. Would you prevent the sale of the spirits at the canteen?—I would; certainly I think it would be desirable.

3530. Would you allow beer to be sold or any other drink?—I should say that good Cape wines, with sherbets and effervescing waters, or any other thing to satisfy the thirst, would be much more healthy and suitable to the climate. Beer would be better than spirits, but I consider that, as the healthy maintenance of the eliminating functions of the body, in warm climates, is a great consideration, good Cape wines, which can be obtained cheaply, and sherbets, with different forms of effervescing waters, would in many cases be much more suitable for the preservation of health.

3531. (*Chairman.*) Could Cape wine be supplied at such a price as would bring it within the reach of a private soldier?—I think so, now that it is sold very cheap.

3532. (*Dr. Farr.*) But do you think it could be sold at the same price as the arrack which they now procure?—I should think at very nearly the same price.

3533. Do you think that the drinks you have recommended, on sanitary grounds, could be supplied at nearly the same cost as the spirits?—I cannot positively speak to that, because I do not know the comparative prices. I only know what prices Cape wines generally fetch; I do not know the price of arrack in India.

3534. There is a profit made on the sale of the spirits; would the same profit be realized, do you think, on the sale of the articles you have recommended?—Perhaps not to the same extent, but they would be more useful to the soldier. I cannot speak to the money details.

3535. (*Chairman.*) The substance of your suggestions, with regard to the soldiers' diet, I understand to be this; you would do away, as far as possible, with the consumption of spirits, and you would substitute the drinks you have mentioned, and, in the case of European troops newly arrived, you would temporarily lower the diet?—Yes, for a short time.

3536. (*Dr. Farr.*) Substituting a larger proportion of vegetables?—Yes, or vegetable diet, with milk, perhaps.

3537. (*Chairman.*) After the first novelty of the change from Europe to India is over, you do not think that the ration consisting of one pound of meat, one pound of bread, and one pound of vegetables, and, I think, a certain amount of rice in addition, is excessive, even during the hot season, when the men pass a great part of the day without exercise?—No, not particularly so; but the men will abstain from the animal part of the ration, and take to rice, provided it suits them, and that gives the cooks an opportunity of gratifying their capricious appetite.

3538. (*Dr. Sutherland.*) Ought not a man who eats plentifully to take plenty of exercise?—That is the theory; but I think the men are not the worse if they are supplied with varieties.

3539. (*Dr. Farr.*) But would you not say that there should be some proportion between the diet and the amount of exercise?—Yes, certainly.

3540. (*Chairman.*) You are of opinion that nature will settle that matter for herself, and that if the soldier is taking very little exercise he will not be disposed to consume so much?—Yes. Nature certainly points out the natural means of equalizing the functions in that respect.

3540a. (*Dr. Farr.*) Still men do make mistakes in the matter of diet, even in the city of London?—They do.

3541. (*Dr. Gibson.*) Do you consider that the diet of the soldier on the voyage to India is so arranged as to effect that object?—Certainly not; it has not been so within my own knowledge and experience.

3542. (*Chairman.*) We have been hitherto considering the diet of the troops when quartered in India. Can you suggest any improvement as to their

diet and exercise during their voyage to India?—Considerable improvement, both as to diet and clothing, might be made in the transference of European troops on ship-board from England to India. The diseases which I have found to be most fatal to recently-arrived Europeans, in tropical climates, have been dysentery, hepatitis, with fevers, caused, I think, in many cases, by too large a proportion of salt provisions, the continuance of the spirit ration, want of exercise, and neglect of the regular movement of the men's bowels, and also from having clothing which is unsuitable to the variations of temperature, which are experienced in the several latitudes, through which the men have to pass. On ship-board provision should be made for the issue of a mixed fresh meat and salt diet, with a portion of compressed vegetables and lime-juice, sherbet at least twice a week, clothing suited to the variations of a high temperature, and daily military and medical inspections of the men.

3543. (*Col. Greathed.*) Do you think that porter is a good thing to give to troops on board ship?—If you ask me for a physiological opinion, I should say that, except in cases where the habit is established, and the natural condition of the system is adapted either to beer or porter, that it is not the most healthy drink.

3544. Would you prefer it to spirits?—Certainly.

3545. Are you aware that porter is issued now in preference to spirits on board the ships going to India?—No.

3546. (*Dr. Gibson.*) You would not recommend porter to be supplied as a general rule?—I think that all hydro-carbonized materials are objectionable; it is a physiological principle that any hydro-carbonised drinks, whether beer or spirits, are more objectionable to men going to a warm climate than the drinks which I have recommended. I never could bear them myself.

3547. In many of the ships in the mercantile navy, spirits and beer are now altogether discontinued, and they have nothing but tea?—Yes, I believe so.

3548. (*Col. Greathed.*) Do you know that they issue preserved meats once a week to the troops going to India on board ship?—I do not know that.

3549. (*Chairman.*) What are the means of recreation for the men at the stations at which you have served?—The soldiers in India usually play rackets, cricket, quoits, and skittles. Indoors they play draughts, billiards, and they have a good library; but soldiers should be encouraged to work at trades, and to amuse themselves out of doors with gardening during the monsoons and in the evenings; a tea or coffee room should be added to each station.

3550. You have stated that the men should be encouraged to work at trades, do you think it would be easy to find occupation for them in that way, and that it could be made profitable to the men without entailing an inordinate expense upon the Government?—I think that at the very large European stations ample employment could be found for the soldiers who have learned trades. If the barracks were constructed with double stories, workshops might be fitted up in the basement story.

3551. What kind of workshops?—For shoemakers, and tailors, and such like.

3552. Do you think that the labour of the men could be utilized, so that it would not be much more costly than employing native labour for the same purpose?—I should say that, altogether, it would be very useful for the comfort of the men, and not detrimental to their health. As to the comparative cheapness of it, that is, perhaps, a different question which I cannot answer.

3553. Would you not consider it in the light of extra pay given to the men to encourage them to employ themselves, totally irrespective of any profit that the Government could derive from their labour?—I think it would tend much to their comfort and good conduct; for I have always found that the Europeans so employed were the best behaved men in a regiment.

3554. (*Sir P. Cautley.*) Do you intend that the Government should supply them with the necessary tools for their different trades?—I should say so; that the Government should supply them with tools, but that they should pay for them out of the profits of their labour; that they should be advanced to them in order to encourage them. I think that tools and all the means should be supplied to the men at first, and that they should be debited to pay them from the profits of their labour. I think that could be very easily effected.

3555. (*Col. Durand.*) Do you not think that, as sailors are taught to do a great many things, the soldier also might be taught to do a great many things, and thereby find him in employment?—Yes, there is no doubt of it.

3556. (*Chairman.*) Do you think, as a matter of fact, that the men in India suffer from ennui and from want of occupation?—That depends upon the nature of the station. At large military stations, where there is much military duty to be performed, I do not think it is so.

3557. Is there anything in the daily course of the soldier's duties as to drill, guards, and the like, which you consider injurious to his health?—The thing that is most injurious in many cases to the men's health is this:—After violent exercise, whether on parade or at play, they throw off their clothing and get chilled, and I look upon that as the most frequent cause of disease in India.

3558. How would you propose to prevent that?—By doing that which all Europeans who value their health in warm climates should do, namely, to wear woollen next their skin. I speak from personal experience of many years. I have been a long time in India, and a long time out of it, and I know the value of woollen both in temperate and in hot climates. The flannel belt is a very good thing to wear.

3559. (*Sir R. Martin.*) A complete but light woollen dress would be very beneficial to the soldiers, after long marches in hot weather and in the rains?—Most certainly; better than flannel, because that shrinks so much.

3560. (*Chairman.*) Woollen, if at all coarse, has a tendency to irritate, has it not, in a hot climate?—Woollen articles, such as are made in the Scotch manufactories now, woollen jackets, and woollen belts are quite equal to flannel in their salutary effects upon the skin; and they have not the objectionable quality which flannel has, namely, shrinking from washing.

3561. (*Dr. Farr.*) Do the officers wear any such dress?—A great many of them do. I have done it always, and I do so now.

3562. (*Dr. Gibson.*) But could the soldiers afford it?—The articles are not very expensive, and I think that they would be much cheaper than flannel.

3563. (*Dr. Farr.*) The natives wear cotton, do they not?—Yes; but it is not equal to woollen, as to the healthy action of the skin, because the action of the skin is twofold; it is not merely perspiration, but there is the oily *sebaceous* secretion of the skin, which guards against the injurious effects of variations of temperature; and there is accordingly great advantage in using flannel or woollen.

3564. Do you attach very great importance to the use of woollen?—Yes, both from personal observation and from physiological knowledge. I know what the effect of it is upon the skin.

3565. (*Chairman.*) Apart from the question of flannel or woollen, is there any improvement that you can suggest in the soldier's dress?—When I was a regimental surgeon, the dress of the soldier consisted of a cotton shirt, and sometimes an under waistcoat of flannel; that was in the artillery; trousers of cloth for the cold season, and of linen for the hot season; a cloth coat and a great coat; a leather stock and shako; and a forage cap, with a white cover for the head. I think several improvements might be made.

3566. Of what kind?—I should say that the men

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ought to have a coloured cotton dress for the hot weather, and woollen coatee and woollen pantaloons, with all the necessary means of warmth, during the cold season.

3567. With regard to the head-dress, is there any improvement that you could suggest?—I think that a quilted white cotton forage cap, with a cover over it, and a similar cover for the shako, is as good a means for protecting the head as anything; and if you wish to remove the uncomfortable tightness sometimes of the shako or of the helmet of the horse artillerymen, I think you would do well in many cases to do as the French soldiers do, substitute a forage cap with a very thick quilted cotton white cover.

3568. (*Col. Greathed.*) Do you think that the wicker helmet that is universally worn in India is a good helmet?—It is lighter than the one we used to have in the horse artillery.

3569. But this is worn by the whole of the troops?—It is better than any other form of shako, if it be covered with a good white cover.

3570. (*Chairman.*) Is there any other remark that you wish to make on the subject of the accoutrements of the soldier?—No.

3571. (*Col. Greathed.*) Do you attach much value to the cummerbund?—I think it is very useful in all cases for the protection of the stomach and bowels.

3572. (*Sir R. Martin.*) But it is not necessary, is it, if a man wears a flannel shirt or a woollen shirt?—It would still add to his comfort, and likewise to his protection from variations of temperature and climate.

3573. (*Col. Greathed.*) Would it not also help a man to support the weight of his belts?—Yes, I think it would.

3574. (*Dr. Farr.*) Are head diseases common in India?—Very common.

3575. Are they fatal?—Yes.

3576. They are not usually fatal in England at the soldiers' age?—Not so fatal as in warm climates.

3577. To what do you ascribe the frequency of what is sometimes called apoplexy and sunstroke in India; is it at all connected with the head dress?—No, I do not think it is, except where a man is exposed to solar radiation.

3578. Do you think it is caused by exposure to the sun?—Yes, in many cases.

3579. Would the men be more liable to be attacked by that disease when confined in a barrack, or when taking exercise in the open air?—If they go from one extreme to another, they are more likely to be attacked than men who take habitual exercise. We know that the officers never have *coup-de-soleil*, or very seldom indeed. It is the men who perhaps are suddenly exposed to the influence of solar radiation.

3580. It is stated in the returns to be more fatal than spirit drinking, and it is obviously a question of great importance. Do you think it is not to be attributed to exposure to solar radiation exclusively?—In some cases I believe that it is very much aggravated, I only speak of the men of the horse artillery, by having marched through a district where fermented toddy was to be found on every march; and I believe that exposure to the sun acted along with this stimulating toddy injuriously in producing apoplectic seizures, producing very bad symptoms and very bad cases, but both were acting together. Solar radiation is a very considerable cause; and when intemperance is combined with that solar radiation, the number of attacks will be considerably increased.

3581. Toddy and the sun combined are sure to be injurious?—Yes, very injurious. A great mortality took place in the horse artillery as we marched through a great number of date trees, where the men pulled down the pots that are attached to the trees; they could pull them down, and drink the contents; and the consequence was that there was very bad fever at our encamping ground near Baldaparee, and a great number of cerebral attacks took place, with a very considerable mortality.

3582. The instances of sunstroke which occur so

often on marches you think are not to be attributed merely to exposure to the sun?—Not solely, but to intemperance on the march.

3583. (*Chairman.*) Although the sun may be the immediate cause, you are of opinion that it would not operate in that way upon men who had taken care of themselves?—No, but that it would operate upon the intemperate men.

3584. Are the marches so conducted, so far as is practicable, that the health of the troops is protected from injury, or can you suggest any improvement?—I think that the judicious settlement of the time and hours of the march was, in my time, mainly left to the discretion of the individual commanding officer; but I think it should not be so left indefinitely, but that the marches should be conducted, when possible, under medical regulations in the quartermaster-general's and the sanitary departments of the army. Hitherto sites of stations were selected by the engineers', and quartermaster-general's departments, without any fixed rule as to consulting the medical officers, or without a report from a fixed committee of military and medical officers. That was the case, I believe, at Kayra.

3585. (*Col. Greathed.*) As a general rule, at what time would you suggest that the troops should arrive at their camp on an ordinary march?—Before the sun attains any great amount of heat; they should march early, before sunrise; but I would not recommend, as some have been accustomed to do, that they should march at one or two o'clock in the morning; for I do not think that that is the most healthy time.

3586. And after broken rest?—No, that is very objectionable. I think that if the men were ready to march by sunrise, arriving at their ground after a march of 10 or 12 miles, say by eight o'clock in the morning, that that would be the best mode of conducting the march. I have marched with the horse artillery, and been brought up by ravines, where I have been obliged to stop from three o'clock till sunrise.

3587. Have you observed on marches of that kind that the men do not get much sleep during the day in their tents?—Yes, it is impossible that they should do so, and therefore it is desirable that they should have good rest at night; I am sure that that is the most salutary mode of conducting a march.

3588. (*Sir R. Martin.*) Could a march, as recommended by you, be conducted well in hot weather, starting at sunrise?—No; in the hot season it would perhaps be requisite that they should march a little earlier than that, but I speak generally of marches, such as have been spoken of, and they have been generally during the temperate season of the year.

3589. (*Chairman.*) I think you stated that epidemic diseases, such as cholera, diarrhoea, dysentery, and fevers, have prevailed at some of the stations at which you have served?—Yes, particularly diarrhoea, dysentery, and fevers; they have prevailed, and have been attended with great mortality at those stations from want of due precaution in the selection of sites. Cholera, as an epidemic, appears mainly to owe its development and origin to miasmata, favoured by elevated temperature, and peculiar atmospheric conditions of climate; this development being greatly aided by preceding established conditions of filthy endemic situations, badly constructed and ill ventilated habitations, unhealthy articles of food and drink, producing predisposition to disease, aided by unhealthy trades, and depraved moral conditions of vice and poverty. The other diseases are mainly local, and miasmatic in their origin.

3590. What precautions of a sanitary nature are adopted when epidemic disease appears in a station?—The men are generally moved out into tents; the barracks are whitewashed by the engineers' department, and all overcrowding in the barracks is prevented; frequent inspections of the men who are proceeding to the rear are made by the non-commissioned officers, who report to the medical officer.

3591. Do you consider that the mode of treating such cases is effectual, or that it stands in need of

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improvement?—You can scarcely devise any plan more calculated to obtain an early knowledge of the attack of any epidemic disease than the one I have mentioned.

3592. Has liver disease prevailed to any extent at the stations with which you are acquainted?—At Belgaum, elevated more than 2,000 feet, liver disease was very prevalent during the cold dry easterly winds of the cold months; and both pure liver disease, and that accompanying dysentery, are produced by the predisposition caused by high temperature followed by cold. Woollen clothing worn next the skin, warm bathing and temperance are the necessary measures for prevention.

3593. Has rheumatism prevailed much in your experience?—Rheumatism is also a prevailing disease at Belgaum, and proceeds from like causes as liver disease, the blood being more impure in the former.

3594. Is there any precaution to be taken against that?—Warm clothing and bathing, with attention to the excretory functions of the body.

3595. Can you give the Commission some information with regard to scurvy and guinea worm?—Scurvy I consider is a blood disease, and is analogous in some respects to rheumatism, having its origin in deficiently nutritious diet and damp localities. Guinea worm, regarding which I wrote an account of its prevailing among the artillery at Matoongha, is I believe produced by the ova of an *entozoa* introduced into the system through the water of particular localities.

3596. In that case it might be prevented by attention being paid to the purity of the water?—I have already stated that the water should be filtered before it is issued to the soldiers, when obtained from wells.

3597. Have you considered the question of the hill stations, and have you examined the effects of the climate, in high and dry situations, on the health of the men, and if so, will you favour us with your opinion upon that subject?—I was resident for a considerable time at Mahableshwur and the hill station of Sattara; and upon the whole I consider that table lands of 2,000 feet, when favourably exposed to the influence of the sea breeze, and protected from dry land winds are the most healthy. Isolated hills with like topographical conditions are best suited for *sanitaria*. Elevated upland climates beyond 2,000 feet, removed from the influence of the *oceanic* aerial current, give us a diminution of temperature, with such a lessened amount of atmospheric pressure, that the last in a great measure counteracts the healthy invigorating effect of the former on the nervous, muscular, and digestive system; and by supplying an attenuated air to the lungs, while producing an unhealthy and chilling amount of transudation from the skin, deranges the balance of the circulation, and causes a local determination of the blood inwards, with congestion in various internal organs.

3598. (*Dr. Farr.*) What elevations are you referring to?—I have divided them. I have prepared this table of the hill climates, shewing the rainfall, the temperature, and the variations:—

TABLE of ELEVATED LOCALITIES and CLIMATES.

WESTERN UPLAND CLIMATES.					
Station.	Altitude in feet.	Mean Temperature.	Mean daily variation.	Rainfall.	No. of rainy Days.
Poona - - -	1,800	73.70	18.50	inch 25.	—
Kirkee - - -	—	—	—	—	—
Sattara - - -	2,320	76.6	14.	39.	—
Belgaum - - -	2,200	73.	20.	48.	—
Dharwar - - -	2,398	75.	—	25.64	—
		74.44		34.41	

TABLE of ELEVATED LOCALITIES and CLIMATES—*cont.*

Station.	Altitude in Feet.	Mean Temperature.	Mean daily variation.	Rainfall.	No. of rainy Days.
WESTERN HILL CLIMATES.					
Aboo - - -	5,736	69.7	12.4	78.66	72
Singhur - - -	4,200	—	—	72	—
Poorandhur - - -	4,570	—	—	—	—
Mahableshwur - - -	4,500	66.6	9.7	254.	131
Panchgunnee - - -	4,000	69.	12.2	55.	100
Ootacamund - - -	7,560	56.2	13.9	47.78	100
Kotagherry - - -	6,571	62.2	—	—	—
EASTERN HILL CLIMATES.					
Darjeeling - - -	7,218	54.6	—	—	—
Simla - - -	7,486	55.	—	—	—
Landour or Mussourie - - -	6,500	56.6	—	127.99	—
Chirra Poonjee - - -	4,200	62.5	—	—	—

3599. (*Chairman.*) Is it not a drawback upon the benefits of a hill station that in many cases the ground about the station is so confined that the soldier, in rambling about to take exercise, is compelled to descend to a considerable distance, and so subject himself to very violent transitions from one climate to another?—Yes; and I consider *that* very detrimental to the health of the soldier, and I consider that want of exercise is equally detrimental; they are certainly the two main causes of general disease so far as climate and bodily influence are concerned.

3600. Do you think it essential to the healthy character of a station that it should have a certain amount of table-land about it, so as to admit of the men wandering about freely?—Yes.

3601. Without exposing themselves to any very great change of climate?—Yes, certainly.

3602. (*Sir R. Martin.*) Selected mountain stations, also, in the front ranges, such as Mahableshwur and Chirra Poonjee, and some of the Himalayan stations, so as to bear the brunt of the south-west monsoon, would be also injurious?—Only where there is a very great rainfall. Hill stations, of a greater elevation than the upland Deccan plains,—that is, from 3,000 to 8,000 feet,—where there is a high ratio of rainfall during the wet months, could be most advantageously used as prophylactic stations, during the extreme heats of April and May, and again in October, when selected bodies of debilitated Europeans might be sent from time to time for change of air from the stations on the upland plains. Men selected from debilitated bodies of troops, in malarious and coast districts, should be first sent to maritime *sanitaria*, established in good positions on the sea coast, such as Vingorla, Bassein, Poorbundhur, and Kurrachee, for Bombay, Goozerat and Sinde; and probably the Sand Heads, for Lower Bengal. Although I have considerable doubts as to the propriety of occupying very elevated hill stations of from 7,000 to 8,000 feet as permanent stations for the accommodation of European soldiers in India; yet those, favourably influenced by the influx of an atmospheric current from the ocean, associated with no very great amount of rainfall, as some of the Neilgherry stations, and Newera Ellia in Ceylon, might perhaps be found advantageous.

3603. And also mountain stations, inland from the front, such as the one you mentioned as inland from Mahableshwur, such stations as Chenec, which are inland from Simla, and where the rainfall is moderate?—I should occupy them as prophylactic stations, and I think that it is in that way they will prove beneficial, making a proper selection of the men to be sent thither.

3604. (*Dr. Farr.*) Do you mean that you would station healthy troops at those points?—No; Many of the hill stations are not of sufficient *area* to admit of full exercise for large numbers of men; but selected bodies of debilitated men might be sent from

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time to time, for change of air, from stations on the upland plains. I think that the upland plains, at an elevation of 2,000 feet, have the very best climates, far preferable to the hill stations. I have divided them. There is a great difference between the hill climate and that of an upland station.

3605. (*Sir R. Martin.*) You have stated that the civil and military officers stationed at Mahabeshwur and other stations enjoyed good health while they remained there?—They only use them during the hot months of April and May; they go to Poona, or some other upland station, during the rains, and, if necessary, they can return to those hill climates in October, and in that way, with maritime sanatoria, all the benefits can be obtained from hill climates, that can possibly be obtained, unless you had a complete transference from one latitude to another. Of course, even with the greatest reduction of diseases, by using the very best prophylactic means, both endemic and dietetic, and all that can be done for the troops, still in tropical latitudes the mortality must be higher than in temperate latitudes.

3606. (*Chairman.*) You mean that you cannot obtain a European climate, by merely going to a certain elevation above the sea?—Yes; it does not give you the same climate. There is a difference in the barometric pressure which acts injuriously upon the constitution. The difference is from five to seven inches of the barometer.

3607. Your personal experience refers chiefly to the Bombay presidency, does it not?—Yes, it does; but the same principles are applicable to all the presidencies; it does not matter which the presidency is, the physiological results, whether in Bengal or in Bombay, are the same.

3608. But the mortality generally is higher in Bengal, is it not, than in Bombay?—Yes, because the miasmatic influences are greater.

3609. Will you be good enough to state the disadvantages of the hill stations, and the facts on which you rely, as establishing those disadvantages?—I have generally stated, from my experience, the diseases which arise at those hill stations, and from a physiological knowledge of the changes produced by them, I have stated that the diminished atmospheric pressure, produced by elevation, mainly counteracts the beneficial effects of the diminution of temperature, because naturally the changes both in the circulation, and particularly in the circulation of the lungs and heart, are such, that congested diseases, both of the lungs and heart, and of several of the viscera, will be produced by them in many cases; or at least, an unhealthy circulation of the blood through these viscera will seriously injure the individual, and produce an increase of disease. For instance, in many of those cases which have been not simply functional disease of the liver, but a tendency to organic disease, abscess has been produced from that circumstance, and when not properly attended to, and means were not taken to reduce the congested state that is produced by that diminished atmospheric pressure, the result was fatal.

3610. (*Sir R. Martin.*) Apart from the physiological theory, are you able to state any statistical facts to bear out your statement?—There have been no means of obtaining them at those elevated stations, but these facts are known to every individual who has observed the diseases at those hill stations. Mr. Murray's experience, during twelve years, bears that out, both practically and theoretically.

3611. You are probably aware that Dr. Grant, surgeon in Bengal, has given accounts quite at variance with the statements you have made in respect to the Himalayan ranges, especially and particularly in reference to the Lawrence asylum and its inmates?—The effects of hill climates on children, and the young permanently located at these stations, have been found more beneficial and salubrious to these than to adults from the plains; but I should, at any rate, doubt, from the experience I have had, and from the experience that others have had, the results on bodies of soldiers contrary to these:

because we know well that a tendency to congestion is produced frequently on the elevated plateaus of America, as shown by bleeding from the nose and hemorrhage from the lungs, which are the natural result of a physiological diminution of the pressure I have mentioned; and I should look very minutely and carefully at any statistical results differing from what I have now stated.

3612. (*Chairman.*) Do you not consider that at a hill station danger arises from the power of the sun being greatly underrated, and from the men exposing themselves to it in consequence?—Certainly, very considerable danger.

3613. (*Dr. Farr.*) Do you rely chiefly on physiological reasoning for the principles you have laid down?—I rely on physiological reasoning, with practical observations. I presume that physiological reasoning affords a justification of the practical results.

3614. You assume that it is a fact?—It is not an assumption; it is a fact as much as any fact can be the reality of observation and reasoning.

3615. Assuming that these diseases do prevail in hill stations you explain it by this physiological theory?—Yes, in a great measure, but I admitted just now that imprudent exposure to the rays of the sun is very apt to produce a very large amount of disease.

3616. (*Sir R. Martin.*) But this imprudent exposure chiefly refers to the men descending into deep valleys lying between the hills?—Yes, in some cases it is so, but there is likewise exposure even during the day to solar radiation, which is much more considerable than in climates of lesser elevation. In the case of a man going up to Mahabeshwur during the months of April or May, one of the most necessary things for the recovery or the preservation of his health is, that he should not expose himself, in the very great heat of the day, to that solar radiation.

3617. (*Dr. Farr.*) What diseases are particularly prevalent in the hill stations?—Hepatic disease is frequent.

3618. But I mean diseases originating there?—If men are constantly resident there, there is no great amount of disease originating in a station.

3619. Not diarrhoea?—Scarcely diarrhoea or anything. If a man went up from a temperate climate to a hill station, he would not suffer any great amount of disease if he remained there; the question would be whether he would do so when he descended into the plains.

3620. That is another question. Is hemorrhage prevalent in those hill stations?—Determination of blood to the various organs is, and sometimes hemorrhage.

3621. But it is not frequently fatal?—Not so.

3622. That is one of the results, is it not, that would be peculiarly produced by diminished atmospheric pressure?—Yes, it sometimes happens.

3623. But the effect does not quite agree with what you would expect?—There is bleeding from the nose.

3624. And from the lungs?—No.

3625. Those stations are not sufficiently elevated to produce those bad effects?—Not the very extremes that you mentioned.

3626. Practically, are not diarrhoea and dysentery more prevalent in the low stations than in the high stations?—Certainly, but they are very much aggravated by transference from the lower stations to the higher.

3627. (*Sir R. Martin.*) That is by the injudicious removal of the men?—Yes.

3628. (*Dr. Farr.*) Are they not much more frequent at stations, such as Dumdum and others of a similar character, than they are in the higher stations?—Wherever miasmatic influences prevail.

3629. All the peculiar diseases of India are produced in the plains, are they not?—In a great measure.

3630. And they are not produced either among the troops or among the civil population placed on those higher ranges in anything like the same degree?—

Not while they remain there, but they would be when they were removed to lower elevations.

3631. On sanitary grounds, if for no other reason, without regard to military considerations, would it be good policy to keep a certain proportion of the troops on the higher grounds?—I have already stated that it would be so on upland plains; but I do not think that there would be any diminution in the mortality of soldiers in India, if they were permanently located in more elevated hill climates, and brought down for service in the plains. I think it would even be greater, and I am borne out in that by medical officers of ample experience, Mr. Murray more particularly.

3632. (*Sir R. Martin.*) Even in the instance of healthy troops being placed on the higher ranges?—If they were afterwards called to service in the plains, they would have to undergo the same process.

3633. What process do you mean?—That of being acclimated, their functions being adapted to the climate.

3634. Do you think that there is such a thing as acclimatization in the plains of India, when the men are exposed to miasmatic influences?—There is acclimatization to elevation of temperature, but not to *endemic* miasmata; and here is a great mistake that is often made, that we rely upon statistics that have been drawn up upon this subject, without having separated their combined effects.

3635. When you have high ranges of temperature on the plains, do you not always likewise have miasmatic influences conjoined to the heat?—Those miasmatic influences are removed by hygienic measures in India, as in England.

3636. Can they be removed from Bengal?—In a great measure by proper barracks, and by endemic draining.

3637. Would any description of structural arrangement, for instance, render such a station as Berhampore, in Bengal, healthy?—A good barrack. We know that the barracks at Berhampore are not well constructed, and they have been often overcrowded, and much of the mortality has been in consequence both of the bad construction of the barracks, and the overcrowding that has taken place. We have had repeated evidences in the medical Bengal transactions of those facts, and those consequent results.

3638. Have the barracks erected by Sir Charles Napier in Sinde rendered the stations healthy for the occupation of the troops?—I cannot speak to that.

3639. (*Dr. Farr.*) Has not much of the uncertainty as to the influence of the hill ranges arisen from persons confounding the circumstance of healthy men and unhealthy men being sent to them?—Not according to the experience and practical opinions of those men whom I have seen. They would not admit, that there has been any such confusion, because the causes of the mortality generally, that has occurred in the hill stations, have arisen from the improper selection of bad cases from the plains.

3640. You would not recommend, I presume, that persons labouring under such complaints as diarrhoea or dysentery should be sent to the hill stations from the plains?—I have recommended that particular cases, calculated to receive benefit from a change to a hill climate, should be selected; but there are many diseases that would be associated with a transference to the hill climates, particularly dysentery and hepatic disease.

3641. Supposing that troops were stationed on the hill stations, and then that they were brought down to the plains, would their health, in your opinion, suffer very much?—Yes, I think so.

3642. From what diseases?—From all diseases incident to Europeans in tropical climates.

3643. Upon the whole, do you think that the loss of life would be as great under that arrangement as under the present arrangement?—No. I think that is putting the question in a way to obtain a result that would be very different from what is intended. I can mention the opinions of medical officers of long

experience, which are in accordance with my own. I should say, for example, that if a man were sent from a temperate climate to the hills at once, and then that he was suddenly brought into service in the plains of Goozerat, or even in the Deccan plains, away from any sea breeze, he would be liable to a very considerable amount of the usual diseases incident to tropical climates.

3644. (*Col. Durand.*) Suppose the case of two bodies of troops, one quartered at a hill sanitarium, and another quartered in the usual run of cantonments in the plains of India, and then those two bodies of troops sent upon continuous service in the plains of India, exposed during the hot weather and rains to campaigning, which of the two in your opinion would suffer the most?—The men who came from the hot malarious districts of the coast.

3645. (*Dr. Farr.*) Upon the whole, do you consider that troops might be placed under very favourable sanitary conditions on plateaus 2,000 feet high or upon hills of moderate elevation?—With proper maritime sanitarium you can obtain all the benefits of that kind which are essential to the health of European troops.

3646. Do you think that the mortality can be reduced?—Yes. I have already stated that statistics have been obtained showing the influence of increased temperature as well as of miasmatic influences. But if you consider the question of obtaining a low ratio of mortality, and so adapting the men to their condition, that they become acclimated and accustomed to tropical latitudes, you must remove all the endemical sources of disease. My opinion is that elevation of any kind in a tropical climate is a very great benefit.

3647. You know nothing about the sanitary condition of the hills?—I cannot speak to any actual results.

3648. There are hills in the interior, and therefore not exposed to the sea breeze as the hills are of which you have previously spoken; are they objectionable on that account as sanitarium?—I have said before that they ought to be used as prophylactic stations during the hot months both of April and May, and during the hot month of October; but that they should be combined with maritime sanitarium, in order to obtain all the possible good results that can be obtained.

3649. (*Chairman.*) Have you considered the question of sending invalids to recruit their health to Western Australia, or to any station beyond the sea?—Remittent fevers are more benefited by a change to the sea coast; the cerebral excitement caused by hill climates, in many of those cases, interferes with perfect convalescence; and organic visceral diseases of the brain, heart, liver, and spleen of a chronic inflammatory kind, are accelerated in the progress to complete disorganization in many cases; and should be removed either by a sea voyage, or by going to a maritime sanitary station on the coast. Invalids might be sent to the Cape of Good Hope, Prince of Wales's Island, or Western Australia, in cases of simple intermittent functional disorders of the stomach and liver, and impaired general health; but nervous debility and incipient consumption are most benefited by the hill climates.

3650. Will you state from your experience whether there is a certain age up to which a soldier is less liable, and after which he is more liable to suffer from Indian diseases or climate. In other words, at what age do you consider that a soldier's service in India should begin and end in order to ensure the largest amount of efficiency?—That question involves the question of acclimation. We must understand acclimation to be the whole physiological modifications effected in the organism of animals or plants, by which, under the influence of change of climate, the conditions of health are established, and from which the stranger acquires the same capability of life, and power of resisting disease, incident to those indigenous to the country. Viewing this in reference to the

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transference of Europeans, from temperate to hot countries, I would say that their constitutions can, under proper training, accommodate themselves to the inherent influences of climate, as temperature, dryness, or humidity, but not to those that pertain specially to localities, as miasmata from damp, filthy situations, which the human system may for a time resist, but cannot be habituated to. The deleterious conditions of the latter are correctible by hygiene. M. Boudin, from having confounded these separate influences, and from having lumped them together in obtaining numerical results of disease, among the French troops in Algeria, has been led into error, I think, in saying that there is no acclimation for hot climates. The increased ratios of sickness and mortality of masses, placed within equatorial latitudes must be brought down by judiciously selecting good positions, well elevated, and free from local causes of disease. In such the sanitary condition of European establishments may be so perfected, as to be not inferior to that of the most healthy temperate regions in England. The mortality of five regiments sent from the Cape to India, after the first year of service, was, I find, 4·8 to 11·0 among eight regiments sent direct from England; and if the ratio of mortality of three additional regiments at the Cape be added to the former ratio, we obtain the comparative beneficial results of transference from the Cape and from England as 7·21 per cent. to 11 per cent. of their strength. This statistical practical result is consistent, and in keeping with the physiological deductions I have made, from observing the physical effects of hot climates on European bodily functions. In a lecture I have published, on the acclimation of European troops for service, I have expressed the result of my experience and observation, that “the adaptation to “the changed conditions of hot climates, independent “of miasmatic sources of disease, must be gradual and “progressive for unacclimated masses of strangers, “and imposes on them the necessity of shorter or “longer sojourn in intermediate regions, with proper “attention to moderate eating and drinking, selection “of season for landing in the new climate most akin “to that which they have just left, and, after arrival, “fixing on habitations and localities free from miasmata, protected from land winds, and under the “salutary influence of those from the sea, together “with the resolute adoption of suitable clothing and “exercise. Such care and attention become necessary, in order that certain organic functional actions “be reduced in force, and so regulated as to be “brought into vicarious healthy action in place of “others, and to aid some lessened in power and “activity.”

3651. (*Sir R. Martin.*) If I understand you correctly, you would say that a soldier may become acclimated *quoad* a high range of temperature, but not *quoad* the miasmata that you mentioned?—Certainly.

3652. Can you separate the two influences; do they exist separately in nature, or in any part of the plains of India?—In certain dry localities they do.

3653. Referring specially to the plains, do they exist there separately?—They do exist for the most part together, but are removable. They have indeed been removed at Batavia, where when we occupied it the mortality was frightful. Mr. Money tells us, that from “the effects of Dutch sweeping, cleaning, and “draining, the most deadly city in the world had “become a healthy and agreeable residence.”

3654. Is the heat removable?—The miasmatic emanations are removable, as in Cadiz or Gibraltar, or any other place where yellow fever may be produced under special elevations of temperature in temperate latitudes.

3655. By what means would you remove malaria in the plains of India?—By proper draining and proper elevation of the barracks, and by all the sanitary engineering means which are applicable to such cases. No one can doubt that the fever at Gibraltar, or that the yellow fever at Cadiz, was produced

by local causes even in European latitudes. You may see from a beautiful map that has been drawn up by Mr. Keith Johnston, that yellow fever appears temperate latitudes from the bad local sanitary condition of a place.

3656. The improvements you suggest are universally known and appreciated as well as improvements of climate with improved agriculture?—No doubt.

3657. But such improvements which would necessarily occur, and do occur in localities, could not under any government be extended to kingdoms or provinces?—Of course all endemic sources of disease are removable by hygienic measures in a great measure.

3658. Within certain limited localities?—Within certain latitudes. For instance if you will allow me to state the difference between the mortality in a tropical latitude and a temperate one I will do so.

3659. In India only?—The mortality of Bombay is 1 in 20, and in ten of the hottest districts of France you have the mortality brought down to 1 in 37; but in the northern districts where the heat is less, the mortality is 1 in 41. Such is the proportion; therefore you can never remove so far the ill effects of tropical latitudes, although you can remove them in a great measure.

3660. (*Dr. Farr.*) You would endeavour to place troops upon their first landing under the most favourable sanitary conditions?—Certainly.

3661. And you would effect that partly by selecting stations of the healthiest character that you could find, and, where a station was unfavourably situated, you would do everything you could to drain the land and keep the atmosphere around the station as pure as you could?—Certainly.

3662. (*Sir R. Martin.*) Practically can you remove the sources of malaria over any extended area on the plains of India?—You cannot remove them over any great distance, but you can very much diminish their influence on individuals. We know that in the West Indies endemic cleanliness and draining, with elevation, give immunity from disease.

3663. (*Col. Durand.*) When you stated that you would select stations that were defended from any very strong land winds, you probably adverted to keeping away the miasmata by keeping off the land winds?—Yes, in a great measure. That is the advantage of stations where the oceanic aerial current prevails.

3664. Which are partly defended from the land winds?—Yes.

3665. (*Dr. Farr.*) Have you given much attention to the diseases and mortality among the natives of Central India?—I have never been much among them.

3666. The mortality among them is very low, is it not?—Yes, it is very low comparatively.

3667. (*Dr. Gibson.*) Do you think that the mode of invaliding sick soldiers in India, and sending them to England, is satisfactory?—No; some acclimation in the transference from a tropical latitude to a temperate latitude is as necessary as from a temperate latitude to a tropical one; it is certainly very unsatisfactory, if you transfer men directly from one climate to another, as they do in large masses.

3668. The depressing influence of the climate of England is too great, is it not?—Yes; the men should be sent to the Cape of Good Hope in the first instance.

3669. But independently of that, the men are very often sent down from the upper provinces to the coast by the regimental surgeons, and then they are very often sent back again to the regiment, and they very often die?—That is from their perhaps not viewing the case as they should do, as to the necessity of obtaining completely restored health by a change of climate. The men should be carefully selected under those circumstances, and sent to some milder climate, and in many cases, no doubt, they might be transferred to the Cape, I think very beneficially.

3670. Are you of opinion that the want of some such sanitary station near India causes results to which I have referred?—The maritime sanatoria which I have recommended, would be in some degree a substitute; but certainly if they were transferred to the Cape of Good Hope or to Australia, that would be, perhaps, better. I think there ought to be a sanitary station in Prince of Wales's Island, but at the same time, I think that maritime sanatoria on the coasts of India would, of course, be useful. I think that the great mortality is caused by a too immediate transference from a tropical latitude to a temperate one.

3671. And the reason probably why men are sent back to their regiments is, because there is no intermediate climate?—Yes.

3672. (*Col. Durand.*) Did you observe whether there was much difference in the manner in which these sudden changes were borne by the soldiers of different ages?—Certainly; there is great difference, because the changes after complete growth, and in youth are much more easily met by the elasticity of the constitution than by men of older age.

3673. (*Col. Greathed.*) Is it advisable in your opinion that a final invaliding board should be held, where the evidence of the regimental surgeon could be obtained?—I think it is very desirable that the evidence of the regimental surgeon, wherever a medical board is held should be obtained, and which could be easily provided for under any circumstances.

3674. But suppose the case of men sent down from the upper country?—Still it is desirable that the surgeon, or the assistant surgeon, from the regiment should be sent with a detachment of invalids so sent.

3675. You know probably that the men are often sent back to their regiment by the final invaliding board?—Yes; and I ascribe that to the medical boards being in a great measure constituted, as they were at one time, without having a sufficient knowledge of the cases of the men. I think that in many cases, that has been the cause of it.

3676. (*Dr. Farr.*) Of the troops embarked from India invalided during ten years, 954 died on their passage from India to England; do you think that number was excessive?—There must have been, I think, a very improper selection of cases. I think that in almost all cases the opinion either of the surgeon or of the assistant-surgeon of every detachment of invalids should be obtained, upon which the final decision of the board should rest.

3677. (*Sir R. Martin.*) Would you have the final decision come to at the presidency or at the place from which the soldiers were sent?—The difficulty is to obtain a good medical board, in many cases, in India at the out-stations. They are very well for the large stations.

3678. Would it not be preferable, where it was possible, to assemble a competent committee to make a decision, and consider the decision of that committee final, instead of having the man again subjected to an examination and decision at the presi-

sidency?—I should say that it might have been at one time, when many of the men upon a medical board were very little acquainted with the diseases of European troops; but I think that if a medical board, or the Inspector-General, as he must be now, is well acquainted with the diseases of European troops, the decision should be rather as a final one at the presidency, because the great body of Indian medical men have been very little with European troops; all their experience has been gathered from the native troops.

3679. (*Dr. Gibson.*) Do you think that a medical officer who serves almost entirely with native troops is acquainted with the diseases, and the habits, and the requirements of European troops in India, and is he competent to supervise those European troops?—I do not think, except they are men of very intelligent characters, who have been with native troops, and there are such in India, that they have had full experience bearing upon the knowledge of diseases, and all that is connected with the discipline, as well the medical treatment, of European troops. I should say that many officers of native troops have not experience that is altogether reliable.

3680. Then it would not be safe to entrust them with the supervision of large bodies of European troops?—That would depend entirely upon whether the medical officers had had sufficiently varied experience.

3681. Take the ordinary class of men?—Then I should say no; but I think that medical officers generally with native troops are very intelligent.

3682. Do medical officers improve in their professional acquaintance and knowledge?—Many of them improve very much, I think. Formerly the knowledge generally, scientific as well as medical, acquired by the medical officers of the Company's army, was very highly creditable and of a superior character.

3683. (*Dr. Sutherland.*) It has been stated that the men who are invalided by local boards have been sent down, and afterwards rejected by the board at the port of embarkation, or that the men have been sent down and delayed there for a length of time till they have become fatally ill; how would you remedy that state of things?—I should propose in all cases that the invaliding committee at the presidency should be selected by the Commander-in-Chief; that they should be men well acquainted with the diseases of Europeans. No doubt the character of the medical officers so selected must be known to the Commander-in-Chief, and a careful selection of men to constitute that board should be made.

3684. Suppose that a man sent down were delayed for months at such a place as Calcutta, would he not be very likely to die?—Yes; and I do not think that they ought to be so delayed. I have known such men transferred, and upon coming down they used to be sent to the regimental hospital of the artillery; but I do not think it is advisable that the men should so come down, and be kept at the presidency.

The witness withdrew.

Saturday, 18th May 1861.

PRESENT :

The RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.

Sir RANALD MARTIN, C.B., F.R.S.

J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.

Colonel GREATHED, C.B.

Colonel DURAND, C.B.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.

JOHN SUTHERLAND, Esq., M.D.

Brigadier-General RUSSELL, C.B., examined.

3685. (*Chairman.*) You have served, I believe, with the Queen's troops in India for 16 years?—Yes, from 1842 to 1858.

3686. In what Presidency?—In Madras, except during the mutiny in Bengal in 1857 and 1858.

3687. You have also, I presume, had some experience of service at home or in other stations?—I have served at home, and in the West Indies.

3688. Then you can compare the barrack accommodation and the sanitary arrangements in India with
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Dr. J. Bird,
F.R.C.P.

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Brig.-Gen.
Russell, C.B.

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Russell, C.B.*

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those which exist elsewhere?—My Indian experience has been entirely confined to the Madras Presidency and to Burmah.

3689. Referring to the stations with which you are familiar, what should you say with regard to the sanitary arrangements and the general comfort of the barracks?—Many of the old barracks were very inferior in those respects, but I consider the new barracks generally admirable, and that the sanitary regulations are amply sufficient, if the commanding officer and superintending surgeon will only carry them out.

3690. At what stations have you made the longest stay?—At Moulmein, Fort St. George, Secunderabad, Trichinopoly, and Rangoon, and I have visited on duty Arcot, Arnee, Kamptee, and Jackatalla.

3691. Beginning with Moulmein; that I believe is a station not in a very healthy country?—We suffered a good deal from dysentery, and had one attack of cholera. We landed there from England, and the dysentery was attributed by the medical officer to fresh pork that was issued by the commissariat; the supply was stopped; and after that, I think, the men got better. There was also a good deal of intemperance among the men on first landing; they were not accustomed to the ways of the country.

3692. Was it easy for the men to obtain spirits there?—They got a nasty Chinese spirit called shamshu from a place just behind the cantonment.

3693. Were the barracks at Moulmein new?—I believe the barracks had been built in 1826.

3694. Will you describe those barracks?—Each company had a barrack raised from two to five feet from the ground, built of wood; the walls were of bamboo matting at first, but they were afterwards changed for wood, thatched with the leaves peculiar to that country; the verandah was not floored or covered in.

3695. Were the barracks often overcrowded in your time?—They were rather too full; we landed from England 1,000 strong, and there was a great want of accommodation for the married people; we were stronger, having just come out from England, than the regiment which had occupied the barracks before.

3696. Are the barracks surrounded by an open space?—Yes, the inside of the bund was all cleared away; these barracks have been condemned, and I believe that now the European troops have been withdrawn entirely from Moulmein. But there was an excellent plan for the erection of pukka barracks, and the bricks were being collected when I was there, just before the mutiny broke out.

3697. (*Col. Durand.*) I think the artillery were in pukka barracks?—Yes, after the fire. Not that I think pukka barracks are good in Burmah; I consider barracks constructed of wood are cooler and drier.

3698. Then you would prefer barracks constructed of wood?—Yes.

3699. (*Chairman.*) But they are less durable, are they not?—I saw those barracks in 1857; they were built in 1826. The roofs should be shingled to avoid the risk of fire; the new native barracks at Moulmein were shingled.

3700. Will you now be good enough to describe the barracks at Fort St. George?—They are very bad, especially the ground floor. We had an attack of cholera, which was attributed to a drain which ran close to one of the rooms.

3701. Has that state of things been altered since?—I believe it has, and that the officers have been moved into another part of the fort, and their quarters have been given over to the men, but whether any men are lodged in the under story at present I do not know.

3702. Were these barracks within the fort?—Yes; and no breeze could reach them.

3703. Since you knew them, I believe, part of the fort has been taken down?—That I do not know.

I speak of them as they existed from 1845 to 1847, when I was stationed in Fort St. George.

3704. What kind of accommodation was there in the shape of barracks at Secunderabad?—The barracks there were overcrowded; they were badly constructed, built in squares, one square within another, and the air could not freely circulate round them. They had been built for 700 men, and we were 1,000 strong; thus all the verandahs were occupied by the troops, and that prevented the air getting in. The nights were at times very cold, and the men barred up every hole by which any air could possibly get into them. There was a detached building occupied by two companies and the band. When punkahs were put in the Secunderabad barracks in 1848, it was found necessary to replace the beams in this building. The opportunity was taken to raise the walls three feet, and to put on what was termed a Bengal roof, by which a current of air was admitted all round, and wire gauze was placed inside and outside the ventilators, beyond the reach of the men. After this was done no serious case of dysentery, the scourge of Secunderabad, occurred among the men quartered in this building, and the medical officer who visited it before morning gun-fire, found the atmosphere as pure and sweet as in his own bedroom, which he had just left, while it was very offensive in the other portions of the barracks. This dysentery I therefore conclude arose more from the construction, overcrowding, and defective ventilation of the barracks than from their site.

3705. (*Sir R. Martin.*) But that position was very bad, was it not?—It was not good. It was in a hollow, with a swamp on one side and an old graveyard on the other.

3706. It was in a saucer, in fact?—Yes; but we were comparatively healthy whilst we were there.

3707. Will you now favour us with your opinion as to the barracks at Trichinopoly?—The barracks formed a square, two sides bomb-proof and two sides tiled. There were also five detached buildings outside, each holding a company, built of mud, and covered in with thatch. These latter, called temporary barracks, were by far the cooler and most agreeable. They have since been burned down, and I believe all intention of building new barracks at Trichinopoly, for which timber had been collected, has been abandoned since the station of Jackatalla has been established.

3708. You say that the temporary barracks were cooler than the others?—Yes, they were.

3709. They were more suited to an extremely hot station, such as Trichinopoly is?—Decidedly. Bomb-proof barracks were most unsuitable to that hot station. They were unbearable by day, and the men could not sleep in them by night. A few days after our arrival application was made to have them thatched over and a pandall erected, this was immediately complied with. I never knew the Madras government refuse a reasonable request which was calculated to benefit the European troops. This was done instantly, at considerable expense.

3710. (*Chairman.*) The mortality at Trichinopoly is low, is it not?—We were very healthy. In the first year we only lost 14 men, in the second 16, in the third 18, in the fourth year we lost more, because we were upon the move, and cholera broke out. We had latterly 250 men employed in levelling a hill and building a barrack at Jackatalla.

3711. What is the situation of the barracks at Trichinopoly; is there a free circulation of air round them?—There is comparatively. On our arrival we found the patchery of the regiment that we relieved close up to the barrack on one side, and on the other side abutting on the bazaar. I refused to take this patchery over; and when the other regiment marched out the whole was levelled to the ground, thus giving a space of about 200 yards clear on that side of the barracks, and we then built a patchery for ourselves elsewhere.

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3712. Are the barracks there old or new ones?—Old.

3713. I presume the part that was bomb-proof formed part of an old fortification?—No, I do not imagine that that was so, I think it was the style of building at the period they were erected; the artillery barracks at Secunderabad were bomb-proof, and also the barracks at Arnee and Arcot, if I recollect rightly.

3714. With regard to the barracks at Rangoon, were they old barracks or of modern construction?—They were built whilst we were there.

3715. (*Col. Durand.*) Were they constructed of wood?—Yes.

3716. And raised from the ground?—Yes, from 5 to 9 feet.

3717. For those countries, taking the coast of Burmah and the Tenasserum provinces, you have a decided preference for barracks constructed of wood as compared with any others?—Yes.

3718. (*Chairman.*) But there is considerable risk and danger to be apprehended from fire, is there not?—Yes, there is that disadvantage in wood, which I think could be remedied if the barracks were shingled, instead of being thatched with leaves, which require renewing every second year. During the monsoon the ridges and portions of the leaves are occasionally blown away, and the men are drenched; I remember that after one storm there was not a dry house in the whole cantonment.

3719. (*Sir P. Cautley.*) The objections are the danger of fire, and the effects of very heavy hurricanes?—Yes, the south-west monsoon.

3720. (*Dr. Gibson.*) Why are barracks so constructed cooler than others?—I think there is a freer circulation of air through them, and they did not appear to me to hold the damp as the pukka houses did.

3721. (*Sir R. Martin.*) Hitherto they have been constructed after the fashion of the country?—Yes, very much so.

3722. Raised off the ground, and the roofs made of leaves?—Yes, I think the barracks were 20 feet wide, with an enclosed verandah of 12 feet, and a pandall outside that again of 8 feet.

3723. You would recommend a more solid roof?—Yes, they have now machines for cutting shingles; many of the houses in the town were shingled, the same as in the West Indies.

3724. (*Chairman.*) What is the nature of the country in the neighbourhood of Rangoon as to healthiness; are there any marshes round it?—It is covered with jungle, but well drained into a fine lake about a mile from the infantry barracks, or into the river; the substratum is laterite.

3725. You have spoken of one case in which a want of ventilation was found at night; has that, in your experience, been an ordinary subject of complaint that the barracks are close and ill-ventilated?—The barracks at Secunderabad, and the permanent barracks at Trichinopoly certainly were very badly ventilated, and that had I have no doubt a great deal to do with the disease; which was indeed proved by the comparative immunity from dysentery in the barracks that were altered at Secunderabad.

3726. I presume that the effects of defective ventilation are more felt in the cold than in the hot season?—In the cold season every aperture is stopped; the ventilators consisted of wooden shutters, opened and shut by ropes, which were within reach of the men, who closed them at night. These wooden shutters were removed, and wire gauze put inside and outside. There was not enough gauze to do this throughout the barracks; it was an experiment on the part of Captain Buckle, the engineer officer, and proved most successful.

3727. Is it difficult to arrange the ventilators so that the men cannot touch them?—It is easily done in the manner I have described when the apertures are above the reach of the men. The lower panels of some doors were taken out, and replaced by double wire gauze. It was found, however, that the men

nearest them nailed blankets and rugs across them at night; this was in consequence of the men being obliged to sleep in the verandahs; and when a man's head happened to be placed close to a draught, he of course closed it up.

3728. The men do not object to ventilation, but they object to its being conducted in such a manner that they have a complete draught upon them?—They object to any air coming upon their own persons.

3729. A thorough draught is what they object to?—Yes. The nights in Burmah are close at the commencement, but become cold towards morning; the men throw off their clothes before going to bed, and when they awoke they were frequently chilled, and diarrhoea ensued.

3730. That was an extensive cause of the sickness?—Yes, and that was the great cause I believe among the Burmese themselves; I was told that their children suffered very much from bowel complaints, caused by the chilly morning air.

3731. (*Chairman.*) Have you found any difficulty in getting repairs executed that were required?—Never; we sent in an account of the repairs required every week, and they were done instantly by the executive engineer. The troops in India have not to pay rent, as they have at home, under the head of barrack damages, fair wear and tear is allowed, and only wilful damage charged.

3732. How often are the walls and ceilings of barracks cleaned, and who directs that operation?—They are whitewashed once a year by the executive engineer or officer in charge of public buildings, and the companies used frequently to whitewash them to the height of six feet. Hospitals also are whitewashed once a year, as often as the medical officer sends in a requisition. The outside walls of the various buildings are coloured every second year.

3733. Have there been, within your knowledge, any complaints of the floors being damp?—Not in any of the barracks that I have been in. They do not generally wash the floors in India; there are sweepers appointed by the government, and they damp and sweep them over three or four times a day. I believe that washing introduces white ants.

3734. Have there been any complaints, at any of the stations which you have mentioned, of surface water lying about from want of drainage in the immediate neighbourhood?—No; if there were any it was instantly removed on being pointed out; the drains all round the barracks are washed and swept by commissariat sweepers attached to the quartermaster's department; there is a regimental establishment of lascars, sweepers, toties, carts, &c., quite sufficient to ensure perfect cleanliness in and around the barracks.

3735. Do you think that in that respect there was nothing left undone that should have been done?—The provision made by Government is ample. All depends upon the commanding officer personally seeing that all under him do their duty in this respect.

3736. (*Col. Durand.*) Are the requisitions always attended to?—Invariably.

3737. (*Sir R. Martin.*) It was difficult, I believe, to drain the ground about the barrack and hospital at Secunderabad, was it not, owing to its being an inconvenient locality?—There was a good fall from the barrack on the one side and the hospital on the opposite side; I never found any difficulty; there was a little accumulation of water, I remember once, but the quartermaster-general instantly cleared it off.

3738. Were new barracks constructed before you left that station?—No, none were thought of.

3739. (*Dr. Gibson.*) Where were the urinals usually placed?—Tubs were placed in the verandahs, and removed by the toties before gun-fire.

3740. During the daytime what was the arrangement?—Then the men went to the rear; the tubs were in the verandahs during the night, but there was nothing in the barrack rooms during the day in the way of urinals.

3741. (*Chairman.*) At the various stations to

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which you have alluded has there been, in your judgment, sufficient accommodation for the married men, who live, as I understand, out of the barracks in huts?—They do; at Moulmein the patchery was not sufficient for the number of married people; the married men of the right wing of the regiment had to build huts for themselves, and they incurred thereby a heavy pecuniary loss, as we were not replaced by another regiment, but only by a wing for whom the accommodation in the Government patchery sufficed. In Fort St. George all the married people were put into a large bomb-proof, which might be described as a hell upon earth. There was no privacy and no ventilation; one crying child would disturb half the place, and this was more than men's tempers could bear in that bilious climate. The scenes which ensued may be better imagined than described. Afterwards an old stable, or some gun sheds, were converted into quarters for the married people, whose health and morale improved from the moment they had separate and respectable accommodation.

3742. (*Sir R. Martin.*) Do the objections which you have stated apply generally to all the bomb-proofs throughout India, as being unsuited for occupation by Europeans?—Yes; but I am talking of married families being placed close together, with nothing perhaps but a sheet between them, in the same place, so that every sound is heard from one end to the other.

3743. (*Chairman.*) How many men are allowed to marry in a regiment?—Twelve per cent., exclusive of the serjeants.

3744. Was it the same in the Indian service?—The company's troops and the Queen's troops are exactly on the same footing, the regulations apply to both services.

3745. (*Col. Greathed.*) Do you prefer huts or barracks for the married people?—Huts; at Secunderabad the quarters for the married people belonged to natives, from whom they were rented. At Rangoon the married people were accommodated in barracks run up originally during the war, which had been made at Moulmein and put up at Rangoon; at Trichinopoly we built huts for ourselves.

3746. How did you provide a fund for building those huts?—Those huts were built out of the canteen fund, the three per cent. fund and coffee-room fund, but it was entirely at the risk of the commanding officer.

3747. Had you any hutting allowance there?—No; the huts cost from 70 to 80 rupees each, and each man paid two rupees a month as rent.

3748. (*Chairman.*) I think you have stated that you prefer huts in all cases to barracks for the married families?—Yes, I prefer them for the sake of the domestic privacy, and the consequent increased comfort and happiness they afford the married people. I think that each man should have his butt and his ben; but I would not make the huts too comfortable, that would be placing a premium upon matrimony.

3749. Does it lead to a great increase of expenditure to provide separate huts for the married people?—I should imagine not.

3750. (*Sir R. Martin.*) Materials and labour both being cheap in India?—Yes.

3751. (*Col. Durand.*) You do not think that it affects discipline?—Not injuriously; I think that all are likely to be more careful and better behaved when every married man has a hut to himself. In a barrack a man has only a part of the barrack partitioned off for him, and he has no comfort in going home to the society of his wife, for every word that is said is heard; on the other hand, I have seen the married men sitting in their little gardens smoking their pipes, with their wives and children playing about them; we never allowed a single man to go into the patchery without a pass.

3752. Did that, in your opinion, affect the general discipline of the regiment?—There was a regulation against any unmarried man going to the patchery without a pass, and that pass was given for one afternoon by the commanding officer; the married

people found this to be so great an advantage, that if a man did go into the patchery he was sure to be reported, and he was punished for disobedience of orders. I conceive that that arrangement promoted the comfort and respectability of the married people—that they had more self-respect, and conducted themselves far better than they did before.

3753. (*Sir R. Martin.*) It produced greater self-respect and greater contentment?—Very much so; the single men seemed to be satisfied that the married men were respectable and properly looked after, and, indeed, it seemed to have a beneficial effect upon the whole regiment.

3754. (*Dr. Farr.*) Was the pay of a married man sufficient to support a wife and family?—A European woman was allowed five rupees a month, an Eurasian three and a half, and each child two and a half. I think this is a solitary instance of a man's income increasing with his family.

3755. Do you think that an extension of the permission to marry would not be injurious in India to some extent, as in other places?—I think that the married men are the most healthy, and there is one class of disease which of course they are entirely free from, but the difficulty is on the line of march.

3756. Would you be disposed to remove all restriction upon marriage in the army in India?—No; I should have no objection to see the number of married people increased. The commanding officer must of course approve of a woman who is to enter his regiment, and a man must have some means of keeping her. We never allowed a man to marry unless he had 50 rupees to start with in the bank.

3757. Subject to those restrictions, you would not object to an extension of the number of married soldiers in each regiment in India?—No; but it is a heavy drain upon the canteen fund when marches are long and occur after short intervals.

3758. (*Col. Durand.*) A difficulty is felt in times of service when you have to leave them?—Yes.

3759. (*Dr. Farr.*) Marriage I suppose has a tendency to diminish the amount of debauchery, and of syphilis?—Yes.

3760. (*Col. Greathed.*) When you do leave the women they receive only five rupees a month?—They and their families continue to draw the Government allowance already mentioned, and the husbands allot them a portion of their pay. Our families did not accompany us to Burmah, and were separated from the regiment for nearly two years; during this time each woman was granted a rupee or two monthly from the canteen fund, the Government allowing them a fair proportion of barrack attendance and utensils. When the regiment took the field in 1857 Government issued rations to the families, but the canteen fund was not rich enough to give any allowance.

3761. That remittance from the men was made entirely under an arrangement made by the commanding officer, was it not?—It is done by what is called in Madras family certificates.

3762. Is that universal?—Yes; for instance, the Sepoys when going upon service to Burmah did not take their families with them, but they allotted to them so much of their pay, that is universal in Madras.

3763. (*Chairman.*) To what extent would you increase the permission to marry?—From 12 to 25 per cent.

3764. Have you at all calculated what the extra expense would be?—I have not; it would just be double the present expense if the number was kept up, which would seldom or ever be the case, more especially with the limited service of ten years. We have been under the 12 per cent.

3765. (*Col. Greathed.*) And not often up to 12 per cent.?—It happened that we were more than once stationed nearest to other regiments ordered home, and the married people volunteered to join us, on account of the small expense that they would incur in removing their things.

3766. (*Chairman.*) With regard to the occupations and amusements of the men, do you think that sufficient provision is made for them in that respect or not?—There are ball alleys provided in all the barracks, and the Government have latterly provided skittle grounds, skittles being certainly the most favourite amusement of the soldier, both at home and abroad; they have other games, like Eton and Harrow, which come in their appointed seasons, but skittles they play at all the year round.

3767. Has the experiment ever been made of utilizing the labour of the soldiers by encouraging them to learn trades?—We always had our tailors and shoemakers employed, our carpenters were in full work, and often the blacksmiths; there were one or two other trades who found full occupation among the officers and civilians in the cantonment; if the men had any trades, they were allowed to exercise them in Burmah; at Rangoon we had nearly one half of the regiment employed in levelling a stockade; some 50 or 60 of the men were employed as clerks in the various offices; before the natives from the other coast came over the men made a great deal of money, and their health improved.

3768. Do you think that the men are better conducted when occupation is found for them?—Decidedly, and they are more healthy.

3769. (*Col. Greathed.*) I think you said that the men were employed for a considerable time at Jackatalla?—There were 250 employed there; two companies, and all the tradesmen in the regiment were sent to Jackatalla to clear the ground and build new barracks. A very fine range of barracks was being erected while I was there, and the situation seemed well chosen; our men were at that time located in huts of wattle and dab.

3770. (*Chairman.*) That could only be done, I suppose, at a hill station. You would not, I presume, put European soldiers to work in the plains if you could avoid it?—From what I understand of the plains of Bengal, and from what I saw of them, they are rather different from Madras. I have seen no station at Madras in which at certain times there were not some of our men working in gardens, and they never seemed to suffer from it; we were most particular as to the hours during which they might work, and not getting wet during the rainy season. In Burmah the medical officer narrowly watched them and kept an account of the men who were at work to see whether there was a larger proportion of them going to hospital, but I think he found there were fewer; indeed the men became twice as strong, and improved in every respect.

3771. (*Sir R. Martin.*) You would regard the occupation of the men on the plains as preferable to being immured in barracks and leading a listless life?—Yes; at Kamptee, where the infantry are carried off with apoplexy, the horse artillerymen do not suffer from that disease in the hot season. I think that if workshops were found for them, and the men could work protected from the sun, that it would be of great advantage.

3772. You mean, I presume, in covered sheds?—Yes.

3773. (*Chairman.*) I suppose those could be erected at no considerable expense?—Yes. Lord Dalhousie published a Minute on leaving India, showing the advantages which had resulted from his administration, and in that Minute he reckoned the establishment of soldiers' workshops. I had never seen one, and as I was commanding a brigade at Rangoon, I immediately applied for workshops, quoting my authority. After some time I received an answer to the effect that they had no official knowledge of any such document as I had quoted, and therefore nothing was done.

3774. (*Colonel Durand.*) Have you ever known Europeans employed in magazines?—Never.

3775. (*Sir P. Cautley.*) In the Punjab workshops have been erected, I believe?—Yes, I have heard so.

3776. At one end of the barrack there is a work-

shop and at the other end a reading room, but I have understood that it depends very much upon the commanding officer how matters go on as to the men being employed in workshops?—I think that everything depends upon the commanding officer.

3777. As far as I can gather, no results have yet been arrived at as to these workshops?—I do not know as to the workshops. We had a reading-room crowded the whole day long, as we never allowed the men to be out between ten o'clock and four in the afternoon. It was supported by the voluntary subscriptions of the officers and men, and well supplied with newspapers and periodicals; boxes were sent out from Smith and Elder's every quarter, and the library contained at last 1,000 volumes, and was attended with very great benefit to the men. There was also a coffee-room, in which the men could have ginger-beer, soda-water, tea, and coffee, biscuits, sardines, jams, preserves, pickles, cheese, bacon, &c. from an hour before gun-fire till tattoo. Nothing of that kind was allowed to be sold in the canteen; the men had no amusements in the neighbourhood of the canteen, but we encouraged them near the coffee-room.

3778. Did you establish a gymnasium to enable the men to take athletic exercises?—One at Secunderabad similar to the one at Primrose Hill, and for about two months it was in full swing, but after that I do not think that half-a-dozen men ever went near it. They got tired of it, there was no excitement; they preferred foot-ball, cricket, and wrestling. A theatre also was a great source of amusement; it gave so many men occupation, and to the actual performers it was rather lucrative. The room was also used of an evening for glee singing, dancing, &c. by the various companies in succession.

3779. You took care to keep the canteen as far as possible from the place of amusement?—Yes. The object was to draw men from the canteen to the coffee room, the very smell of the liquor being a temptation; each man was obliged to drink his allowance at the bar and move on; no one was allowed to sit down in the canteen. There was an attempt made to induce the men to draw their malt liquor to drink at dinner, but they had not been accustomed to it, and preferred bolting their dinner and running off to the canteen, and drinking the porter fresh from the tap, as they said.

3780. (*Col. Greathed.*) There is a difficulty in carrying the beer about, is there not?—Yes, the men said that it got flat, and they did not like it.

3781. (*Chairman.*) The custom, I presume, with you was not to issue a spirit ration, but to allow the soldier to draw it, paying for it?—There is no spirit issued as a ration in India. Two drams daily for each man on the strength of the regiment may be drawn from the commissariat at the rate of two rupees a gallon, and it is retailed in the canteen at the rate of two and a half. More cannot be drawn, but I doubt whether the full allowance is ever drawn. The malt liquor is also received from the commissariat, and retailed at prime cost.

3782. What means are there of preventing a man, after consuming his own allowance, from consuming that of his comrade also, or of selling it?—At the bar of the canteen each man's name, by companies, is pasted down on a board, and against this board there are a number of pegs; there is the canteen serjeant present who supplies it, assisted by another non-commissioned officer, and as each man gets his dram a peg is pulled out; it is drunk on the spot.

3783. Do you think that in that way there is sufficient security against excess?—I think it is impossible for the men to get any more than their two drams.

3784. Do you think that the quantity of spirit which each man is allowed to draw is larger than it ought to be?—No. Arrack is not so powerful a spirit as either whisky or brandy.

3785. What is the quantity?—One dram after dinner, and one dram in the evening.

3786. What about is the quantity contained in a

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dram?—A large wine-glass full. The men are very fond of having them double, but we always made a man go out and come in again before he had the second dram.

3787. Do you not think that two wine glasses full of raw spirits are more than are good for the men?—Yes, I think so, when taken at one time.

3788. Do you think that there would be great discontent if that quantity was now reduced?—I think so, and that it would drive the men to the bazaar for liquor.

3789. You would probably therefore think that it is better to rely on those indirect influences which you have mentioned than to diminish the quantity?—Yes; a case of drunkenness should never be looked over, or any excuse made for it. Treat the soldier with due consideration at all times, so that he may imbibe some self-respect and self-control; I believe that men are, as a body, very much what they know your opinion of them to be.

3790. (*Sir R. Martin.*) At present the soldier looks upon the dram as his right, does he not?—Yes, and if he had gone to any other colony he would have drawn the same amount of liquor as part of his ration.

3791. (*Chairman.*) Have you considered the question of the hill stations, that is to say, of removing European troops from the plains and quartering them upon elevated sites?—The removal of the European troops into the hills would render the maintenance of a larger force necessary than if they continued to occupy the stations on the plains; the sheathed sword must be always in view of the natives; with regard to removing regiments to the hills, which had been some time in India, the probability is that 100 men in each regiment would suffer by the removal; there are various diseases which, by the medical regulations, are not allowed to be sent to Jackatalla or to the Neilgherry hills.

3792. (*Sir R. Martin.*) You allude to men suffering chiefly from bowel complaints?—Liver, dysentery, and rheumatism. The men are sent to the sanatoria once a year; if they could proceed in the same manner as officers do it would be of great advantage to them; but when the time comes it is frequently too late; the disease is too advanced for the soldier to be benefited; it should have been taken in an incipient stage. If men were sent to the hill stations in India at first they would enjoy nearly the same health as they did at home; but after going through a scorching in the plains for a few years, if they go to the hills, the probability is it is not so.

3793. If the men were in the first place sent to the hills their health would be preserved there?—Yes; I do not think the detachment at Jackatalla had fewer casualties in proportion to their numbers than the regiment at Trichinopoly; the regiment that succeeded us suffered considerably from dysentery; they had come from the Cape, and it is now admitted that the Cape is a bad preparation for India.

3794. The men endure dry heat for a short period at a place like Trichinopoly?—Yes, we were four years there, and then we went to Burmah. I thought four years rather too long for such an exhausting climate as that of Trichinopoly; three years would have been quite sufficient.

3795. (*Chairman.*) If there were frequent removals of regiments, or parts of regiments, to the hills, and from them again, would not that considerably increase the expense to the officers, and the expense also to the Government?—Yes; in Madras a march is looked forward to with some dread; for it is very seldom that a regiment moves in that Presidency without having an attack of cholera.

3796. And those who would suffer most would be those whose numbers you have already stated you would be glad to see increased, namely, the married men?—Yes, as far as expense is concerned.

3797. (*Col. Durand.*) Were you ever able to discover the cause of the unusual breaking out of cholera when marching in the Madras Presidency?—It is

generally attributed to bad water and over-fatigue; we escaped it; a case of cholera broke out on the last day of our marching into Trichinopoly, and one or two cases occurred after we got in, except that we had no cholera upon the march; we had one case or two when embarking for Burmah, but cholera prevailed then through the whole country.

3798. (*Sir R. Martin.*) Then your exemption from cholera was not from any precautionary measures which you took on the march, but from the circumstance that cholera did not exist in the country at the time?—We had gone through countries where cholera prevailed, and where other regiments had suffered.

3799. Were there no peculiar precautionary measures taken in your regiment?—We spared no exertion to keep the men sober, and from exposure to the sun, and they were well fed.

3800. (*Col. Greathed.*) Cholera generally breaks out among the married people on the march in Madras, does it not?—I am unable to say; we met a native regiment once which had cholera; we diverged, and moved on again, and went down the same road that they had come up, without cholera; proper precautionary measures are undoubtedly a protection against cholera. I can give an instance of it; at Trichinopoly, where the patchery was cleared away on one side of the barracks, and some acres of prickly pear grubbed up on the other, and a free circulation of air thus caused all around, cholera raged in the bazaar on one side, and passed over the infantry barracks to the artillery on the other side, but we had not a case. The surgeon of the regiment, in his annual report, attributed this entirely to the measures which had been taken, of a sanitary nature; he was a most able man, and is now the principal medical officer at the Ionian Islands.

3801. (*Chairman.*) You have never, I believe, been stationed on the Neilgherry Hills?—Never; I went up for 30 days once, having 250 men of the regiment employed at Jackatalla.

3802. Have you at all considered the possibility of stationing a considerable body of men there, now that railway communication is opened in all directions, or will be opened, to the foot of the hills?—I should say that political considerations must rule greatly in that matter. The plains of India must be occupied, and no expense should be spared to render the stations as healthy as possible.

3803. You lay considerable stress upon the importance and necessity of the troops being seen by the population?—Yes; I am of opinion that 800 men on the principal roads of communication, or near to a large town, would have more effect upon their minds than 2,000 men upon the hills.

3804. (*Sir R. Martin.*) Would not the natives of India, as elsewhere, be likely to magnify that which was unknown and remote; for example, supposing that a body of troops was known to be in the mountain ranges, within 10 or 15 miles, might not that take place?—I think that a designing native would inform the people that the troops did not exist there at all.

3805. (*Col. Durand.*) I presume you would think it important to crush rapidly anything like a disturbance?—Yes; a case occurred in 1857 of the 1st and 2nd Fusiliers and the 75th coming down from the hills; certainly they made forced marches, but they all had cholera by the time they reached Umballa.

3806. (*Sir R. Martin.*) That was, I believe, almost the only disease that visited them on the march?—Yes, I believe it was.

3807. (*Sir P. Cautley.*) But they were stationed at a place within hail of the plains?—At a distance of some 60 odd miles; I believe the 29th regiment suffered upon the Sutlej in the same way coming down.

3808. Supposing that the troops were further in the interior would they labour under still greater difficulties?—Yes; their transit would be more difficult and expensive. Stations have been selected at too great an altitude. From what I have heard of the hill stations for six months in the year the men are living in the clouds; the Himalayas have not the same table land as the Neilgherries.

3809. But to place them in the interior at Kunawur and at Chenee would be out of the question, politically speaking, would it not?—I do not know where those stations are; but I think the troops ought to be located where they can be seen, and then a much smaller force would suffice; soldiers are unproductive labourers; the fewer you require the less drain on home.

3810. (*Chairman.*) With regard to the dress and accoutrements of the soldier, is there anything that you think requires reform or improvement?—I do not think that the infantry shako is either a handsome or a comfortable head dress, or serviceable; I may say the same of his trousers and his greatcoat; but my objections apply to all climates.

3811. What is your objection to the shako?—It does not protect the temples or the back of the neck; those are the parts which require protection.

3812. (*Col. Greathed.*) Have you seen the helmet which is now issued?—Yes.

3813. Do you approve of it?—I think it is better certainly than the shako; my regiment went through the campaign with a forage cap having a large peak in front, and another behind, with a padded cap cover, and a large curtain falling down behind. As these were either lost or destroyed they were replaced by helmets.

3814. (*Sir R. Martin.*) You attach much importance to the neck being covered?—Yes, and I think it would be a great improvement if every man had a cummerbund, instead of a belt or braces, round his loins.

3815. (*Col. Durand.*) Do you mean outside the tunic?—No, inside if the tunic was made large enough to go over it.

3816. (*Chairman.*) You think that the greatcoat is defective?—Yes; it soaks up all the wet. In Burnmah during the monsoon, our greatcoats were never dry for five months, and in two years they were destroyed.

3817. Was that the fault of the coat, or of the climate?—I think that it had a good deal to do with the climate, but the cloth does not turn off the wet; it is like a sponge, a shower soaks it through.

3818. Would there be, bearing in mind the necessity for economy, any saving of expense in substituting a better material?—I think there would; that it would last longer, and conduce to the health of the soldier.

3819. (*Col. Greathed.*) Have you had any of the new pattern greatcoats before you?—No.

3820. (*Chairman.*) You stated also that the trousers were faulty?—Yes; they are made of a thick, hard, woody material.

3821. And therefore chafe?—Yes; tweed or tartan would be better.

3822. (*Sir R. Martin.*) The trousers are also usually much too tight, are they not?—Yes, they are, and they shrink; they are made of bad material. I believe that there is something peculiar in the dye that spoils the cloth. The stock might be done away with, low as it is in India; a handkerchief would be much better.

3823. (*Chairman.*) Has not the stock been greatly modified already?—Yes, very much; it is much lower.

3824. (*Col. Greathed.*) Do you think that what are called knickerbocker leggings would be a good dress for India, speaking with reference particularly to the spear grass?—No, I think not; except on service men would not be required to go through the grass, and you must dress the soldier not only for service, but also to walk the bazaars.

3825. (*Chairman.*) Reverting for a moment to the question of the head dress, do you think it is of much consequence that a little should be added to the weight, provided efficient protection against the sun is secured?—I do not think that a soldier cares what weight you put upon his head, for he generally fills his shako full of something or other.

3826. (*Sir P. Cautley.*) The proper fitting of the

shoe is a matter of great consideration, is it not?—It is very essential, but except in Burmah, or on the hills, the natives make very cheap and comfortable shoes, which the men always wear.

3827. But they are fitted to each man?—Yes; the cost of them is a rupee.

3828. (*Sir R. Martin.*) Would you prefer them to the English highlow?—Yes, in hot weather.

3829. Not for marching in India?—Yes, unless you came into wet weather; then the men are glad to put on their ammunition boots.

3830. (*Sir P. Cautley.*) I believe that only a few of the common ammunition boots and shoes which are sent out fit the men?—They are made according to sizes. The men are brought to the quartermaster's stores, and each man fits himself; if there are men who cannot be fitted they have a pair made in the regimental shoemaker's shop and receive the difference of price as compensation.

3831. (*Col. Greathed.*) The sizes are sent home by the quartermaster, or by the commanding officer?—Yes.

3832. It depends, therefore, upon the quartermaster whether the men are comfortably fitted with boots?—I know that that is done with regard to the clothing, but I am not certain that the sizes of the boots are sent home. I think that they send out sizes for every hundred.

3833. Might that practice, in your opinion, be improved?—I never found above five or six men who could not be well fitted.

3834. Do the men wear the ammunition boots without making them over?—They were generally made over, as the stitching usually gave way from the effects of the sea voyage; the men generally had them made over.

3835. (*Sir R. Martin.*) Did they not require softening?—Yes, in the hot weather; and that was another objection to the shako; for not being frequently in wear, when a man took it down to put it on, it was like a piece of wood, and he could not get his head into it; before an inspection we were obliged to have three or four parades in shakos, or they would have tumbled off the heads of the men when they attempted to move.

3836. (*Chairman.*) Do you think that sufficient provision is made either in barracks or hospitals for personal cleanliness?—Regulations came out some years ago to provide ample accommodation for that purpose, which were being carried out by the engineers. Good baths were provided, plunge baths, basins, and a good supply of water; I think that unless they had been stopped for want of money very satisfactory arrangements were being made for that purpose.

3837. (*Dr. Farr.*) You have mentioned some statistics with regard to your own regiment which appeared to be interesting; what regiment were you attached to?—The 84th.

3838. I have before me a return of the mortality in that regiment, during three years, at Trichinopoly. At what date did you join that regiment?—In 1835.

3839. You went to Moulmein?—Yes, in 1842.

3840. Have you any memoranda of the mortality which your regiment suffered while at Moulmein?—I have not.

3841. How long did you remain at Moulmein?—Till March 1845.

3842. What was the strength of the regiment?—1,064.

3843. Of those taken there originally how many did you bring away?—93 landed in England in 1859.

3844. If those records are to be obtained perhaps you will have the kindness to append them to your evidence?—Yes.

3845. You went from Moulmein to Trichinopoly, I think?—No, to Fort St. George.

3846. Do you recollect the strength of the regiment there?—Very nearly a thousand strong; and at Secunderabad more than a thousand.

3847. Can you state what the mortality there was?

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—I do not know what the mortality was, but we had another attack of cholera.

3848. Did you lose a great many men there?—50 or 60; we went to Secunderabad next.

3849. After leaving Secunderabad did you go to Trichinopoly?—Yes.

3850. Was the mortality there large?—Less than anywhere in India to the best of my recollection; I think we lost 14 men in the first year, and two or three more each year afterwards.

3851. The return before me gives the rate of mortality at about 20 in a thousand at Trichinopoly?—Yes, but there is one thing, with regard to the mortality in Indian stations, which is not I think taken into account, I mean the casualties amongst the invalids. Men are sent to the coast for embarkation, of whom many die *en route*.

3852. But still they would appear in the Adjutant-General's returns; every death, I believe, does so appear?—They would appear as casualties in the regiments. All casualties in the Madras Presidency are published in the Fort St. George Gazette, with full particulars.

3853. But every death does not appear in the returns of the Director-General?—Not as having occurred at a particular station, I imagine, though caused by the climate of that station.

3854. So that the returns that we have of the mortality at the different stations in India are understated?—I conceive generally that they are. Accidents are, however, included; and some regiments are most unfortunate at times in the numbers thus lost.

3855. Trichinopoly is notorious, is it not, on account of its heat?—It was the hottest place I was ever stationed in.

3856. You would not therefore attribute the excessive mortality which takes place in the British army in India to mere temperature?—No, not where it is equable, as in Trichinopoly; that was our most healthy station, and we had very inferior accommodation.

3857. The mortality on the other side in Burmah is excessive; what circumstances did you observe in Rangoon to which you would ascribe the high mortality there which the British troops suffered, and which did not exist at Trichinopoly?—I do not think that the mortality was high in Rangoon, although sickness increased in the third year of our stay there, which I attributed in a great measure to the insufficiency of food; everything was so dear, the ration consisted entirely of very inferior beef; the men had no mutton, fowls, butter, milk, or fish, and those things they had been in the habit of buying at other stations.

3858. (*Sir R. Martin.*) Fruit and vegetables were also deficient were they not?—Yes.

3859. (*Dr. Farr.*) The commissariat arrangements were defective, I suppose?—No; no Europeans had ever to complain of the Madras commissariat; the country did not produce those things; the commissariat were anxious to do everything that they could, but the country did not produce sufficient for the large number of Europeans suddenly thrown into it; vegetable gardens were established there in 1857.

3860. (*Sir R. Martin.*) The climate of Rangoon also presents a great contrast, does it not, to that of Trichinopoly?—Yes.

3861. At Trichinopoly there is a high temperature and a dry atmosphere?—Yes.

3862. In Rangoon the atmosphere for six months in the year is saturated with moisture, is it not?—Yes; I think you might say for nine months.

3863. (*Dr. Farr.*) Is Rangoon surrounded by marshes?—Malaria arises from the jungle at times, and very heavy fogs, which do not clear up until 10 or 11 in the day; Moulmein was the same in that respect.

3864. There is a considerable force at Rangoon at the present time; are there no points where the men could enjoy better health than at Rangoon?—Not that I am aware of. Lord Dalhousie pointed out the

very best site in the cantonment, which was given to the European troops.

3865. (*Sir R. Martin.*) Near to the Great Pagoda?—Yes; the barracks are excellent; there were good bath houses and no want of water; there was an excellent lake near at hand in which the men could always bathe, and upon which they also had a boat; every regiment in Burmah had one boat per company furnished by Government.

3866. (*Dr. Farr.*) Upon your return from Burmah to what station did you go?—To Cawnpore and Oude. I was separated from the regiment.

3867. You have not had much experience in what are called hill stations?—None whatever.

3868. How high did you go up the valley of the Ganges?—To Futtighur.

3869. When you stated that you were of opinion that the troops should not be stationed far away from the site of the population, did you refer particularly to the population of the large cities of India?—Yes.

3870. Such as Calcutta and Delhi?—Yes; and on the principal lines of communication where people are passing backwards and forwards.

3871. You know nothing, I suppose, of the Rajmahal Hills?—No.

3872. At Hazareebaugh I find that there are troops stationed, and that there is table land there?—One European regiment has latterly been stationed there; but for some years before the mutiny it had been unoccupied by European troops.

3873. During the last mutiny the danger did not proceed from the population of the country, but rather from the native troops?—Yes, at first.

3874. And for the future we have rather, have we not, to guard against the movements of native troops than against the populations of the cities?—That, I think, is more a question for a politician.

3875. (*Sir R. Martin.*) As a matter of fact the people of the towns in India were only disturbed by the existence of a military mutiny around them?—I think that in the cities and towns the Badmashes were quite prepared to murder and loot; and as far as my observation went, few black faces were at heart friendly to us.

3876. (*Dr. Farr.*) You would not object to troops being placed in unhealthy stations where they would be serviceable in case of necessity, for example, where great strategical points had to be kept open?—I do not think that military and political considerations should be entirely set aside for medical ones.

3877. Do you not consider the mortality in the army a very important point to consider, even from a military point of view?—Yes, most important.

3878. If the loss in the British army in India continues to be as it now is, 150 or 200 men out of 1,000, is not that a very important matter for consideration?—Yes; but I had no idea that the mortality ever reached that point. For the 14 years previous to 1857 the mortality in the 84th regiment averaged only 30 per 1,000.

3879. I mean during their term of residence in India. You would, I presume, be disposed to place the troops generally in stations where they would be likely to enjoy the best health?—Yes; provided the security of the country was not sacrificed.

3880. (*Colonel Durand.*) Have you had an opportunity of forming an opinion as to the best age for recruits to join their regiments in India?—I should say that from 19 to 22 is the age at which a man should go out to India. More attention should be paid to the time at which recruits embark; they should land at the very commencement of the cold season, and be marched off at once to the hills to join depôts, where they might remain for a couple of years until their frames were fully set. I think depôts on the hills superior to depôts in this country, less expensive, less debauchery, less sickness, and no desertion. Recruits would grow into finer men, more capable of work, and who would preserve their efficiency longer. Many of these lads contract at home diseases of the heart and lungs, from carrying their packs, over drill-

ling, and night duty, before their muscles are fully developed.

3881. (*Dr. Farr.*) Do you not think it important that the commanding officer should ascertain precisely the rate of mortality in his regiment year by year as compared with other regiments?—The commanding officer has a perfect knowledge of every casualty in his regiment.

3882. I mean that he should have a record of the mortality constantly before him, in order to see precisely what the sanitary state of his regiment has been year by year ?—That is all before him.

3883. But some difficulty would be found if we wanted to ascertain the mortality of every regiment to India during the last century in arriving at it from existing records?—We had a record of that in my own regiment. I think there would be no difficulty from the current century ; returns might be called from the regiments recently returned home ; I kept an account of the number of deaths in the regiment, and of the number of men who joined, and what became of every man every year. We went out 1,000 strong, and I think 1,240 joined us in India ; the regiment was there 17 years.

3884. You do not know what your losses were?—No. I can ascertain them: there are, however, many casualties besides deaths in a regiment, such as invalids, discharges by purchase, desertions, transfers, &c.

3885. (*Dr. Sutherland.*) As I understand, certain parts of the station at Secunderabad are healthy and certain parts are unhealthy. I think you stated that the artillery barracks at Secunderabad were healthy?—Yes; the artillery did not suffer in the same degree that the infantry did.

3886. Will you be good enough to state what is the relative position of those barracks as compared with the others?—They stand higher, on a ridge, and they were never overcrowded, indeed while we were there they were never fully occupied.

3887. Were they more exposed to the winds?—Yes.
3888. Are the facilities for drainage greater?—
Yes, they must be.

3889. Whence do they derive the water supply for the artillery?—That I do not know.

3890. Not from the same wells as the infantry?—No; all the water for the infantry barracks is supplied by a large well within the barrack wall.

3891. But the artillery do not derive their supply of water from the same source?—No.

3892. Are the artillery barracks, from their construction, better adapted for ventilation?—I should think not, not so good, excepting that they are in one line and the infantry barracks are in two squares.

3893. Then the artillery barracks are better venti-

lated, are they not?—The air gets more freely round them.

3894. The artillery barracks have an advantage in local position, in means of drainage, and in means of external ventilation, and they do not derive their water supply from the same source?—Yes.

3895. (*Sir R. Martin.*) Referring to what you have stated about recruits, I suppose you would agree in the conclusion arrived at by experience in the French army, that 23 is the earliest age at which a soldier should be put to full work ?—It is quite soon enough, where a man has to carry his knapsack and do his work with that weight upon his back. I may state that sufficient attention is not paid to what the troops eat in India. In many regiments toddy is allowed in the barracks ; the men require something besides their bread and tea at breakfast, and in some regiments the native cooks are allowed to buy all sorts of abominations, in the bazaars : bad pork, bad eggs, and fowls which probably died of disease. We had a regimental arrangement, and made a contract every quarter, for the purpose of supplying each man for his breakfast with 8 ounces of mutton, and for the evening meal six ounces of bread in addition to the full ration which was supplied by the Indian Government.

3896. (*Chairman.*) But is not that a very large quantity of animal food for the climate of India?—The meat in India is rather inferior in quality to what it is at home. I do not suppose that that came up to what the officers were eating.

3897. (*Col. Durand.*) I believe that the proportion of meat and bone is different in India?—They are much fairer in India about the bone than they are in this country.

3898. (*Dr. Farr.*) Did your men go out and take much exercise in the sun?—No; they were always confined to the barracks from 10 till 4 in the afternoon, the whole year round, and that was the time when we had a difficulty in finding employment for them; we were not able to supply the extra allowance of bread and meat in Rangoon, because things were so dear there, and the men were unable to buy anything for themselves. We could only ration the soldier up to 4s. $4\frac{1}{2}$ d. a week.

3899. (*Sir R. Martin.*) Did salt meat form any part of the ration issued to the men in Burmah?—It was allowed to be issued twice a week ; sometimes it was when the commissariat could not get cattle, or because they thought the cattle not very good, however the men preferred the inferior washy meat to the salt ration.

3900. (*Chairman.*) Is there any further observation that you would wish to add to your evidence?—None.

The witness withdrew.

ADDENDUM.

RETURN of STRENGTH and MORTALITY in the 84th Regiment from 1842 to 1859.

Landed at Moulmein in 1842		-	-	-	-	Sergts.	Drums.	R. & File.	
						-	50	19	
995 = 1,064									
Joined during	-	-	1842	12	Died during	-	-	1842	11
			1843	26				1843	53
			1844	70				1844	27
			1845	43				1845	48
			1846	123				1846	14
			1847	142				1847	41
			1848	11				1848	36
			1849	2				1849	34
			1850	14				1850	28
			1851	79				1851	15
			1852	65				1852	16
			1853	61				1853	28
			1854	89				1854	32
			1855	37				1855	28
			1856	165				1856	27
			1857	205				1857	274
			1858	104				1858	90
								1859	15
				<hr/>					<hr/>
				1,248					817

Of the number landed at Moulmein in 1842, 93 landed in England in 1859.

Brig.-Gen.
Russell, C.B.

18 May 1861.

Colonel
Sir P. Cautley,
K.C.B.

18 May 1861.

Colonel Sir PROBY CAUTLEY, K.C.B., Member of the Council of India, examined.

3901. (*Chairman.*) How long have you served in India?—I was in India 34 years, including two years on furlough.

3902. You were entirely, I believe, in the Bengal Presidency?—Yes.

3903. At what stations were you quartered?—I must explain that I was only six years on regimental duty, and those were my earlier years—from 1819 to 1826. I may say that I left regimental duty after the siege of Bhurtpore, and I never joined the artillery again, being always employed on canal duties, and in the north-west provinces; therefore, I was entirely separated from the army.

3904. But you have nevertheless had some experience, as to the nature of the different stations at which you have been?—My early stations were Dumdum, Cawnpore, Sultanpore, in Oude, and Agra, and in later days, while serving in the canal department, I was a good deal mixed up with Cawnpore, Delhi, Kurnool, and stations in that neighbourhood; also at the hill station of Mussoorie and Landour.

3905. Did you observe at the stations with which you are acquainted, in the last few years of your stay in India, any want of drainage as a general defect?—A good deal; but latterly great alterations were being made; for instance, at Cawnpore I carried the Ganges canal through a part where the bazaar was very thickly populated, and that led me to be connected with the drainage in general of the place. After I had made my clearances and a road of about 300 feet in width, through the portion of the bazaar to which I have referred, and having drained to the right and to the left, as far as I could, the Lieutenant Governor ordered a survey of the whole place to be carried out in connexion with my operations, and I believe that was done, but I never heard the result. I left India before it was completed. Although Cawnpore is situated on the edge of the river, the high water of which even is considerably below the surface of the ground, the drainage is bad, and I can only trace it to this reason, that the drainage of cantonments was generally done in detached bits, and not upon a comprehensive plan; whereas, if the drainage had been carried out comprehensively, I have no doubt it would have been effectual.

3906. (*Sir R. Martin.*) You speak, I presume, in reference to the surrounding levels?—Yes. To give the Commissioners an idea of the state of these bazaars, I may mention that the natives build their huts entirely of mud dug out of holes as near as possible to the place where they build. In the Cawn-bazaar I came upon ponds full of black mud and all sorts of filth, and the whole place was utterly unventilated, which was a very remarkable illustration of how ill health was produced, not only in the immediate neighbourhood, but all round the place. This was converted into an open road of 300 feet wide, through the centre of which the canal ran, and to the right and the left there were trees planted, as they are seen on the boulevards abroad. That was a very great improvement. It was effected in 1851 and 1852.

3907. The practice of pond making as a receptacle for the refuse matter is common to every town bazaar in India, is it not?—Yes; always. They dig the mud for their huts close by, and do not fill in the hole again.

3908. (*Chairman.*) And then the hole serves to throw all the filth of the town into?—Yes.

3909. And there it remains exposed to the sun?—Yes; and as a bazaar becomes thicker and more populated, those places become more confined and unventilated.

3910. I presume that the neighbourhood of a bazaar frequently becomes a serious nuisance to a station?—I have no doubt of it; a very serious nuisance; but these things are very much more attended to now as to laying out bazaars, than they used to be. Old Cawnpore is a mass of different

bazaars, established by different magistrates and civilians, who made gunjes and bazaars, and that has led to the collection of an enormous mass of buildings.

3911. To what distance do you suppose the bad effects of such a place as you have described would extend themselves, or how far round every station should all such nuisances be removed?—Taking Cawnpore as an instance, I should certainly remove them all to the limit of the boundary of the cantonment, and if there was anything within a quarter of a mile beyond, that was very bad, I should have that removed also.

3912. (*Col. Durand.*) You would, I presume, attach great importance to systematic draining in the first instance?—Yes, to a comprehensive system of draining. If that were done, it appears to me that in places like Cawnpore, Delhi, and Kurnool, there would be comparatively no disease.

3913. (*Sir R. Martin.*) Has there been in any place with which you are acquainted a system of contour lines established, with the view of fixing the relative levels of the different localities?—No; but in the survey of Cawnpore it was directed that those contour lines should be laid down on permanent maps, so that there should be no mistake about them.

3914. With bench marks?—That would be a very good plan; but we merely put them on paper.

3915. (*Dr. Farr.*) Did the nuisances to which you have referred at all affect the barracks at Cawnpore?—The military station is very much detached at Cawnpore; there is a line of six miles of cantonment along the edge of the river, and at detached points are the barracks. I have no doubt that the nuisances to which I have referred did affect health.

3916. It appears by the returns that the mortality at Cawnpore is frightful, and that it is caused chiefly by fever, dysentery, diarrhoea, and cholera?—Yes.

3917. The mortality appears to be 91 in 1,000, while at Trichinopoly it is only 20 in 1000; and there are 260 attacks of sickness for every 100 men. Do you ascribe a good deal of that to the very bad sanitary condition of the station?—I was not aware before of that extraordinary mortality; but hearing it now, I should say that it was on account of the state of the station, the want of drainage, and the filth in the bazaar.

3918. (*Col. Greathed.*) Was not the refuse from the bazaar carried through the infantry station into the river?—It was, and this is a very good exemplification of the way in which drainage is carried out in those places. The station at Cawnpore stands on the edge of the river, and there are a number of natural ravines running into this river, the natural drainage of the place; these are taken possession of by the engineers or other officers, and worked upon as well as they can; they are tortuous and very crooked, and they get stuffed up with filth, and then the only thing that is done to remedy the evil is every now and then to clean them; but they never give perfect drainage. One of those drains ran near the church through the infantry lines.

3919. (*Sir R. Martin.*) I presume that there was a good deal of percolation of the refuse matter?—No, I do not think there was any percolation, for it is rather an impervious soil there.

3920. Then it was more retention?—Yes.

3921. (*Dr. Farr.*) Cawnpore is now occupied by a considerable force, and I suppose is likely to be so occupied?—It is very much altered now; they have thrown the whole of the cantonment, I believe, on the right of the canal.

3922. (*Col. Greathed.*) Where the dragoon lines were?—Yes.

3923. (*Dr. Farr.*) You have no doubt that by proper drainage arrangements the station at Cawnpore might be made much more healthy than it was when you were there?—I think so.

3924. Would it be necessary to incur very con-

siderable expense?—No, I should say it might be done at no considerable expense.

3925. It might be easily drained at a moderate cost?—Yes.

3926. There is a chance, you think, that this heavy mortality among the troops would be considerably reduced by a moderate expenditure on drainage?—Undoubtedly the health of the station would be improved by that drainage.

3927. And that of the native population also?—Yes, undoubtedly.

3928. (*Col. Greathed.*) Do you consider that Cawnpore is a fair illustration of the general defects of drainage in India?—Yes, a very good illustration.

3929. (*Sir R. Martin.*) Perhaps an extreme one?—Yes.

3930. The station itself is not considered a healthy one, I believe, without regard to its sanitary defects?—It is considered a very disagreeable station, because in hot weather there is a great deal of dust. I am not aware that the officers and others who reside there consider it to be an unhealthy station.

3931. So that under proper sanitary regulations it might be brought to about the average condition of healthiness for European troops?—Yes; it lies in a position which offers every facility for doing that, I should think.

3932. (*Chairman.*) Are there any other stations with the drainage of which you have made yourself acquainted?—There is Meerut; but I will first mention a place which is not actually a military station, but which was drained upon a comprehensive plan; I allude to a place called Shamli, in the northern Doab; it is a large town and very much inundated, and in the rainy season was very unhealthy. It is upon the edge of a little twisting tortuous nullah, which was the only escape for the water, and the road fund committees used to be constantly clearing out this little nullah, and trying to remedy its defects, without, however, coming to any result. This went on for some time, until at last it was proposed to treat this little twisting nullah with utter disrespect, and make a straight line of ditch from it into the Kirsunni River, and the effect of it was marvellous; there was never any collection of water afterwards near the town of Shamli. About a year before I left India the Canal Department was called upon to look at Meerut, that was in 1853, and Colonel Baird Smith recommended the same process there, and instead of sticking to a little nullah for the purpose of drainage he suggested a wide open ditch to be made into the deep bed of a river not far off. I never heard the results of that, but I believe it was successful.

3933. (*Dr. Farr.*) You would use open drains in all cases?—Yes.

3934. Do you think it would be necessary to use pipes, or such means as are employed in London?—I should say that it was better to leave them open.

3935. (*Chairman.*) I suppose they would be more easily repaired?—Yes, you can better see the defects.

3936. If there is any obstruction you can see where it is?—Yes, and get it cleared out directly, and it is done cheaply.

3937. (*Sir R. Martin.*) Hand labour in India being so easily procured and so cheap?—Yes; I may mention Delhi again as another instance. The town of Delhi was also taken up under Major Wilberforce Greathed, who was with me at that time, and he was very successful in draining the interior of the city, which was very badly drained before, by a system of under drains running into the Jumna, and I believe they got rid of the water entirely.

3938. (*Dr. Farr.*) From Calcutta upwards I believe all the towns are at present insufficiently drained, and you believe that at a moderate expense they might be effectually drained?—Yes, I think so. I think that that is the complaint which is very generally made, want of drainage.

3939. They have no such simple drains as those you have mentioned, and which might be made at a moderate expense?—I am not aware of any. It is obvious, I think, why this state of things exists, and it is simply for this reason, that these matters are done bit by bit. When a cantonment is first marked out the first thing ought to be to attend to the drainage, and it is now, I believe, attended to, but formerly it was not attended to, partly from one circumstance, and partly from another. Cantonments were hastily taken up.

3940. On sanitary grounds in such a climate as India you consider drainage of the first importance?—Yes.

3941. Are the hill stations drained, or are there any local circumstances in the hill stations with which you are acquainted that would explain the difference in the mortality there?—There are certain points; I speak particularly of Landour which I know very well; the position is very elevated, and there is very little flat ground there, but there are deep ravines, and all the refuse and dirt is thrown down these ravines and allowed to remain, and so very bad is it at times that a person is obliged to avoid walking in the neighbourhood.

3942. Ordinary precautions are not taken in those hill stations, because they are elevated, and therefore easily cleansed?—From what I have observed I should say that that is the case, and that that matter might be better attended to.

3943. (*Chairman.*) What do you think could be done at a station like Landour, there is no water there to carry away any impurities?—No; but they might be taken to a greater distance. The men and women might be prevented from doing certain things within a certain distance of the place, and I think if there were any method of preventing that sort of thing being done at the very doors as it were of the cantonment, it would be a very great advantage; but those ravines and hollow places all about the hill stations make it very difficult to prevent it from occurring.

3944. (*Dr. Farr.*) It would seem that any station by such habits of neglect might be made unhealthy?—I should think so.

3945. (*Sir R. Martin.*) And the more crowded with occupants the place is the more unhealthy it becomes, owing to such neglect?—Naturally.

3946. (*Dr. Farr.*) Therefore we should not be surprised to find diarrhoea and other diseases caused by the filthy condition of those stations?—In those hill stations, particularly at Mussoorie and Landour, diarrhoea is attributed to the water; that is invariably the case, and I have known people going up there take their own water for drinking purposes.

3947. Do you know anything chemically of the composition of the water in the wells of India generally?—No.

3948. (*Chairman.*) Is proper care taken to preserve the water that is used from accidental impurities?—I believe so.

3949. Have you at all considered the question of providing gardens for the soldiers?—Not directly. I have never been in any stations where gardens were established, but I have always understood, in fact, I recollect talking to Sir Henry Lawrence not long before I left India about those very gardens, and he seemed to think that the men did not take to them willingly.

3950. (*Dr. Farr.*) Not the single men?—No. I suppose the married men had little detached gardens.

3951. (*Chairman.*) To what do you ascribe the indifference of the men; is it because they do not stay long enough at one station to feel any interest in them?—It has always struck me that they consider it to be work rather than amusement, and, certainly, taking 100 men, a very small percentage of those men, as you usually find them, would be found willing to work in a garden. It depends very much upon the commanding officer both as to the amusements found for the men and the gardens.

Colonel
Sir P. Cautley,
K.C.B.

18 May 1861.

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3952. (*Col. Greathed.*) I believe there is no difficulty in inducing Scotchmen to work in the gardens?—No.

3953. (*Chairman.*) Do you think that more might be done than has been done in the way of providing employment for the men, such as establishing workshops for them in various trades under cover?—The difficulty always appears to me to be how to supply them with tools. I know very well, from the difficulties I have met with myself, the very great difficulty that there is in procuring tools, and I do not understand exactly how the men, if you had workshops for them, would be supplied with tools.

3954. Do you not think that the tools might be kept at a station, and that they need not be taken about from station to station?—Do you mean that they might be supplied by the Government?

3955. Yes, and remain the property of the Government?—Yes; I consider that the workshops, and the employment of the men in their different trades, would be a most admirable way of giving them occupation. General Tremeneere told me the other day that every barrack in the Punjab had a workshop and a reading room, one at each end of the barrack; I do not know what results have come from that.

3956. Therefore the experiment is being tried now?—I understand that it is; I never heard of it before, but I think it appears evident that anything in the way of occupation must be beneficial to the men.

3957. (*Sir R. Martin.*) You think that the men should be encouraged by their officers to do whatever they can do without injury to their health or discipline?—Yes, I think so. At Mussoorie, where I built some houses, I found that I got very good men to work from the Landour barracks; for example, slating, which is a thing not practised there generally, and not well understood by the natives, was done by a European, whom I employed for some time.

3958. Did he do the work to his own profit?—Yes; he was paid by me so much a day; I do not recollect how much; but I paid him so much a day, and the men from the barracks found a good deal of employment in that way.

3959. (*Dr. Gibson.*) Was he a soldier?—Yes; and they do other work, such as watch-making and mending saddles. I have had saddles repaired in that way by a man in the regiment.

3960. (*Chairman.*) You do not think that there is any indisposition among at least a considerable proportion of the men to occupy themselves in that way provided it is made worth their while?—I should think there is none. As exhibiting the views of soldiers themselves on the point, I beg to hand in some letters forwarded by General Tremeneere, as samples of evidence which, in his opinion, could be obtained to any extent, of the advantages of occupying the soldier's spare time in industrial pursuits.

Referring again to Delhi, I spoke only of the town before; there is a cantonment close by the line of a nullah, which runs from a very extensive jheel, and the unhealthiness of the place arose I fancy from this Nudjuffgurh jheel. I was present there in the earlier days of that cantonment being established; I was there indeed before it was built; I was under the officer who constructed the cantonment, and I believe that had proper attention been paid to the opinions of the natives themselves, the cantonment would most likely not have been placed where it was, for the character of the position taken up with reference to the Nudjuffgurh jheel, although it had been partially drained, was notorious amongst the natives.

3961. (*Dr. Farr.*) Was that the reason why so few troops were stationed at Delhi before the mutiny broke out, that is, because of its being unhealthy?—It was a station that was never liked by the people; it was very hot, and on the slope of a quartz rock; a series of quartz and sandstone strata. Every care was taken, and it was one of the prettiest cantonments that I ever saw as to its design and buildings, and great expense

was gone to in sinking wells through rock to procure good water.

3962. But it was defective in drainage?—It was owing to the proximity of the Nudjuffgurh jheel, and this nullah which ran through at the bottom of the slope upon which the cantonment was placed—this nullah was always objectionable.

3963. Could it be by engineering means purified?—No, I do not think it could.

3964. It would appear then that it is impossible to make that station healthy without an immense expenditure?—I think that the neighbourhood of the Nudjuffgurh jheel is against the position of the cantonment, and it is singular because the interior of Delhi itself was one of the most healthy places in all the Bengal presidency. There were two lines at Nuwabgunj and Duriowgunj, one on one side and the other on the other side of the king's palace, in the centre of the city, which were the most healthy cantonments we had. I am now talking of the native troops.

3965. You would naturally expect that a city situated as Delhi is would be as healthy as any part of India if such nuisances did not exist in the immediate proximity of the station?—Yes.

3966. Did you observe at any time that the drainage works caused ill health among the men that you employed either Europeans or natives?—No.

3967. Do you think that the canals are causes of insalubrity when in proximity to the stations?—I think it is rather the abuse than the use of irrigation which causes insalubrity, but the abuse is so difficult to remedy that you can hardly accept that as an excuse perhaps; for instance, in irrigation a native when he irrigates from a well divides the whole of his field off into little squares, or kyaris, into each of which he pours the water from the well separately, and therefore the whole becomes perfectly and nicely irrigated, but immediately he gets a flow of water from a canal he takes away all his kyaris, and lets the water flow over the whole field which, not being levelled, is left one half of it dry, and the other so much overflowed that I have known very serious reports made by the civil authorities, who were not acquainted with the irrigation of the district, against canal irrigation from that circumstance, whereas it was not from the fault of the canal, but the fault of the people who used the water.

3968. (*Col. Durand.*) The native when he has an easy command of a large quantity of water does not husband it as he does when the supply of water comes from a well; he is then more careful of it?—Yes, precisely.

3969. (*Dr. Farr.*) The water so wasted becomes a cause of disease, such as ague and intermittent fevers?—Yes, and I believe that where water is in large quantities, and where it is allowed to stagnate, or where there is a considerable difference in the level of the ground, some parts being dry and some parts being wet, that that is the source of malaria. That is exactly the position in which all the rice cultivation is in Italy and in countries where irrigation has been long practised; it is so well known that rice is not allowed to be cultivated within certain distances of large cities—Milan is an instance.

3970. Long experience has shown that irrigation under those circumstances is the cause of ill health?—Yes.

3971. Do you think that such engineering arrangements might be made as would get rid of the injurious effects of irrigation?—Yes. There was a medical committee, of which Dr. Dempster was a member, which enquired into all the evils arising from the malaria and canal navigation in the north-west provinces, and he stated in his report that he found whenever there was a soil of a very tenacious character, and where the water used in great abundance was allowed to stagnate there, ill health prevailed, and the particular disease upon which he formed his opinion was spleen.

3972. (*Sir R. Martin.*) Spleen being the result of intermittent fever?—Yes. He found that wherever

there was a tenacious soil, and water was used in large quantities, spleen existed to a great extent, and when the soil was not tenacious, and the water ran off, there was less fever.

3973. (*Dr. Farr.*) Do you think it is important that sanitary considerations should be in some way connected with engineering in planning works of irrigation so as to secure such arrangements being carried on as would prevent insalubrity being produced?—No, I do not think that an officer for sanitary purposes should accompany the engineers. I think that the causes of insalubrity are so well known to any officer who had common intelligence that he would prevent it as far as he could. The rules which the committee to which I have referred laid down were rather stringent ones, namely, that there should be no canal irrigation within five miles of large military cantonments, and that there should be no canal irrigation within one or two miles of large towns and 200 yards round villages. The consequence of that would have been, or it may be that an enormous quantity of land, and most valuable land belonging to the people would be thrown out of irrigation. I mean the land immediately around their houses, and round their homes, which is to them very valuable.

3974. (*Col. Durand.*) It often happens, I believe, that some of the most valuable cultivation in the villages is to be found in the positions that you describe?—Yes; at the same time the water would be used elsewhere, and therefore the Government or the canal would not lose anything.

3975. (*Dr. Farr.*) Engineers have not always attended to these considerations in carrying out large works have they?—No, because it has not, I believe, been sufficiently understood.

3976. If a person, specially considering the population in a sanitary point of view, were consulted, would he not be more likely to fix his attention upon these points than an engineer?—In this case it was done by the committee.

3977. To ensure rules being carried out would you not recommend that a committee or somebody should sit permanently for this purpose?—I do not see the use of it.

3978. The mere laying down of rules does not imply that they will be carried out?—But they ought to be.

3979. (*Sir R. Martin.*) But in the case to which you have alluded the Committee was appointed after the work had been completed?—No, it was before they began this canal, and when the other canals had been in operation for 30 years.

3980. But did not the stringent recommendations which you have mentioned result from the observation of Mr. Dempster that spleen was found to prevail among the villagers in exact ratio to the proximity of the canal to their residences?—Exactly.

3981. And that at a distance of six miles from the canal there was no spleen to be discovered?—Yes, entirely so.

3982. The existence of spleen among the people was accepted by the Committee as a proof that ague had prevailed largely beforehand?—Yes, I believe so.

3983. (*Col. Durand.*) Would not the application of rules of that description lead to an entire revolution in the system of irrigation in India?—So entirely that I do not believe those rules have been carried out. I believe that they have been modified.

3984. They have been partially applied to military cantonments?—Yes, but no rice cultivation is allowed within five miles of any military cantonment, and that has been as stringently adhered to as to other cultivation; for instance, whoever knows anything about the two crops, the rain crop and the cold weather crop, knows very well that the rain crop floods the country and it gives the rice under irrigation in all directions, and of course that may lead to ill effects; the other demands only three or four waterings; they deliver the water only three or four times, and therefore there is not all that flooding that there is in the other

case. It is therefore perhaps very hard to prevent irrigation entirely five miles round a place for, at one season of the year there is comparatively very little irrigation, and at the other a good deal. I do not know what has been done since I left India. Col. Baird Smith drew up a code of regulations, and no man could be better adapted for it than he was, because in Italy and America and Madras he had been studying the subject.

3985. (*Dr. Farr.*) Canals are chiefly used in India for the purpose of irrigation, are they not?—That is their object; irrigation is the primary object, but as there is water running in the canals, of course boats go on the water, but in a heavy drought the boats would be left in the mud if the water was wanted for the fields.

3986. The object that is aimed at is to irrigate the country without making the population unhealthy?—Yes.

3987. Can that be done by preventing the stagnation of the water on the ground which is irrigated?—Then you come to drainage again, and that is what is wanted, proper levels and proper drainage.

3988. In short, a combination of land drainage with irrigation?—Yes. There is one point to which I may allude, which is, that in a country like the Doab, which is very dry, I may say perfectly dry in the hot weather, for the ground is as brown as gravel, I imagine that if you introduce into that country water in the shape of irrigation you will entirely by degrees change the climate, and if that is the case it follows that the habits of the people must be gradually changed to meet the change of climate, that is to say, the people cannot sleep out at night in the one case when they might with impunity do so in the other. It always struck me in that way, so much so that in 1850 I commenced a series of observations on the wet and dry bulb thermometer all the way down the Ganges canal; the observations were made, and registers were kept; ultimately they will come into very great use; the canal was opened just before I left India, so that the hygrometrical effects will be shown very distinctly if the observations are combined.

3989. Would you insist upon land drainage in combination with irrigation as indispensable?—Certainly.

3990. With that precaution do you see any injury that is likely to accrue from bringing the irrigation near to cities?—The people must be taught to cleanse their cities, and to economize the water, which they will not do, and besides the fields ought also to be levelled, for the water gets into the hollows while other parts are left dry.

3991. You might insist upon such places being levelled at least in the neighbourhood of great military stations, and drained?—Certainly.

3992. (*Chairman.*) But surely the interest and good sense of the cultivator himself would soon teach him that such a negligent mode of dealing with the water that he obtains from the canals does not answer his purpose?—So you would suppose, but they will go on in the same way until something else is forced upon them.

3993. Have you at all considered the question of the hill stations?—It is a subject of very great interest, and I have naturally thought about it a good deal in a sanitary point of view.

3994. I mean with regard to the possibility of stationing a considerable proportion of the European troops employed in India in the hills?—I think that there is a great political question mixed up with that. English troops are sent out to India to be usefully employed, and if they are all put out of the way by being stationed in the hills it does not appear to me that they would be of much use in India. If you send troops to a very healthy, although distant place, like Chenec or Kunawur, in case of anything occurring in the plains, what would be the use of those troops?

3995. (*Dr. Farr.*) Do you understand by hill stations what Dr. Bird spoke about the other day?—

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Colonel
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K.C.B.
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When I speak of hill stations I mean distinctly the Himalayas, not the plateaus of central India, places easily accessible and easily escaped from.

3996. Do such plateaus exist in Bengal in the neighbourhood of the great military stations?—No, not that I am aware of. I believe they have been trying to find out places without any effect; there is Hazareebaugh, a place in the Rangurh hills, which I never was at, but it is said to be healthy.

3997. (*Col. Greathed.*) What is the height of that, do you know?—1,750 feet.

3998. (*Dr. Farr.*) Is the topography of those hills well understood. I mean those in Bhogulpore, the southern part of it?—I do not know.

3999. Have we a very complete topographical knowledge of the hill stations of India, such as you have mentioned?—We have a great deal; there are most admirable topographical maps, but I am not quite sure about the parts you are alluding to, whether there is or is not.

4000. It is very desirable to obtain such information about all those plateaus, on which troops might be stationed?—Yes, it is; and the question is how to set about that enquiry, which seems to me to be a very interesting one.

4001. At present a large part of the Indian force is on the hill stations in the upper provinces, at Peshawur, and at Rawul Pindi?—Yes, a great proportion of the English troops are, and have been for a long time, on the other side of the Sutlej, in the Punjab.

4002. (*Col. Durand.*) Are not some of those stations in the Punjab very nearly at the altitude to which Dr. Bird adverted, when he spoke of the plateaus?—In the neighbourhood of Cuttack, they have lately been looking out for elevated sites for troops, but they are in the centre of the densest possible jungle; the hills themselves are covered with jungle, and where there are places like that, they cannot by possibility be healthy for troops. It appears to be a subject worthy of inquiry; but then the question is, how that inquiry is to be instituted. I do not think that it should be carried out by sending up Europeans; it must be done by sending natives in the first instance.

4003. (*Dr. Farr.*) Do you mean by employing natives to clear the ground?—If there is any possibility of making a place useful, I think the plan I should adopt would be to send up natives one season to clear the ground and dig it up, and plant it, and fence it in, and then either leave it altogether, or leave one or two natives there; and then in the next year I would send another party, and in the third year another, and by those means you would be able to judge of the effects of the place.

4004. (*Col. Durand.*) In fact, you would follow

the same course that the natives do in clearing portions of the forests for cultivation?—Yes, run away from it; in fact, that is done in America and elsewhere.

4005. (*Chairman.*) There is always a danger, is there not, of a new station being hastily condemned as very unhealthy on account of the unhealthiness produced by a new clearing, but which would disappear in a few years?—Yes; I do not think that it is quite fair to condemn a station as was done in Harris's Valley, in the Gallicondah Range in Madras; that was condemned because the ill health was frightful. I believe that only two men escaped fever, but the experiment was only made for one season.

4006. The mischief was done by occupying the station too soon?—Yes, I should say so.

4007. (*Dr. Farr.*) By taking precautions you could clear the jungle from those stations which appear to be otherwise in a satisfactory sanitary condition?—I see no better way of doing it; you must sacrifice some life, or run the risk of losing life, and it is better to do that with the natives of the country than with the people who are not of the country.

4008. The natives would be less likely to die?—Yes.

4009. The mortality among the native troops, I believe, is not higher than the mortality among the British troops at home?—I cannot answer that question.

4010. (*Chairman.*) Is there anything that you wish to add to your evidence?—There is one thing that I should like to mention. I was talking to Dr. Acton a short time ago, with reference to a subject which has been adverted to here before, that of keeping a running stream of water, (such as we have in London called fountains), attached to the urinals in barracks—not only to keep the urinals clean, but especially for the cleanliness of the men themselves, to enable them to wash themselves when suffering from the disease which has been so frightful. I have received a letter from Bangalore, in which syphilis is put at 20 per cent. Dr. Acton impressed upon me how necessary it is that this water supply should be provided, and I think there would be no difficulty in doing so. In Upper India water is raised for the purpose of filling reservoirs by a Persian wheel, a rough species of machinery which they have there, or by beesties, and I see no reason why at every urinal there should not be an elevated reservoir, filled either by machinery or by beesties, from which there should be discharged say a cubic foot, or two cubic feet of water an hour, that is all that would be necessary. A very small jet should be thrown out constantly, so that the men would have water to wash themselves with. I think that that is a very desirable thing if it can be done.

The witness withdrew.

ADDENDA.

No. 1.

A STATEMENT OF OPINIONS AND REMARKS ON TRADES in the ARMY.

In 1835, during General Sir John Wilson's command in the island of Ceylon, 150 men were selected, of different trades, from the 58th, 61st and 97th regiments to proceed to Newera Ellia, in charge of an engineer officer and sapper serjeant, for the purpose of building barracks and other public buildings, to form a station for sick officers and soldiers, it being a healthy part of the island, about 8,000 feet above the level of the sea.

This they accomplished in three years, and gave great satisfaction.

The 2nd Ceylon rifle regiment made all the roads under the command of Captain Thomas.

Some of the above-mentioned men saved money and obtained their discharge, after completing 21 years, and settled there; some were employed by Government; some set up business for themselves; some held situations over coffee plantations, &c.

If trade is introduced into the army it will have a wonderful effect, providing they give soldiers a moderate allowance for their work, without compulsion, even if their pay was made up to 2s. 6d. per day.

Men would then enter the service with a good feeling, and consider it a boon rather than a yoke; and a better class of men would be obtained than heretofore.

There are more tradesmen generally speaking amongst the English soldiers than the Irish; the latter are fond of the soldier's life without trade, and are more satisfied in their situation than the English.

The cause of that is the English are better off than the Irish before enlisting.

A soldier would volunteer to do any kind of work rather than go to parade in the evening, such as serjeant-major's

or adjutant's drill; it is of no use to the men; it only makes them careless and disaffected, particularly the English soldiers.

They go to a general's parade or commanding officer's parade with pleasure, without a murmur.

If the Government introduce trade in the army, they will always have sufficient men to do all public works, particularly on foreign service. It would occupy the men's minds and time; and provide something to look for on their return home from station.

There is every encouragement held out for the soldier since the Ten Years Act came in force, and saving banks were established in every regiment.

The only encouragement for trade in the army at present is such as tailors, shoemakers, saddlers, blacksmiths and wheelwrights (for the artillery). On the present system, if you refer to the "Hue and Cry" or "Police Gazette," you will find that half the deserters from the army are tradesmen.

The reason is when a tradesman enters the service and looks about him, he does not see any prospect; he therefore deserts the first opportunity; his trade protects him; and I have known the men to give such means to desert; and few are ever apprehended (not so with the agriculturists).

I was recruiting in Yorkshire in 1842 and 1843. I was acquainted with many young tradesmen; and the only objection they had for not enlisting was, that a soldier's pay was not enough, not thinking at the same time every soldier costs the public 5s. per day. Their aim was for the sappers and miners.

On no consideration should a soldier be allowed to work at his trade until he is acquainted with a soldier's duty; that would urge him to learn his drill quickly to accomplish his object. Tradesmen would be the means of teaching those who enter with no trade. I have known many leave the service good tradesmen; one man in particular, that left the service, after serving 21 years, was a good carpenter and shoemaker.

Why should not trades be encouraged in the British army, as well as the Russian army? Part of their earnings is put by till they are discharged.

I have spoke to many old soldiers on the subject, and they all highly appreciate the idea.

Any more information in my power I shall be most happy to give, as I feel very much interested in the proposition.

(Signed) JOHN PARKHURST,
Late 61st regiment,
21 years' service.

No. 2.
(Extract.)

Hanwell, May 21, 1861.

I have obtained the opinion of some of the pensioners of this establishment, and find them all agree with me, that to introduce into the army more work and less serjeant-major's drill (which I know, from my own experience, soldiers very much dislike), it would be a great benefit as well as saving, provided it was not compulsory, as that, in my opinion, often damps the energies.

I feel sure that such a change would be the means of raising the army, both socially and morally, and induce many young mechanics to join, that now look upon the army with disgust, on account of the smallness of the pay.

Although I am not at present in the army, or receiving any benefit therefrom, I should very much like to see something done to improve the present condition of it.

(Signed) CHARLES LOVELOCK,
Formerly 61st Foot,
13 years' service,

During which he learned three trades,—tailoring, shoe-making, and cabinet-making.

No. 3.
(Extract.)

Durham, May 31, 1861.

I believe the employment of soldiers in various trades will be another step in the right direction, and confer a great blessing on thousands. It will, more than anything else that I know, prevent so much desertion; for the greater number, by far, who desert our service are all tradesmen of some sort or other; and another thing in its favour is the benefits it would confer on the regiments serving in India. How much better a man is, in a country like India, who has anything to amuse him or occupy his mind, anything that would keep him off his bed, providing it does not expose him to the sun, than one who lies dreaming away his time on his cot! However, it is to be hoped they will do away with some of the evening drills, and give the men a moderate allowance for their work, and then there is no fear that the thing would answer well. It is to be hoped that the *quartermasters* will not be allowed to have any control over anything of the sort. I should say some other competent person; and this is the opinion of all the old non-commissioned officers here, who I have spoke to about it. And may the blessing of the Almighty attend those gentlemen who do not think it a disgrace to interest themselves for the benefit of the poor soldier.

(Signed) M. BOWEN,
A serjeant, 21 years in the
61st regiment.

Saturday, 1st June 1861.

PRESENT :

THE RIGHT. HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.
Sir RANALD MARTIN, C.B., F.R.S.
J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.

Colonel GREATHED, C.B.
WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

Colonel GEORGE CAMPBELL, 52nd Regiment, examined.

4011. (*Chairman.*) Will you be good enough to state how long you have served in India?—Nearly five years.

4012. In the Bengal Presidency?—Yes.

4013. At what stations have you been?—Umballa, Subathoo, Meerut, Lucknow, Sealkote, and Jullundur, and I was a year and eight months under canvas.

4014. How long ago is it since you left India?—I left India in August 1858.

4015. As a rule, should you say that the barracks in India are equal to the barracks in this country?—Those that are built upon Sir Charles Napier's principle I consider quite as good as those in this country, but others are not as good.

4016. Those which have been built upon Sir Charles Napier's principle we may take to have been built within the last ten years?—Certainly.

4017. At Umballa are the barracks old or new?—They are old barracks.

4018. What are they at Subathoo?—The barracks there have been rebuilt since I left the station.

4019. Are they old or new barracks at Meerut?—They are old barracks.

4020. At Lucknow what barracks are there?—There were none when I was there, except a temporary building; if there are any they are new ones.

4021. What is the description of the barracks at Jullundur?—They are old barracks.

4022. Taking the old class of barracks are they, generally speaking, deficient in ventilation?—Yes; certainly in upper ventilation.

4023. Are there any openings in the roof or walls?—None that I consider to be of any use; not sufficient generally speaking.

4024. In the new barracks have you found any cause of complaint as to the want of ventilation, or is that provided for?—I have heard no complaints about that, and I think they are generally approved.

G g 4

Colonel
Sir P. Cautley,
K.C.B.

18 May 1861.

Colonel
G. Campbell.

1 June 1861.

Colonel
G. Campbell.

1 June 1861.

4025. Have you in either the old or the new barracks found much closeness in the atmosphere in the morning?—Frequently.

4026. That would be in the early morning after the men had been sleeping there for some hours?—Yes; or if you went in at night at any time.

4027. Are urine tubs used as they are used in the barracks at home?—I always used them.

4028. You do not consider them objectionable?—No, I think that they are very necessary. I do not think that they should ever be in the barrack room where the men sleep, but just outside the barrack room, where the men can go and make water, instead of doing it against a wall.

4029. How often are the barracks and ceilings cleansed?—The barracks are thoroughly cleaned once a year; and then I think generally that the residents clean them once a week—the walls.

4030. Have you ever experienced any difficulty in getting repairs executed?—Yes; delays and difficulties arise on account of the expense.

4031. What is the usual course of proceeding when repairs are required to be done?—By making a requisition upon the executive engineer; he has leave and authority to execute repairs up to a certain amount, but beyond that he has to get his estimates approved, and it is in the routine that the delays and inconveniences occur.

4032. Are the stations generally well drained, or is there often much water lying on the surface?—I consider that to be a most important consideration, but I think it is generally attended to as much as possible. I may have seen cases where the water has been lying occasionally on the surface when it ought not to have been, but I think, generally speaking, that that is well attended to.

4033. Are the floors of barracks and hospitals always as dry as they ought to be?—That depends upon their condition. If they are in good repair and perfectly smooth, they are always dry; but as they are always made of a sort of plaster, if they are broken, the substance of the floors absorbs the wet, and it remains; but if the plaster is good, and not broken, they are always dry.

4034. Is sufficient provision made at the stations for cleanliness in the way of ablution rooms and baths?—In the new barracks there are baths and ablution rooms, and they are very good in the new barracks. In the ablution rooms there are iron basins fixed in masonry with a tap, and a hole at the bottom of the basin to let the water out, and that I consider to be the only way by which you can insure a fresh supply of water to every man, and prevent them using what may be called second-hand water.

4035. Has any attempt been made to supply the old barracks with ablution rooms on the modern principle?—They have been supplied with ablution rooms, but they have only earthen basins, and no taps.

4036. Are there any baths?—In some stations there are baths, and in others there are not. I should think that by this time in most of the stations there must be baths.

4037. Ought there not to be in all stations baths and ablution rooms?—I think so, certainly. I always used baths and tubs on the march. I had a tent fitted up with large tubs, and the men used them on the march.

4038. (*Sir R. Martin.*) So important do you consider attention to the personal cleanliness and health of the soldier?—Yes; and not only to the health of the soldier, but to his comfort.

4039. (*Chairman.*) Is any nuisance experienced in the barrack rooms and hospitals from privies, stables, or picketing grounds?—I think it is impossible to avoid a smell when the privies are being emptied in the morning; it is usually done at daybreak, or very early in the morning, and of course there must be a great smell then, but I cannot see any remedy for it.

4040. What is the general condition of the bazaars

with regard to drainage, cleanliness, and other arrangements connected with the preservation of health?—I think that they are generally well attended to. The station bazaars depend upon the zeal and care of the cantonment magistrate, but the regimental bazaars are completely under the commanding officer, and it is his fault if they are not properly attended to; but I think that attention is paid to those matters generally; I believe that every care is taken.

4041. Are these bazaars ever the cause of any nuisance to the barracks?—That depends upon the sort of nuisance that is meant; if you consider music at night a nuisance, they certainly are, and it was particularly so at Jullundur—tom-toms were playing all night.

4042. The question means nuisances in a sanitary point of view?—There is some annoyance caused at night in all cases, but the station to which I have alluded was a peculiar one.

4043. Do you think there is any reason to complain of any nuisance arising either from the slaughtering of cattle, or from offal lying about, or from the horses and other animals belonging to camp followers?—No.

4044. (*Colonel Greathed.*) Did you ever find the 52nd Regiment suffer from being in very bad barracks?—Yes.

4045. Where was that?—At Lucknow especially, and I believe that they are now in barracks which are hardly fit to live in.

4046. (*Chairman.*) They were in a temporary barrack, were they not?—Yes, but they are now in barracks at Jhansi, which I am told are hardly fit to put them in.

4047. (*Colonel Greathed.*) To what do you attribute the sickness from which they suffered at Lucknow?—I think it was more the effect of an accident than anything else—no doubt they were overcrowded—that was one reason; but the regiment there was put into what had been a huge stable; the executive engineer was directed to put it in order for the reception of the regiment, and when I went to examine it before the regiment went in it appeared to be in perfectly good order—the floors were smoothed over, the walls had been white-washed, and they looked clean, but just as the rain commenced the cholera broke out in a most extraordinary manner; after the regiment had got out I had the floors examined, and then I found that there was a quantity of manure several feet deep immediately underneath the plastered floor, and the exhalations from that I have not the least doubt caused the cholera.

4048. (*Sir P. Cautley.*) Whereabout was that barrack situated?—It was the King's stables, situated on the outskirts of the town.

4049. (*Dr. Farr.*) In what year was that?—In the year 1856.

4050. (*Sir P. Cautley.*) Was it not surrounded by a very close bazaar?—Yes; but there was no cholera among the natives; nobody suffered but the men in that barrack and two men who had been employed in the barrack at work. I made every inquiry that I could, and I never could find out that there had been a single case of cholera among the natives.

4051. (*Sir R. Martin.*) Was the air offensive in the barrack at the time you speak of?—No; and although I took every precaution, and cautioned the men in every way, and requested them to let me know if there was anything offensive, they never said a word, but afterwards I found out what I have mentioned, and then upon questioning the men again they acknowledged that at night they had frequently been obliged to leave their beds from the very great stench that arose in the night; and when the ground was opened before me, one of the men who was standing by my side would have fallen down from the power of the stench had he not been supported by another.

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4052. (*Chairman.*) And it had not been noticed until you called attention to it?—No; but at the same time I believe it was accidental. I do not think that the engineer was aware of what was under the floor; it was nicely covered over, and no one knew it. I believe it was a pure accident.

4053. (*Dr. Farr.*) The 32nd Regiment, I believe, was with you?—No, they relieved me.

4054. Did they not suffer equally with you?—They were there during the year of the mutiny.

4055. But I mean in the year 1856?—No, they were not there in 1856.

4056. It appears by a return before me that out of a strength of 189, 59 men died in the 32nd Foot?—That could not have been in the year 1856. I did not march out until Christmas Day 1856, and they came in the day after.

4057. The return also states, as to the 52nd Regiment, that out of a strength of 628 they lost 71 men during the same year?—Yes.

4058. You think that the return is erroneous with regard to the 32nd Regiment?—Yes; they were not in Lucknow on Christmas Day of that year.

4059. In the stations at which you have served has there been anything to complain of either as to the quantity or quality of the water supplied?—At Lucknow it was bad; it certainly was not good; but I consider Lucknow an exceptional case, and I do not think you can judge by that; at the stations generally the water was good.

4060. (*Sir P. Cautley.*) Did they take it from the rivers or from the wells?—At Lucknow from wells; its badness was accounted for by the circumstance of their having buried a number of elephants near the wells, and those in time had contaminated the soil and spoiled the water to a certain extent.

4061. (*Chairman.*) Most of the stations are supplied by wells are they not?—They are.

4062. (*Sir P. Cautley.*) You have been alluding to ablution rooms and the water being used in iron basins; how has that water been supplied at the places with which you are acquainted?—It was supplied in this way; there was a tank, and the water was filled by the use of bullocks with a wheel; they raised up a certain quantity every morning; the bullocks were at work for an hour or two hours, and they filled all the baths and supplied the water for the ablution rooms.

4063. (*Dr. Gibson.*) Was the supply of water generally abundant?—Yes. I have known it rather scarce at Umballa, but that is the only station at which I ever knew it to be scarce.

4064. (*Chairman.*) Is there anything which it occurs to you to suggest on the subject of the soldiers' rations? A good deal of evidence has been given as to the facts, but is there any improvement that you could suggest, or is there anything to complain of?—With regard to the commissariat, I think that there should be a trained commissariat.

4065. How is the commissariat at present constituted?—It is composed of officers selected from regiments; some of them are exceedingly good, and others are exceedingly bad, as far as my experience has gone.

4066. But none of them are specially instructed in their duties?—No; there is no special corps.

4067. (*Colonel Greathed.*) But they are specially instructed, are they not?—I suppose they are.

4068. (*Sir R. Martin.*) They now undergo a year's probation, are you aware of that?—I think it is very necessary that they should do so, for I think that there is a great obstacle in the way of procuring good rations, in fact the system of bribery which exists so generally among the natives has made it almost impossible, and the officers are open to that temptation, or they were; I cannot say what it is now.

4069. (*Sir P. Cautley.*) Do you think that military officers would be more open to it than civilians would be?—No, I do not think so.

4070. Then the advantage of a change from military officers to civilians would be a very doubtful one?—

The difficulty is to select good men. I will give the Commission an instance with regard to a Government contract for a building at Sealkote. The contractor furnished the Government with bricks at eight rupees a thousand, and he had furnished private individuals with those same bricks at five rupees a thousand, and the three rupees or six shillings constituting the difference must have gone somewhere.

4071. (*Colonel Greathed.*) With regard to the rations, do you not think that the order which was issued by Lord Dalhousie in November 1854 enables officers commanding regiments to secure for their men supplies of the best possible bread and meat?—Certainly, if acted upon.

4072. It depends, does it not, entirely upon the commanding officer of the regiment?—Not entirely; it depends upon the superior authorities. I was thwarted for months.

4073. But your regimental committees are final, are they not?—No. I was thwarted for months by the brigadier; it was months before the question was decided in my favour, as I had rejected the bread, and positively refused it. I was ordered to give it to the men because the station committee overruled my regimental committee, and I could only complain to the Commander-in-Chief, and so I was positively thwarted for months. The reports of my committees were so doubted that a medical committee was formed in the station to analyse the bread and to test it. I was so positive that it was not pure bread that this committee was formed, and they gave it in my favour, and pronounced that the bread was not pure.

4074. At what station was that?—At Umballa.

4075. (*Chairman.*) Do you think that there is sufficient facility for officers to protect their men against being supplied with bad provisions?—It is a very difficult question to answer, but I never failed in having good bread as long as it was under my own eye, but the contractors will bring you morning after morning bread that is tainted, and your only resource is to buy flour for the men, and have cakes made of it, or anything that you can; of course they do not like it so well as even the inferior bread, and it ends in your being obliged to take the inferior bread, for the perseverance of the natives is so great.

4076. (*Sir R. Martin.*) Have you seen the unleavened cakes of the country, the chupaties used by Europeans?—Only in that case when they could not get anything else. When the bread was thrown back upon the bakers flour was purchased and given to the soldiers, and they made what they could of it.

4077. (*Sir P. Cautley.*) But they prefer bread to the chupaties?—Yes.

4078. (*Colonel Greathed.*) In the case to which you have referred the order was plainly disobeyed by the officer commanding the station?—Plainly disobeyed.

4079. And that was the only reason why you did not get good rations?—That was the only reason at that station.

4080. (*Sir R. Martin.*) Your general estimate of the commissariat department in India would be good, would it not?—In some places good and in others bad; it depends upon the officers. I could name one or two who never had a bad loaf and others who never could get a good one.

4081. In general the troops were well served in 1857 and 1858, were they not?—Yes, wonderfully well, considering the circumstances at that time. I was fortunately connected with a very excellent commissariat officer, better I never knew.

4082. (*Sir P. Cautley.*) Are there not great difficulties in making bread when the troops are on the march?—None whatever; it is the most simple thing possible, and I always had better bread on the march than in cantonments, because I had it under my own eye. I had no commissariat officer; and if I did not like it, I could deal with it myself, and I got two loaves more out of every 18. In my first march up the country, the terms of the contract were that there should be 16 loaves supplied for a rupee;

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that was on my first march, and I did not then know the rules of the service. I found that the flour was inferior to what the contract set forth, and I positively refused to take it, and threatened the baker to send him off. He then gave me 18 loaves instead of 16. I was then ignorant of the ways of the country, and I thought it was better for the soldier to have a little more bread for his money, and I accepted it, but I was afterwards blamed; the great difficulty is the bribery that takes place in all these things.

4083. (*Chairman.*) Whenever you employ native agents of an inferior class, you are almost certain to meet with bribery?—It does not matter whether they are of an inferior class or not. I was told of a case by a very distinguished officer, who belonged to the 32nd regiment, that a native came into his room one day to get a contract for the supply of the canteen when bottled beer was allowed, and he threw 1,000 rupees on to his bed; and it is very difficult for a needy man to resist that; but that is the thing to be guarded against I think; and with regard to the repairs of barracks it is the same thing; when the Government pay eight rupees a thousand for bricks, and private individuals can get them for five, of course much more might be done for the money.

4084. Have you ever known a case in any country where the Government did not pay more for the same articles than other people?—No; and I only mention this instance because it appeared to be brought forward so clearly.

4085. Are you satisfied with the practice of allowing men to draw a spirit ration?—There is no such thing as a spirit ration in India. You allow them to have a certain quantity of spirits, but it is not issued as a ration.

4086. But the soldier is allowed, is he not, to draw it from the canteen, although he is not allowed to exceed a certain quantity?—Yes.

4087. (*Sir R. Martin.*) In effect, it comes, does it not, to much the same thing as the issue of a spirit ration?—No, it does not, because if the spirit were issued as a ration the soldier must either take it or throw it away. My own canteen regulations were that every man might receive two drams in the day, but not both together; and if he chose to drink beer, he could get one dram of spirits, that is to say, if he took only a certain quantity of beer; if he exceeded that quantity he got no rum.

4088. Do not nineteen-twentieths of the men take the rum from the canteen?—No.

4089. Is not that the practice among the old soldiers?—No; and it is a curious thing that when my regiment landed in India, the confirmed drunkards of the regiment gave up their intemperate habits.

4090. (*Chairman.*) Was that because they had a sufficient knowledge of the danger of persisting in them?—I cannot account for it, but they did relinquish those habits.

4091. (*Col. Greathed.*) Do you think it is possible to do away with the practice of serving spirits out in the canteens?—No, and I would not advise it. I should discourage it, and recommend the men to take beer instead; but there are certain men who cannot drink beer; it does not agree with them. I myself sometimes could not drink a glass of beer when I could take a little rum and water.

4092. (*Sir R. Martin.*) Would not the men regard the withdrawal of the spirit as an interference with their rights?—Yes, I think so; and I do not think that it would do any good, but rather be mischievous. There is one point that I wish to mention as to the beer. I think it is a great pity that bottled beer should not be allowed to be obtained by the men. I do not know whether the order has ever been rescinded.

4093. (*Col. Greathed.*) There used to be no objection to the men purchasing it at the canteen?—No, but an order came out positively prohibiting bottled beer being sold in the canteen, and that was to insure

the consumption of the beer which was sent out on requisition from England. Of course it was necessary to do that, as it would have been a great loss to the Government if that beer had not been consumed; but it was a great deprivation to the soldier in the hot weather, as any drink which effervesces is much more refreshing.

4094. Do you think there would be any difficulty in the Government themselves supplying bottled beer?—I do not see why there should be.

4095. (*Chairman.*) Was the bottled beer sold below the cost price?—It was never furnished by the Government; it was provided by private arrangement, but the price of the beer was lowered in consequence of the surplus profits upon the rum, so that the beer was issued below cost price to the soldier, and at the expense of those who drank the rum.

4096. (*Colonel Greathed.*) That was only a regimental arrangement?—Yes; but I think it was generally acted upon.

4097. (*Dr. Gibson.*) Was the draught beer sold at a low price?—The price was very moderate; but in warm weather it naturally gets stale and flat, and is not so palatable as the bottled beer.

4098. (*Sir P. Cautley.*) Did you ever see any of the beer made on the hills?—Yes, I have seen it.

4099. Down in the plains; at Umballa, for instance?—There was some beer made at Meerut by the quartermaster of a native cavalry regiment.

4100. Did the men take to that as freely as to the English beer?—No, I cannot say that they liked it so much as they did the English beer.

4101. (*Chairman.*) They have never succeeded, I believe, in making beer altogether in a satisfactory manner?—I should always prefer the English beer myself. I have heard that there is a very good beer made, and this quartermaster to whom I have referred, of the 9th Native Light Cavalry Regiment at Meerut, made beer and sold it to great advantage; but his officers neither approved of the experiment, nor of the sale of it; they did not like the idea of it, and the quartermaster was obliged to give it up. That was the only instance of its being made in the plains that I ever heard of.

4102. Did the officers object to it as a matter of discipline?—They did not like the idea of a brother officer selling beer; it was a matter of pride.

4103. Various opinions have been expressed as to the amount of intemperance among European troops in India; will you be kind enough to inform the Commission what your experience has been in that respect?—It is rather an invidious question, but I can only speak with regard to my own regiment, and they were far better conducted in India than I ever knew them anywhere else. I consider their conduct to have been admirable, and, taking them as a body of men, extraordinary. I do not recollect ever having a single man suffering from delirium tremens.

4104. Do you think that there is any considerable proportion of the men in your regiment who, without going the length of actual intoxication, injured their health by habitual drinking?—Not one; it was impossible for a man to be in the slightest degree under the influence of liquor without being detected and brought to punishment for it.

4105. (*Sir R. Martin.*) The case which you have mentioned must have been exceptional?—It may have been, but I can only speak as to my own regiment.

4106. (*Dr. Farr.*) Did you make any special arrangements?—Discipline was very strict. The non-commissioned officers did their duty well, and we had an excellent regimental police.

4107. (*Sir R. Martin.*) Were the men recruited with any peculiar care?—No.

4108. (*Chairman.*) You stated that the men became more sober on arriving in India than they had been before?—The regiment became more sober from the day it landed in India than it ever had been before decidedly, and even the confirmed drunkards, the

few men who passed their time principally in the military prisons, gave up the habit.

4109. Should you say that in the whole of your military experience there had been any considerable improvement in the habits of the soldier in that respect?—Certainly.

4110. (*Sir R. Martin.*) As compared with what they had been when you first entered the service?—Yes.

4111. (*Chairman.*) To what should you ascribe that improvement?—To many things. I think that the good conduct warrant had a very good effect, and I think that the discipline of the army has been improved very much; that is another thing; and I also think that more encouragement has been given to the soldier to amuse himself within his barracks, to take care of his money and save it; and in a hundred ways I consider his condition has been improved.

4112. (*Sir R. Martin.*) Do you think that the abolition of corporal punishments to the present extent has had much to do with that improvement?—No, I do not think so.

4113. (*Chairman.*) What are the usual means of recreation which are provided for the troops?—None are provided by the Government, except a fives court. As far as I was concerned, I invariably did everything that I could.

4114. Is that a matter which rests entirely with the commanding officer?—I think it does almost entirely. If the commanding officer is inclined to assist the men, he may do a good deal.

4115. But if the commanding officer were indifferent to it, would there be any regimental school?—A school there must be, but I refer to recreation, and such things as newspapers, pamphlets, chess boards, draught boards, skittle alleys, quoits, and every conceivable thing of that kind.

4116. (*Sir P. Cautley.*) But skittle alleys are built by the Government, are they not?—No, I put them up from the canteen fund; temporary ones.

4117. (*Col. Greathed.*) You bought them, did you not?—Yes.

4118. (*Chairman.*) Are books and newspapers much appreciated by the men?—I think they particularly like reading pamphlets, weekly publications, and newspapers; but I think the libraries generally are indifferent; they do not change the books often enough. A man going out to India, and being perhaps for three months on board ship, has books furnished to him; and when he arrives at his regiment, he finds exactly the same books there, and there they remain perhaps two or three years.

4119. You think that they would be more valued if there was a larger supply of books?—Yes, and a constant influx of new works, no matter how cheap or how trivial they might be.

4120. It has been stated in evidence that the men do not take much to gardens when they are provided; has that been your experience or not?—Yes, and I can account for it. They would I think take to them, but, as far as my own regiment was concerned, we were so constantly moved about, that the moment one garden was got into order we went away, and therefore it was a continual labour, and no advantages resulting; and in the same way with trades work. On first arriving in the country the officers very liberally subscribed about 150*l.* to set up a trades union in the regiment, and we established it perfectly. We got turning lathes, printing presses, and everything of that kind from England, and we had not been in the station five months before we were ordered out of it.

4121. And you were unable, I suppose, to carry those things with you?—We were always moving afterwards, and they were all lost at last; we could not carry them about with us.

4122. If there were permanent workshops established at the different stations, do you think that they would be kept up?—Yes, I think that they would answer unexceptionably well. I think that there should be a spacious building or room for the pur-

pose, which might be used in the evenings as a room to read in, or to take refreshments in, and to be well lighted. I think that the men find a great want in that respect, that the barrack rooms are badly lighted. It is impossible to light every room well I believe, but I think that one room might be set apart in each barrack to be well lighted, and that perhaps might be appropriated to other purposes in the day time.

4123. (*Col. Greathed.*) Do you think that that is a universal fault in India, deficiency of light?—Yes.

4124. (*Dr. Gibson.*) The oil is not sufficiently good in quality?—No, but the lamps, or the species of light that they have is bad; and I got some of those American reflecting lamps, and when placed against the walls they gave a very good light, using the oil of the country; but these things are very inconvenient to carry out for a regiment, although they cost very little in the first instance.

4125. (*Sir R. Martin.*) A deficiency of light is very much felt, is it not, during the long nights of the cold season?—Yes, every evening after dusk; of course a trades establishment would require a good deal of light.

4126. (*Chairman.*) If regiments are frequently being moved from station to station there would be a difficulty, would there not?—No; not if they found tools ready for them at every station, and a place to work in, and materials to work with. If a regiment has to find its own tools and to take them about with them, and also to carry about materials, they might get damaged, and the expense would become too great to bear.

4127. (*Col. Greathed.*) How would you set to work to establish a trades union at a station?—It would merely require the building, the tools, and the materials. I think the system to be pursued should be left to regiments, and the men allowed to select their own chiefs or foremen. I did so.

4128. In going from one station to another you would have, I suppose, to take over the materials and tools from the regiment that you succeeded?—Yes.

4129. How would you manage that?—I would put that in the engineer's department.

4130. (*Dr. Farr.*) What trades do you think could be carried on in the way you suggest?—Such as cabinet-making, and shoe-making especially, which is a very useful trade to the soldier, and a printing press is a very useful thing to have in the regiment. I used to print all my own returns, and, in fact, at Lucknow I printed particular papers for the civil authorities there, for they had no printing press; also a turning lathe; that affords great amusement to the men; and a variety of other things.

4131. (*Sir Proby Cautley.*) Do you mean that the things made in these shops should be sold?—Yes, I think so, and a value should be put upon them by a committee, according to the labour bestowed upon them.

4132. And then I suppose that the money should be put into a fund?—Yes, for the purpose of purchasing new material.

4133. (*Col. Greathed.*) How would you set the thing going; how would you buy the tools and materials in the first instance?—They must be found, I think, by the Government in the first instance.

4134. To be repaid for afterwards?—Yes. At Meerut we supplied the 81st regiment with 100 pairs of boots, which they could not otherwise have obtained.

4135. (*Chairman.*) At the stations with which you are acquainted are there any covered places set apart where the men can occupy themselves during the heat of the day or in the time of the rains?—No; and I think that is a very great want.

4136. They have no place except the barrack room to be in?—No, or the verandah, or they may get under the shade of the barrack late in the afternoon, but I think they should have covered places;

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I would have one to each large barrack for each company, and a skittle alley.

4137. You would require nothing beyond a shed?—Nothing but a thatched shed.

4138. (*Sir Proby Cautley.*) I do not quite understand how the money to be obtained from the sale of things made is to be disposed of ultimately; is it to be put into a saving fund, and then to be divided among the men?—In my own case I put it into the hands of the paymasters; I gave over to them the accounts, and they were sent to me by the president of the committee.

4139. Is there any advantage or encouragement held out to the men individually to do the work, and do they know that they will obtain in the end a profit in money?—Yes, certainly; they were paid according to the work they did, and we had an established set of charges for everything that was done.

4140. So that a pecuniary advantage was held out to each man?—Yes; and that you must do at any rate to start with, for you will not get them to work for nothing.

4141. I believe workshops were established in the Punjab, I was so informed by General Tremenhare?—I never saw them.

4142. (*Col. Greathed.*) How long do you think that a regiment should be stationed in barracks to enable the men to get a profit out of their gardens?—I think if they are there for two years they will do so.

4143. Not less?—I do not think so.

4144. (*Chairman.*) In a time of peace does it often happen that regiments are moved from station to station, or oftener than once in two years?—I was never stationed at any place for more than nine months.

4145. Can you state what the object is of these repeated removals?—No; I believe it was accidental in my own case, but I fancy that they do leave regiments for two years or a year and a half in a station.

4146. Do you think that the present dress and accoutrements of the troops are what they ought to be?—I hardly know what their dress is at present; it certainly was not what it ought to be when I was in the country, but I believe they have improved it very much, and that attention has been paid to that matter.

4147. The wicker helmets had not been introduced when you were in India?—No; I never saw them.

4148. Do you think that the soldiers have anything to complain of generally speaking in India in regard to their duties, or on account of being many consecutive hours on guard?—No; the soldier is much better off there than he is at home as far as duty goes.

4149. You do not think that the ordinary service required from a soldier has anything in it injurious to health?—Not in the least.

4150. Have you been quartered at any of the hill stations?—Yes; I was at Subathoo for a few months.

4151. Had you an opportunity there of observing the effect produced upon the health of the men?—No, I cannot say that I had; but if I were to give an opinion upon that subject, I should say that a regiment ought rather to go to a hill station in the first place rather than afterwards. I would put the soldier in the highest place first, and bring him down gradually into the plains. I think that men who have suffered in the plains are very apt to get dysentery and diarrhoea if they go to the hills afterwards.

4152. You think that the hill stations are better for preserving health than for restoring it?—Yes; but I think that it is very beneficial to send certain invalids to the hills; as a sanitarium it is very well, but for a regiment generally I think it would be better that they should go there in the first instance rather than after having been in the country some time. There was an important question under discussion, as to the water at the hill stations when I

was there, and I wrote to the quartermaster general upon the subject, and recommended that tanks should be formed in the same way as in the West Indies, for the purpose of catching the rain-water. I think that that would be an admirable thing.

4153. (*Sir Proby Cautley.*) Do you mean from the roofs of the buildings?—Yes. When I was there the water was brought by mules from the bottom of the hill up to the top; every drop of the water that was used in the barracks at Subathoo, and I believe it is the same in most other places.

4154. That depends upon the time of the year, does it not, and they may have wells?—Yes, they may have wells; but then the water that trickles down those hills, of course, must be impregnated with decayed vegetable matter, and if it was caught before that in a clean iron tank it would be always pure, as it is in the West Indies.

4155. What diseases arose from the use of the bad water?—Diarrhoea and dysentery.

4156. And the same effect takes place at Mussourie, Sindore, and Simla?—Yes; and I believe at all those stations that we at present have.

4157. (*Chairman.*) Have you at all considered the question, how far it would be possible in the Bengal Presidency to remove any considerable number of the troops from the plains to the hills?—There was a committee sent from Sealkote, when I first went there to examine some ground just within the territories of Cashmere. I think about 30 miles from Sealkote, Dr. Graham, who was murdered at Sealkote, told me that they found there a large plain, 16 miles in circumference, possessing the most beautiful climate, the most park-like land, and the most beautiful verdure, with plenty of water, and I believe that you might put any number of troops almost there.

4158. At what height above the sea was that?—About the same altitude as Subathoo; quite sufficiently high to give a temperate climate.

4159. That applies to the extreme north-west?—Yes; I do not think that you could find other portions applicable for any considerable number of troops, for there is not sufficient space.

4160. (*Sir R. Martin.*) From the want of table land?—Yes; the barracks must be built on a spur of land.

4161. In the case of all regiments stationed upon the hills I suppose you would bring them down into the plains for exercise in the very cold season?—Yes.

4162. Both for the purpose of exercise, and in order that the natives might see a European force?—Yes. I think that that would be advantageous in every way.

4163. (*Chairman.*) Do you think it would be safe to leave the great cities of the Ganges entirely without European garrisons?—No. I do not think that it would be altogether safe certainly; of course railways may make a great difference. I believe that that there are a good many stations in the plains which might be done away with. I have never considered the question particularly, but I have no doubt there are a great many.

4164. Can you name any of them?—I hardly know those which are really occupied at the present time. I judge entirely from the number of troops that there are in India at the different stations.

4165. Do you think that there might be a considerable reduction in the number of the troops stationed in the plains without withdrawing garrisons from really important posts?—Yes, I do think so.

4166. (*Sir Proby Cautley.*) You would be inclined to keep the troops in large bodies rather than scattered about the country?—Yes; to a certain extent; not in bodies too large.

4167. (*Chairman.*) Do you think that frequent changes from station to station are advantageous, or to the contrary, to the health and efficiency of the men?—I do not see how they can be at all. If a regiment has suffered very much in any particular station I think it is as well to move it, because of the

impression that it makes on the minds of the men, and the bad effects of that impression.

4168. A march itself is laborious, is it not?—No.

4169. It is useful training, is it not, in a time of peace, as a preparation for a campaign?—It is useful, no doubt; but I think that they might remove a regiment for a shorter distance; for example, I have been three months on a march without ever getting into a barrack at all.

4170. Three months continuously?—Yes.

4171. (*Dr. Gibson.*) Does the health of the men suffer or improve upon a march?—It does not in the least suffer; it is very good. They do not carry any knapsacks.

4172. (*Sir Proby Cautley.*) In a time of peace it is only in exceptional cases when troops are removed from one end of India to the other; the plan which the Government adopts is rather to move a regiment from a station to the next nearest station, and so gradually up and down the country?—My own regiment only the other day moved from Sealkote to Jhansi, passing I dare say, half a dozen other stations.

4173. (*Dr. Farr.*) And that was since the mutiny?—Yes, only two months ago.

4174. (*Sir R. Martin.*) Do you approve of the men not carrying their knapsacks in India?—Yes; I do not think they could do it.

4175. But they are carried along with the regiment, are they not?—Yes.

4176. (*Chairman.*) At what age should you say that a soldier ought to begin duty in India, how young might he be?—Twenty.

4177. Not earlier than that?—I think not.

4178. For how many years ought a man remain efficient in the climate of India?—That depends so much upon the man. Some men are better after 20 years' service than they were when they first went out, and others knock up in a year; the strongest looking men may be the first to go; it is impossible to say.

4179. Are you able to say that there is any considerable number of men who are unfit for service in the climate of India, but who would be still capable of giving good service in a temperate climate?—Yes.

4180. Would there be any difficulty in making arrangements for transferring such men from one regiment to another, or from India home again, or to some temperate station?—The only effective method that I can see would be to relieve regiments more quickly, and for my own part I should recommend that there should be no depôts. Suppose that the establishment of a regiment was 1,000, I would send it out, say 1,500 or 1,200, but I would not send a single relief. I would keep them for a shorter period abroad, and let them bring home whatever number was left.

4181. (*Dr. Farr.*) How long would you keep them in India?—For seven years.

4182. (*Sir R. Martin.*) You consider the dépôt system objectionable?—I think it is bad in every way.

4183. (*Chairman.*) What is your objection to it?—My objections really extend to every point. I can see no advantage in a dépôt. If you get recruits for a regiment who have been at a dépôt, say for three years, they are just as unfit to do duty in the ranks as if they had joined the regiment only yesterday, and then they require to be drilled over again; and then these men sent out every year have to march perhaps 1,000 miles all through the country, they do a great deal of mischief, and they are no good for a year or two, and it causes enormous expense.

4184. (*Sir R. Martin.*) The men being too young and undisciplined?—Yes; and their want of discipline is only increased by the way in which they are sent through the country under officers who know nothing about them and quite at haphazard; whereas if you sent a regiment out, say 1,200 strong, in the course of seven or eight years they would probably come home 700, and they would be a good nucleus

for the purpose of reforming the regiment, and I would rather have those 700 than have 800 or 900 with 200 recruits.

4185. (*Chairman.*) Perhaps you think that there would be some advantage in the public being able then to see what the effects of the mortality had been?—Yes, I think it would afford a very good test.

4186. It would then become a point of honour with the commanding officer to bring back his regiment as complete and as unthinned as possible?—Yes.

4187. (*Col. Greathed.*) You think that for the first seven or eight years a regiment remains pretty effective in India?—Yes; I do not see why it should not.

4188. (*Dr. Farr.*) Would you approve of a transfer of the men from regiment to regiment, supposing you were about to bring a regiment home?—No; I would bring every man away, and keep the regiment within itself. I condemn volunteering entirely; I think it is a bad system.

4189. (*Chairman.*) You think that the more the unity of a regiment can be preserved the better?—Exactly; and if a man is sent abroad for seven years only he naturally looks to coming home, and he would not wish to remain, for his interest still lies at home; whereas if a man is sent out to India for 15 years all hope is gone, and in fact he may be there for 18 years.

4190. (*Sir R. Martin.*) In one case he would have an object in life, and in the other that object would be wanting to him?—Yes; and again you would then have fewer married men.

4191. (*Dr. Farr.*) What is the term of service now?—There are few regiments that escape under 16 years.

4192. Is it likely to be less now than it has hitherto been?—I cannot say.

4193. But men are only enlisted now for a certain number of years?—It is only for 10 years.

4194. So that they must be sent home in separate detachments if they remain in India so long as they have hitherto remained?—Yes; but I believe that question is now under consideration.

4195. How do you think your system would work if men were engaged for a term of 10 years?—I think it would work much the same as it does now. I think that the men would be more likely to remain in the regiment after 10 years' service if they thought they were coming home. I think they would take on again.

4196. But must not some alteration be made in the terms of the engagement if you keep them in India only for seven years?—You cannot keep them now. If a man has nine years' service when he embarks you cannot compel him to stay beyond his 10 years.

4197. But you could not take out, say 1,200 men, and keep them in India for seven years, unless you altered the terms of the engagement?—No, not as to the whole of them, certainly; but I think the chances are that you would bring back at least 700 of them.

4198. You would not interfere with the terms of the enlistment as at present?—I condemn the 10 years' enlistment act altogether. I do not see what good it has done.

4199. Would you, then, engage men to serve for an unlimited time?—No; but I should say for a further period than that.

4200. (*Col. Greathed.*) I believe the question of enlistment for 16 years is now under consideration?—Yes. I would give a man a pension after 16 years' service, to a certain extent; but that, I believe, has all been brought before the Recruiting Commission.

4201. (*Sir R. Martin.*) Is not the climate of England very much disliked by old soldiers who have served several years in the East Indies?—Yes, and the duties also, and carrying the knapsack.

4202. (*Chairman.*) You would propose, I think, that men who preferred to stay in India should be allowed, as now, to volunteer into another regiment?

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—No; I am rather against volunteering. I think that very few of them would volunteer; at least, that is my opinion. Perhaps it would be as well to permit those who wished it to do so.

4203. Do you think there would be any advantage in increasing the number of men in the Indian army who were permitted to marry?—I should certainly not allow them to marry coloured people not natives.

4204. I believe at present 12 per cent. is the limit?—Yes. I do not think that there is any objection to men taking out their wives. It is, of course, a great expense, and it is attended with a great deal of trouble to them.

4205. It has been stated to the Commissioners that it is advisable to increase the proportion from 12 to 25 per cent. Do you agree in that?—Certainly not.

4206. I suppose that whatever is done by the Government, and whatever expense is incurred, it is never possible to make the position of the soldier's wife very comfortable?—It is quite impossible, because, if the men are ordered on service, they must leave their wives behind them. You may have to leave 100 women behind, with many children, and no one hardly to look after them.

4207. I need hardly ask whether great abuses do not follow from that state of things?—Of course it is so, and they are put themselves to great discomfort.

4208. (*Dr. Farr.*) These objections particularly apply, do they not, to a regiment moving about as yours did, and being constantly on the march?—Yes. A regiment is always liable to be called on service in a country like India; and it happened to me twice in the course of five years that I had to separate the men from the women; and once, in a time of peace, when I went to Lucknow, there was no accommodation at Lucknow for the women, and they were obliged to be all left at Meerut.

4209. There is, however, accommodation generally provided for married soldiers?—Yes, at the regular stations.

4210. Is the accommodation comfortable?—Yes.

4211. Are the married soldiers as well behaved as the others?—They are very well behaved.

4212. Do you not think that permission to marry to a great extent would have a tendency to diminish some of the vices of the soldier?—No. I have no complaint to make at all about the vices of the soldier in India. I do not think it is possible for you to get 1,000 men to behave better, or as well, as the soldiers I had under my command in India.

4213. Is not venereal disease common in the Indian army?—No; you have great power to check it. It is not so common as in England. You know the native women who frequent the bazaars, and you bring them to the hospital when necessary.

4214. Under what arrangement is that done?—They are all known—there is a list kept of them.

4215. That I suppose is attended to by the Commanding officer?—A list was always sent to me by my bazaar master every month of the women of that kind to be found in the bazaar, and, if I found three or four of the men going into hospital suffering from disease, I then had them all examined by the surgeon.

4216. If you found them infected what was done?—I sent them off, or had them cured.

4217. In that way you diminished the amount of disease?—Yes; and you may very easily do that. I do not suppose that in a place like Calcutta you could do it; but generally in the stations in India you have it completely in your own hands.

4218. (*Col. Greathed.*) What, in your opinion, is the best way of lodging the married people—in separate huts, or in barracks for the married people?—I think the best way is in separate huts; but I should say that a house that would hold two or three families would be preferable, because then they could arrange better with regard to their servants, one servant might do the work of one or two families if

they were in the same building, which could not be done if they were in separate buildings.

4219. They attach great value, do they not, to privacy?—Certainly, I think so.

4220. (*Chairman.*) Is there any other suggestion that you would wish to offer to the Committee?—No. There is one point, however, about which you have not asked me; namely, the cooking.

4221. Do you think that the cooking arrangements for the soldiers, both European and native, as at present carried on, are satisfactory?—Yes.

4222. Do you think that there is any room for improvement as far as you are aware?—None.

4223. (*Sir R. Martin.*) Have you observed that the men in your regiment have constantly been in want of fruit and vegetables?—Sometimes they have been in want of them at particular seasons of the year, when there may have been a difficulty in getting good potatoes, and then you must furnish them with rice. I do not think that that could be remedied. There has always been plenty of everything that was in season.

4224. (*Dr. Gibson.*) Do you think that the attendance on the sick by the native attendants is satisfactory?—Yes, they are very well attended to; I think that a great deal depends upon the regiment itself, and, that if the men treat the natives well the natives will behave well to them. I have known an instance in which a regiment has been deserted by every native that was attached to it.

4225. In severe cases of disease is the patient left in the hands of a native attendant, or does the man's comrade look after him?—If a man is in danger he has his comrade to sit up with him; otherwise it is all done by natives.

4226. But if a man is seriously ill and requires assistance he calls to his comrade?—Yes.

4227. It is not considered safe, is it, to leave him to the care of a native?—I do not think that that is so; probably a man would not like to trust to a native to watch him during the night if he was dangerously ill—but I think that the natives are very good in that way.

4228. (*Dr. Farr.*) To what do you ascribe the mortality which occurred in your regiment at Subathoo?—I ascribe it to the circumstance that we marched in the rains and the ground was ankle deep in water; the men were actually obliged to sleep, as you may say, in the water, it was a four days' march, and I do not think that they recovered from it for four or five months, it engendered fever and ague, and the men were carried off, I think, upon an average of about 12 or 13 a month.

4229. From what station did the men march?—From Umballa.

4230. Both of the places being hill stations?—No. Umballa is on the plains; but the barracks were in a very shaky state at Umballa, and the Commander-in-Chief was anxious to get the regiment out of them. I fancy that he was rather afraid, from the example which had been given by the 50th regiment in the Punjab; there were some cracks in the walls of the barracks, and we had in consequence to march away at that season.

4231. Were the men attacked by disease at Umballa before they left?—No; they were healthy there, and for a week or two after we got to Subathoo, and then disease showed itself.

4232. Were they placed in bad barracks at Subathoo?—The barrack was not good, still it was not very bad.

4233. You attribute the disease a good deal to the march they had to undergo in the rains?—Yes, entirely.

4234. In what season of the year was it?—In the month of August.

4235. How long did they remain at Subathoo?—We remained there for three or four months.

4236. And during that time they experienced a

heavy mortality?—Yes; and they did not entirely get over it for some months afterwards.

4237. (*Sir Proby Cautley.*) August is a particularly unhealthy month in the north-west provinces?—Yes.

4238. (*Dr. Farr.*) Were there any other detachments of troops or any other regiments at Subathoo at the same time?—Yes; I think there was a draft.

4239. Did they suffer from disease to the same extent as your regiment?—No; they did not.

4240. Did you get provisions and everything that was required for the comfort of the men at the station at Subathoo?—Yes.

4241. There was no complaint of any deficiency of that kind?—Nothing of the sort.

The witness withdrew.

WALTER ELLIOT, Esq., late Commissioner in the Northern Circars, and Member of Council, Madras, examined.

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G. Campbell.

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4242. (*Chairman.*) You have served, I believe, nearly 40 years in India?—For 39 years.

4243. Entirely in the Madras presidency?—No; also in Bombay.

4244. Have you turned your attention at all to the question which this Commission is appointed to investigate, namely, the sanitary arrangements for the army in India?—Only as far as regards the health of troops employed in unhealthy parts of the country. I happened to be employed for some years in a part of the country where the hill districts required to be frequently visited by troops, partly for the suppression of refractory zemindars, and partly for the purpose of putting down human sacrifices among the natives.

4245. In what part of India was that?—In the Northern Circars, and there a detachment was sent out every year, with the agent for the suppression of Meriah sacrifices, and frequently strong detachments were employed to coerce refractory zemindars, and the greater part of those men who went up with the agent suffered severely from fever, and the parties always came back quite disorganized.

4246. Was that among the hills?—Yes.

4247. Are the hills in that part of the country covered with jungle?—Yes; a low jungle. In consequence of the sufferings of the troops, being commissioner there, I on several occasions addressed the Government, proposing that some means should be taken to ascertain the circumstances under which malaria was generated, in order that the troops might be saved from its effects. I thought that a careful examination of the phenomena of fever might lead to such precautions being taken, as would prevent the men suffering to so great an extent as they had done, and perhaps enable them to avoid it altogether.

4248. What was the nature of the precautions that you recommended?—We recommended several times certain precautions as far as our experience enabled us to suggest them; for instance, closing their tents at night, using curtains to prevent the malaria coming directly in contact with the lungs, lighting fires, and a number of such practical suggestions as had been found useful from time to time. What I further suggested to the Government was that a series of experiments should be undertaken to test the quality of the air, the soil, the water, and the general conditions, in fact, of those places which were supposed to be unhealthy, in order that we might have some guide to indicate at what places the troops should halt, and at what places they should not.

4249. That experiments should be made as to the healthiness of the various stations?—Not the stations so much as suspicious localities, in order that we might ascertain the cause why certain places were so unhealthy; but it is a very difficult subject to deal with, for men may encamp in a place that is unhealthy, and inhale the poisonous malaria, and the disease may not appear for a fortnight or three weeks afterwards; therefore, if medical officers had some knowledge of local phenomena, such as might be obtained by experiment, and by examining into the conditions of particular places which we know are more or less liable to fever, I think precautions might be taken to prevent detachments of troops from being halted and sleeping in such places, or if that could not be avoided, to neutralize the miasmatic influences.

4250. (*Sir R. Martin.*) The experiments being made chiefly on the qualities of the air and of the

water?—Yes; it is also supposed that the geological formation has a great deal to do with fever and also elevation; in fact, I think that the conditions might be so easily submitted to examination that one thing would suggest another, and that a very considerable amount of knowledge would be gained that might prove of the greatest value. We know that a certain extent of country generally is liable to fever, but we do not know the particular spots, or the conditions, or the seasons, for it varies with the seasons and the elevation; in fact we know but little more than that a certain tract is unhealthy.

4251. The ranges of hills to which you refer in the Northern Circars are not of any very great elevation?—No; they are from 2,000 to 3,000, and perhaps an elevation of 4,000 feet is the highest.

4252. (*Chairman.*) Is there any military station present in the neighbourhood?—Not in the hills, but lately, in consequence of suggestions of my own, a high tract was examined with the idea of forming a sanitarium at a place to the west of Vizagapatam called Gáli-Parwatam, but the height there is not above 4,200 feet.

4253. (*Sir Proby Cautley.*) That appears to have been a failure?—I have not heard the result of the experiment, but I am afraid that perfect immunity from malaria cannot be attained, under an elevation of 5,000 feet.

4254. That place appears to have been tried for one season only, and the conclusion then come to was that it was a failure?—I do not think that was a sufficient trial.

4255. (*Sir R. Martin.*) You apprehend, I presume, that at 4,000 feet, you do not get above the fever range?—I think not, I think that an elevation of 5,000 feet is hardly safe.

4256. (*Chairman.*) Do you think that a trial for one year is sufficient to test the merits of a station, for example, is there not always a certain amount of unhealthiness attendant upon the process of clearing away the jungle, and exposing the soil in the first instance to the action of the sun?—Yes; I think, however, that in those hills the place selected was free from jungle, but I do not know under what conditions the men are marched up to the hills, for if they happened to sleep in any place near the base of the hills, which is always very feverish they might carry up the malaria with them from there. Then upon the plateau of those hills we know that there are a number of villages and a good deal of cultivation and open pasture land and a plentiful supply of water, and all these circumstances would induce me to suppose that they were not so unhealthy as they were supposed to be; I do not think that the experiment can have been fairly carried out, but still there is this general objection to it, that the elevation is hardly high enough for perfect safety.

4257. Do you not think that some advantage in point of health is gained by going up to a height of even 4,000 feet?—If you can avoid fever, most decidedly. We have reason to believe that the miasmata causing fever are for the most part only generated in the night, and if you could adopt precautions against nocturnal exposure in a place which was otherwise not perfectly free from danger, I think the preservation of health might be ensured.

4258. The greatest prevalence of fever is about the foot of the hills, is it not?—Yes; that is a dangerous

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place, and there is another circumstance which I may mention ; I have known instances in perfectly healthy places where the malaria has been blown up ravines by currents of air, and persons have become affected by fever in situations that were otherwise perfectly healthy. I recollect several instances of that kind which were caused, no doubt, by the malaria being wafted up by currents of air over sites far above fever range, and those who slept within their influence were attacked, and died ; I recollect the case of a whole family being swept off under such circumstances. I knew the place perfectly well ; I had slept there in tents, over and over again, and we all knew that it was perfectly free from malaria. In that instance it can only be accounted for, I believe, by the cause I have stated ; you see a mist rolling up the valley with the breeze from the low country, and the malaria is taken up in that way.

4259. Even if you find a station that is healthy in itself I presume it is an important consideration whether that station is accessible only by passing through a tract of country in which fever prevails ? —Yes ; and it is almost invariably the case, that you cannot get to those high ranges without passing through such a tract of country.

4260. (*Sir R. Martin.*) What is called the Terrai in the north ?—Yes ; we do not use the word, but the case is exactly the same in the south.

4261. (*Chairman.*) At Ootacamund is there not an extensive belt of unhealthy jungle to pass through ? —Yes ; all round the base of the hills there is an extensive belt, and it is a curious fact that the approach from Mysore by Segoor, which was exceedingly unhealthy, has become much less so of late years, I think, in consequence of the jungle being cut away for firewood. To look at it you would not suppose that it was at all a dangerous place ; it is not a dense jungle, and there is a gravelly soil and good water ; and yet at first many of the early travellers who were detained there at night died of fever.

4262. But since the wood has been thinned, it is much less dangerous ?—Yes ; it is much less unhealthy, and even with regard to Segoor the last time that I went up, which was about two years ago, there was a little village at the base of the pass where the people did not seem to suffer, whereas, before that, the natives suffered as much as the Europeans.

4263. You refer this favourable result to the clearing of the woods and the progress of agriculture ?—Yes. I can attribute it to no other cause ; but I may mention another circumstance which may have had some influence, namely, that the land about the base of the mountain appears to have been highly cultivated at some former period, and to have been afterwards deserted. Whenever such has been the case I have observed, not only in this, but in many other instances, that those places become subject to malaria. Perhaps the improved salubrity at Segoor may be owing, in some measure, to the renewal of cultivation.

4264. (*Sir Proby Cautley.*) Would it be a good plan, in order to test the value of a site upon the hills, to send up Europeans first, or natives ; or what plan would you adopt ?—I think that the conditions which would be unfavourable to the one might not affect the other. I recollect catching a very severe fever once when out with a shooting party. I and a friend of mine were attacked almost at the same time, and yet not one of the servants suffered. Not that natives are exempt. In other cases I have seen tracts of country where the natives suffered most severely, and that annually ; every year, as the season comes round, they are laid up, and you see the effects of it unmistakably upon them in their enlarged spleens, emaciated limbs, and pallid complexions.

4265. Would you send up Europeans or natives in order to test the value of a site at a considerable elevation ?—If you want a site for Europeans, unless you send them up, you would get no certain results. The plan that I always advocated as the best means of obtaining a satisfactory solution of the existence of miasma was that of having a scientific commission,

appointing one or two men of scientific acquirements to test the conditions under which fevers arise, in order to arrive at some certain results.

4266. You mean men selected on account of their particular knowledge of those subjects ?—Yes ; they should possess a knowledge of meteorology, chemical analysis, geology, as well as of the general principles of disease, and I think that you might obtain a very valuable amount of information by such means. At present the regiments that are sent out into those districts are utterly disorganized ; you not only lose your men by death, but you have to pension so many of them who are never fit for service again, that it becomes a very expensive matter, looking at it merely in a financial point of view.

4267. Would you adopt the same plan in selecting large stations ?—Certainly. I think that we are lamentably ignorant of the whole subject of the origin and causes of fever in India, and as they are I think all dependent upon natural phenomena, I cannot understand why we might not obtain a full history of the causes of disease and their influence, and act accordingly. There is another case that I may mention ; it has been found that the Shevaroy hills are perfectly healthy and continue so for long periods, for a period, perhaps, of 15 or 20 years, and then all at once there comes a sickly season, and all the Europeans on the hills are seriously affected by it, and many of them are swept off ; that has happened twice in my own recollection.

4268. (*Sir R. Martin.*) The same thing has been observed in stations on the plains, both in the East and the West Indies ; are you aware of that ?—No, nor did I know of it in the plains of India, nor have I met an instance of it except in this one locality ; it never happened on the Neilgherries.

4269. (*Chairman.*) Assuming that healthy stations can be found on the hills, which are not unsuitable on account of the dangerous nature of the country to be traversed before reaching them, do you think that there is any great difficulty as to the administration of the police of the country in keeping a considerable proportion of European troops in the hills instead of in the plains. I put the question with reference to the Madras Presidency especially ?—I should say not the slightest difficulty.

4270. If, for instance, the hills in the neighbourhood of Ootacamund were selected as a site for a considerable European station there would be railway communication both to the east and to the west, would there not ?—Yes.

4271. When the lines at present projected are carried out ?—Yes, by the end, I think, of next year.

4272. Do you think it would be possible to place a considerable proportion of the European force to be maintained in the Madras Presidency there, leaving only comparatively small garrisons at the present stations ?—Yes, and there are means of supporting a great many men there.

4273. You think it is possible, and that the security of the country would not be imperiled by the withdrawal of troops from localities where outbreaks were most likely to arise ?—I think that it would be quite safe, and we have of late years acted largely upon that principle by withdrawing the whole of the military force from all the provinces except at three or four principal stations, and leaving the country entirely to the civil police, and with the best effects.

4274. That applies to the Madras Presidency, which I think we may assume is by far the quietest part of India ?—Yes, I think that the people are quieter generally, but still there are a number of turbulent tribes under Zemindars and petty princes.

4275. (*Sir R. Martin.*) There is, I believe, a large proportion of the Mahommedan population in that presidency ?—Yes.

4276. And those are everywhere the most turbulent, are they not ?—Yes ; I believe that there is about one-sixteenth of the population. There are also a number of predatory tribes, and they are always apt to be turbulent ; they are quite a different race of

men from the ordinary Hindus, bold, independent, and very ready to defend their rights; they take possession of the fastnesses, and I think we have always had more trouble with them, and more expeditions which have been very trying to the troops in Madras, than in any other part of India. They are comprehended under the general name of Poligárs in the south, and of Hill Zemindárs in the north. The Poligárs were engaged in a serious rebellion during the early part of this century, and proved themselves no mean opponents. They have also given much trouble on more recent occasions, in Mysore, the western coast, and the ceded districts. The insurrections of the Hill Zemindars in 1834-6, and again in 1843-6, were very serious, and cost us many officers and men.

4277. Those were chiefly native troops?—Yes, almost all, and it was these circumstances which made me so anxious to have some inquiries conducted into the causes producing fever, and which I am confident, from what I have seen, and what I have noticed of the peculiarities attending feverish localities, would be attended with useful results.

4278. It has also been stated that the natives would not believe in the existence of a military force if it were placed remotely from the great cities; do you think that that is likely to be correct?—No, I do not think so; I think, and indeed I know, that in the south of India the people are quite intelligent enough to understand our power, and sufficiently aware of its existence.

4279. If the troops were brought down every cold season for exercise, would not that be sufficient for the purpose of enabling them to be seen by the natives?—Quite so if it were necessary, but I doubt whether it would be at all necessary; many of them never see a soldier from one end of the year to the other. The agricultural population is most submissive and quiet, and, in fact, the parts where the people have not a just idea of our power are those of the unhealthy tracts, to which the troops cannot go, and it is this ignorance of our military power in those hill districts that encourages them to resistance; they never see any indication of it until they have provoked its exhibition.

4280. (*Chairman.*) Is your acquaintance with the Bombay Presidency sufficient to enable you to inform the Commission whether you think that any similar concentration of troops at some two or three of the great hill stations could be effected without public disadvantage?—Yes, I think it could be; a large part of the Deccan country is precisely the same, and the people too, as in the Madras Presidency; and you would have in the Mahabeshwur hills an excellent sanitarium, except that I believe the troops could not remain there during the rains. But in the hot weather it is an excellent place, and free from all objection as far as I know. There are several hill forts also in the Deccan, and in the north there is Mount Aboo.

4281. In those hill ranges is there sufficient open country to enable the troops to move about freely?—On the Mahabeshwur hills there is.

4282. It has sometimes been stated as an objection to hill stations, and probably with justice, that where they are established on mountains of a precipitous character, and where there is very little open ground about a station, it is hardly possible for the men to go through any exercise, as they are confined either to their station or to one or two roads along which they can alone move?—Yes; that objection applies to some of the stations, but not to the Neilgherries nor to the Mahabeshwur range. I think that there is ample space there. On the former the plateau is at least 50 miles in length by 30 in breadth.

4283. (*Sir R. Martin.*) You have stated, I think, that you have thought it would be advisable that the troops should be brought for exercise into the plains, for the cold season?—Yes; but not on account of the effect that their appearance would produce upon the people, but for the good of the men with a view

to acclimatize them, and to familiarize them with the circumstances they would encounter in the event of a sudden call on service.

4284. (*Chairman.*) Should you think it expedient that the hill stations should be used for the purpose of sending troops thither fresh from England, or would you reserve them for invalids?—I think they might be used with advantage for both purposes. I think that the young recruits probably would be better acclimated by passing a season there before they went to the plains; I think that the sick ought to be sent there in a great majority of cases, but I believe that men suffering from liver complaint and dysentery should not be sent to the hills; I know that in the Neilgherries it was always prejudicial to send patients suffering from liver complaint there, but for most of the diseases of India it would be a very favourable change.

4285. Is there any other suggestion that you wish to make to the Commission relative to the question which they have to consider?—The main suggestion I had to press is that of endeavouring to ascertain the causes of fever, and partly also of cholera, by an intelligent course of experiment and investigation, with the view of guarding against attacks of such maladies, and of instructing medical officers in charge of regiments how to prevent them by the adoption of prophylactic measures, and by avoiding positions where the troops might suffer from noxious influences.

4286. (*Sir R. Martin.*) Have you been in the country of Travancore?—Not in Travancore.

4287. There are extensive ranges in the Travancore country which are said to give great promise on account of their salubrity?—Yes, as far as the elevation goes they are very favourable, but I am afraid that there is a want of space or table land upon them. There is one place, called Kudarei-muk'hu, which I know is a very desirable spot, immediately to the east of Mangalore, and it has been used by the civil officers there, for some time, and found to be a very desirable place of residence, quite as agreeable as the Neilgherries. General Cullen also found a delightful spot on a lofty mountain of Travancore, called Agastiswara-malei. I have no doubt that along the whole of that range spots would be found that might be very advantageously employed for sanitarium. Wherever you see the green tops of the hills rising above the jungle where there is short turf and grass you are almost sure of salubrity.

4288. (*Chairman.*) Is there anything else that you wish to suggest to the Commission?—I would only again press that one point, as to testing the phenomena of fever by experiments.

[The witness states that he had noted a few points connected with the subject on which he expected to be examined, for his own satisfaction, which are at the service of the Commissioners, and submits the following MEMORANDUM.]

We frequently observe the health of troops in India to be suddenly and unexpectedly attacked by epidemic disease without apparent cause when on service, or on their march from station to station, or even in cantonment.

Such visitations are attributed in general terms to atmospheric influence and to malaria, but no one has ever attempted to *prove* the truth of these assertions, or, admitting them to be correct, has ever tested the precise conditions under which the noxious influences are developed.

In the case of fever, in its worst form of jungle fever, and whether remittent, intermittent, or continuous, we say that it is produced by malaria; but whence the malaria itself is derived no one cares to inquire. All that is known on the subject may be summed up in few words, viz.—that feverish miasma exists in connection I., with particular seasons, II., with particular localities, and, III., with other circumstances of an occasional or accidental character.

I. With regard to season, malaria is rife in certain districts at the close of the S.W. monsoon, whilst in others that season is the most healthy period of the

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year, and disease makes its appearance at the close of the cold season, and continues during the hot months. The western Ghats between the southern Mahratta country and Goa and Canara furnish examples of the former. In the tracts about the base of the Neilgherries and in those between the northern Circars and the Nizam's country, the latter is found to be the case.

II. Again certain localities are affected with malaria while others are free, owing, to the geological formation. Dr. Kirk, of the Bombay establishment, attributed the sickness prevalent in parts of the cantonment of Sukkur to the presence of magnesian limestone rocks, which had been subject to the influence of volcanic action now extinct; and Sir Charles Napier, in submitting Dr. Kirk's report to the Government of Bombay, confirmed these views by numerous examples which had occurred within his own experience, while serving with the army in Spain and Italy. Dr. Heyne, of the Madras establishment, recognized a connection between the existence of fever miasma, and a kind of granite very frequent in Southern India, distinguished as syenitic granite, which contains a large proportion of hornblende. He found that whenever this constituent occurred in a state of disintegration from the action of oxide of iron, there fevers of the worst type prevailed. I observed an instance of a similar kind myself in a village near Badámi, in the Southern Mahratta country, which was supplied with water from a small stream flowing through a bed of tufaceous limestone. The inhabitants suffered so much from intermittent fever in consequence, that I persuaded them to remove to a new site, and they were afterwards quite free from the disease. The village was originally situated at the junction of this stream with a larger one less easy of access, and beyond the limestone beds. One family which had always drawn its supply from the larger stream had never suffered.

2. Another circumstance which seems favourable to the generation of malaria is the neighbourhood of rivers. In 1843-4, a large body of workmen employed on the repair of the Walbhapur anicut, across the Tunga Chadra river, in Bellary, were obliged to leave the work from this cause. Captain Shaw, the engineer officer in charge and many of the coolies, died, and all suffered more or less from attacks of fever. This occurred in the month of February. The officers and men employed in the construction of the Dowlaiswaram anicut across the Kistna were well acquainted with this fact, and always adopted precautionary measures in the early part of the year.

III. Malaria is sometimes carried by currents of air from places in which it is generated to others who are otherwise free from danger. Thus it is known to have been wafted by the wind blowing up the vallies and ravines on the sides of the Neilgherries to the summits of the mountains, and there to have manifested itself in its most virulent form. Several members of the family of a planter were destroyed by this cause near Káteri on the Neilgherries.

2. In all places subject to malaria the intensity of its influence is in an inverse ratio to its height above the ground. I have seen it stated that the officers commanding the guard at the Salt station, near Saugor, have enjoyed immunity from the fever for which that station is notorious by the addition of a fourth story to the building provided for their residence.

3. Another peculiarity of malaria is, that it does not appear to pass through gauze or muslin, or other media causing it to be minutely subdivided. Colonel Blake, now commanding the Pegu police corps, tested this characteristic with great success when engaged during several weeks in the pursuit of a hill Zemindár, the Jagirdar of Lingamparti, who, after committing an atrocious murder, fled to the jungles of Rampa, the most deadly tract of Telingana. By a careful observance of the usual precautions, and especially by closing himself within thick cotton curtains whenever he slept, Captain Blake was enabled to follow up and capture the fugitive without having suffered any

detriment from the dangerous country through which the pursuit lay.

4. Places may be comparatively free from malaria for years, and then be suddenly deluged by it in its most virulent form. Places in southern India, where the elevation reaches to 3,000 or 4,000 feet, are very liable to such alternations. The Shevaroy hills afford notable examples of such intermissions, which have occurred at intervals of 15 to 20 years.

5. I have met with many instances in which malaria has been generated in districts and towns which had once been populous, but had become more or less deserted. The city of Goa is in this state. Numbers of the wealthiest Hindoo merchants and bankers emigrated to Bombay about 150 years ago, rather than embrace Christianity under the pressure of the Inquisition. Whole streets were deserted and became infected with malaria. To escape the danger, those of the remaining families who could afford to do so, removed to Panjim, an island now forming the most populous suburb of the city. The decay of the muslin manufacture at Dacca was followed by marked increase of fever in the localities abandoned by the weavers, and places which have been long under cultivation are generally liable to miasma when they have been for some time deserted.

The natural history of cholera is even less understood than that of fever. We know that it has overspread the whole continent of India in an epidemic form, at long and distant intervals. The Jesuit missionaries, in the *Lettres Curieuses et Edifiantes*, have described its ravages in Tanjore and Madura, where it was known as the *mort de chien* in the beginning of the 18th century. It made its appearance again with General Pearce's force on the march from Bengal to Masulipatam in 1767-8; and the records of the Northern Circars are filled with details of its desolating effects at that time. It made its appearance again in the armies of India employed in carrying out the combined operations conducted by the Marquis of Hastings in 1816; and every one is acquainted with its last great work of devastation, which was not confined to Asia, but overwhelmed the whole of Europe.

But besides these extensive visitations, it is continually making its appearance in more limited spheres. Not a year passes without instances of detachments or stations being attacked. Its visits are capricious and unaccountable. During the periodical reliefs it sometimes happens that every corps suffers from the disease, at others only a few. No one can explain why it comes or why it departs. Every precaution that has been suggested, every remedy that has been tried, has proved worthless. All we know is, that we know nothing. Attempts have been made to prove that certain localities are exempt from its influence, but these rest on negative evidence only, and that of a very unsatisfactory character. I have myself observed one remarkable instance of the converse of exemption in a district of which I had charge. For several years every detachment or body of troops which marched through the town of Moti-Bednúr, situated half way between Harihar and Savanúr, was attacked by cholera, though exempt at all the other stages, whether coming from the north or the south. There is not even a theory, as in fever, by which an explanation of its origin has been attempted. Men talk vaguely of atmospheric influences, especially in connection with electricity. I remember reading a letter in a newspaper from an officer employed on the survey in Trichinopoly, noticing some remarkable disturbances of the magnetic needles of his compasses during a severe visitation of cholera. But these indications and surmises have never been followed up.

In the case of malaria, the indications of which are found in a more constant and permanent form, the conditions under which it originates, and to which its continuance is due, are obviously capable of being tested by experiment.

In cholera the course of investigation is less clearly pointed out, but it may be predicated that a careful examination of meteorological phenomena, at times and places when the disease prevails, can hardly fail to yield valuable results.

The only argument that can be urged against the inauguration of a scientific investigation into the causes of these maladies is that of expense.

But when we consider the heavy outlay to which the Government has been put by the disorganization of corps, by the provision made for families of soldiers perishing on service, and by invaliding the survivors, the objection sinks into insignificance.

The course I desire to recommend is simply that of instituting a careful series of observations, conducted by properly qualified persons, on the natural phenomena of the air, the earth, and the water, at the times when, and the places where, the danger is known to exist.

Their attention should in the first instance be directed to observations of the temperature at different hours of the day and night; to indications of the ozonimeter; to the course and effects of the wind and of currents of air; to the chemical analysis of the atmosphere at different heights and at all hours; to

the examination of the strata under all circumstances, whether permanent, or in course of formation or decay; to the analysis of soils; to the influence of particular descriptions of vegetation and of vegetable and animal matter in a state of decay; to the analysis of the water in wells, tanks, and streams; to observations on the electrical state of the atmosphere, at all hours, both on the surface of the earth and at the greatest heights above it to which they can be carried; to the evidence of the inhabitants, and to the careful sifting of their statements of their own experience, &c.

All these offer ready and obvious subjects of inquiry. Persons conversant with such matters will find many more, and the course of the experiments themselves will suggest farther points to which the attention of those engaged in them will naturally be directed.

It is needless to add, that the success of such investigations depends entirely on the zeal and love for science of the persons to whom they are entrusted. If left to the perfunctory execution of men nominated by order, without enlisting their sympathies and interest in the cause, the attempts will end in disappointment and useless expense.

W. Elliot, Esq.

1 June 1861.

Saturday, 8th June 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.

Sir RANALD MARTIN, C.B., F.R.S.

J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.

Colonel DURAND, C.B.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.

JOHN SUTHERLAND, Esq., M.D.

ROBERT MONTGOMERY MARTIN, Esq., examined.

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4289. (*Chairman.*) The Commissioners have to thank you for having sent them the model map of India which is in the room. It was made by you I believe?—Yes; I prepared it some time ago to illustrate a history that I have recently finished on India, in which I have endeavoured to describe the events which have occurred in that country from the period of the invasion by Alexander to the close of the late mutiny. It is, of course, only an approximation to the truth, and cannot be asserted to be accurate, but it gives a better delineation of the country than I could obtain from any map.

This topographical model of India represents an irregular pentagon, with an extreme extent from north to south of 1,500 miles, and from east to west of 1,800 miles; a superficial area of 1,500,000 square miles, and a well-defined boundary of 9,000 English miles. The natural frontiers extend *northward* along the Himalayan chain and its prolongations, termed the Hindoo-Koosh, for a distance of 1,800 miles. This gigantic barrier, whose altitude varies from 16,000 to 27,000 feet (three to five miles), separates India from China, Thibet, and Independent Tartary, and has only one pass (Bamian) accessible for wheeled carriages. On the *west* the Hindoo-Koosh is connected by the low Khyber ranges with the lofty Suffied Koh and its conjoint, the Suliman Mountains, which rise 10,000 feet like a mural front above the Indus Valley, and have a southerly course of 400 miles.

The Suliman are connected by a transverse chain with the Bolan Mountains, which proceed nearly due south for 250 miles, and become blended with the Keertar, Jutteell, and Lukkee hills, which terminate in the promontory of Cape Monze, a few miles to the north-west of the mouth of the Indus.

This western boundary of 900 miles supports the plateaux which constitute a large part of Afghanistan and Beloochistan, to which there are four principal ascents—the Khyber, Gomul, Bolan, and Gundava Passes—readily defensible against an invading army. The *eastern* boundary, as represented in this model, is

formed by an irregular series of mountains, hills, and highlands, which extend from the commencement of the Brahmapootra along the wild and unexplored regions of Naga, Muneepoor, and Tipperah, through Chittagong and Arracan to Cape Negrais, at the extremity of the Youmadoung range, and near to the mouth of the Irrawaddy. To the southward and eastward of Pegu and Martaban the Tenasserim ridge commences, about 100 miles distant from the coast, and prolongs the mountain boundary to the Straits of Malacca, along the narrow strip of British territory which fronts the Bay of Bengal. The length of this eastern frontier is about 1,500 miles, and it forms a barrier against aggression from the Burmese, the Siamese, or the Malays, with whose dominions it is conterminous.

On the *south* the shores of the above-described territory are washed by the waters of the Bay of Bengal, the Indian Ocean, and the Arabian Sea for 4,500 miles, making, as before stated, with the land boundary of 4,500 miles, a periphery of 9,000 British miles.

I visited India several times, and resided in Bengal about a year. I was in Bombay twice, and visited the Deccan once. I also traversed the interior of Ceylon and the mountain regions there, and I have given considerable attention to the climate of our different possessions in Asia, Australia, Africa, the West Indies, North America, China, and Europe, when visiting those countries preparatory to compiling my "History of the British Colonies," so that I may, perhaps, be able to answer any questions that the Commissioners may please to put to me as to climate and the health of troops.

4290. Beginning with Southern India, in the first place, have you examined the hill country on the Neilgherries about Ootacamund, and the range of hills surrounding it?—I was not at Ootacamund. The delineations on that model are principally derived from the Ordnance Trigonometrical Survey, and from various private maps showing the slopes of the country and the elevations, and I believe they are pretty accurate. The scale, horizontally, is one inch to about

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15 miles, and vertically, is, as nearly as possible, one inch to 3,000 feet: by comparing the loftier ranges of the Himalayas with other subordinate elevations, an idea may be formed of the relative heights of the different divisions. I have brought, for the use of the Commissioners, a list of the mountain ranges, with their heights, and the circumstances connected with them; the different mountain passes; the rivers (which are coloured according to the fluvial area), and of the table lands which form a conspicuous feature in India. It may be of some use to the Commissioners for reference.

4291. Have you paid any attention to the climate of the various parts of India?—Yes; and I have brought with me a record of facts and observations on the subject, which I beg to hand in, as it may also be of some use to the Commissioners. But I may add that the climate is materially influenced by other circumstances as well as latitude or as altitude. The climate will be influenced, not only in India, but in other countries, by the aspect of the place being either east or west, and its position either north or south; and also by its exposure to trade winds and monsoons. Perhaps I could not better illustrate the difference of climate owing to position than by referring to Newfoundland and Vancouver's Island, both in the same latitude, but one being on the eastern side of the continent and the other on the western side, and yet in Newfoundland, it is with difficulty that oats can be grown—wheat cannot be grown,—and for a portion of the year it is extremely cold; whereas in Vancouver's Island, exposed to a western aspect, there is a climate like that of England. So with regard to India; the eastern and western sides have different climates. But there is another feature which influences climate in reference to the health of man, and that is, its geological characteristics. At Hong Kong, in China, I found no marsh and scarcely any vegetation, and yet a rapid destruction of life; a European regiment was entirely destroyed there in three years; its efficiency was much impaired in one year. On inquiring into the cause I could find no other but the existence of a mass of decaying granite; and I infer that in the mineral as well as in the vegetable and animal kingdoms, disintegration or decay involves the emanation of gases destructive to life, particularly when it is associated with ferruginous hornblend. Upon examining the bodies of Europeans who died in Hong Kong, it was ascertained that the intestinal canal was coated with a mucous slime, corresponding very much with the decaying granite of the place. The same took place at Koolungsoo, in Amoy, which I visited, where rotten granite was the predominating feature; but when our troops were removed to Chusan, which has a clay slate formation, the mortality among the European soldiers did not exceed three per cent. I find that Dr. Heyne, of the Madras Artillery, describes the insalubrity of a large part of southern and western India as the result of the troops being placed on granite with ironstone predominating; but when they were removed to the clay slate formation the fever abated, and did not appear at the stations where that formation was manifest. Sir George Arthur described the same results arising from the geological characteristics with reference to the troops in Bombay; and there is no doubt that the investigation of the geology of a country will be of material importance with reference to its salubrity. I have brought with me a collection of materials on the geology of various districts of India, and also showing where the different formations predominate, which may on future occasions indicate—because, of course, no one can say that the entire geology of India is known,—the leading formations and the geological features. I have also added a table showing the density of population in different parts of India in proportion to the area on which the inhabitants dwell.

4292. (Sir R. Martin.) Are you aware that an analysis has been made by Professor Baumann, of London, of the various red ferruginous soils that you

have mentioned in Hong Kong, and on the west coast of Africa, and various parts of India?—No, but on returning from China, where I was in an official position, I brought with me some of the decaying granite, and submitted it to the late Chevalier Bunsen, who immediately recognized it as being similar to the granite which is found at Auvergne in the south of France, and which Lyell describes in the 1st Volume of his Principles of Geology. He refers also to Dolomieu, who describes it as "*la maladie du granit*," and states that disease arises from a residence upon it, which he ascribes to the evaporation of certain gases, the nature of which could not be distinctly ascertained; he speaks of sulphureted hydrogen, and probably of carbureted hydrogen, but I noticed in China that when drunkards fell down and were lying on the ground in a state of intoxication death was almost inevitable, as if this gas, from its ponderosity did not rise a great height above the surface, and was imbibed more rapidly into the system from the recumbent position of the sufferer.

4293. You are aware perhaps that the same character of soil is to be found in large districts in the southern slave states of America, where the water is red from the ferruginous composition of the soil, and that there fever produced by malaria is never absent?—I was not aware of that, but, in endeavouring to trace the causes of sickness and health among the troops in the West Indies at former periods I found that at different periods one island or position was healthy and remained so for five or six years, when suddenly, without any apparent cause, fever would break out and decimate the troops, and after a certain course, cease again, without any apparent cause. It may be supposed that the geological strata being acted upon as in Hong Kong by extreme moisture, followed by extreme heat, some state of decomposition is produced, from which injurious gases are evolved, or—and which I think has not been sufficiently considered—an absence or an excess of electricity in the atmosphere producing a disturbing cause which originates disease at one time and not at another.

4294. And to those disturbing influences has been in a great measure referred the insalubrity of the districts where the soil has been of a ferruginous character?—Dr. Heyne, in speaking of the health of the troops on the Malabar coast in the regions west of Seringapatam, alludes to the circumstance that fever predominates in that district.

4295. And when you cross into districts where the cotton soil prevails, the country is comparatively salubrious?—Yes; I have understood that the limestone formation in the neighbourhood of the Indus has been productive of fevers. It is difficult to say why, because limestone is an absorbent of moisture, and is generally pretty dry.

4296. (Sir P. Cauteley.) Dr. Maclellan, who was in the Himalayas for some time, mentioned the limestone formation about Almorah as bearing very much upon goitre?—As a general rule I have observed, in various places, that elevation, to a certain degree, irrespective of geological formation, is conducive to health. Lord Combermere mentioned to me the other day that a large body of invalids were reviewed by him at Cawnpore, to be embarked for Europe; but the men appeared to be so emaciated, that he thought they would not reach Calcutta; and he therefore took upon himself to transfer them to Mussourie, which is upwards of 6,000 feet above the level of the sea; and the result was that at the end of 12 months those men were returned to their regiments in a state of perfect health, and with the loss upon the whole of not five per cent.

4297. (Sir R. Martin.) But the mountain ranges of India, generally speaking, have not been found to be so beneficial, by any means, for the cure of disease as for its prevention?—Perhaps not; but in locating troops ready for action, as Lord Wellesley used to say, ready like bloodhounds to be let slip, it is advisable to place them above the rain gauge limit, which varies in different parts of India from 3,000 to 4,000 feet.

Therefore in the formation of stations for troops, it appears advisable to establish them beyond that limit, instead of having them located in spots which are saturated for six months with moisture. When I went out to Jamaica to examine that island previous to writing the History of the West Indies subsequent to the abolition of slavery, I found that about 2,000 feet above Kingstown there was a perpetual mist during the rainy season. I went to 5,000 feet elevation, and there had a dry delicious atmosphere. During the forenoon, until about 12 or 1 o'clock, I saw nothing of the town of Kingston or of the harbour; but about 12 o'clock the clouds rolled up like the curtain of a theatre, exhibiting below the whole scenery and surface of the earth, which remained clear until the end of the day; whereas, I believe, at Stoneyhill barracks and other places they were for six months in the year in moisture. But the Newcastle barracks are now in a state of perfect salubrity, by reason of being placed above the rain-gauge limit. This limit will vary probably in different parts of India; the clouds which strike on the Western Ghauts, roll up unbroken by any land from the south pole, and pour a torrent of water upon those ghauts; the clouds thus checked cross the peninsula with a diminution of their accumulated moisture, and finally strike and fall in snow upon the Himalayas. But the consequence of their first bursting on the Western Ghauts is that at Mahableshwur there are upwards of 200 inches of rain; but in Coorg and on the higher portions of the Western Ghauts there is but a moderate quantity of moisture.

4298. At the rear of the ghauts?—Yes; you have a clear sky, with a dry salubrious atmosphere. Having served some years ago in the Royal Navy in the capacity of a medical officer, I am entirely satisfied that moisture is one of the most inimical conditions with regard to the health of man.

4299. Whether conjoined to heat or with cold?—Yes; the intensity of both is affected thereby. I have ridden through a burning forest in Australia, with the trees around in one red flame, with the thermometer at 110°, and have tired out two horses without feeling much oppression; and I have lain on a couch in Calcutta, with the thermometer at 86°, scarcely able to think or to move; the difference being, of course, very great in the pressure of the atmosphere. I experienced the same at Aden, where there is an intensely dry heat in that extinct crater of a volcano, which certainly is not immediately destructive of life; on the contrary, the colonel of the European regiment, when I was there for ten days' examination of the place, informed me that the health of his men was excellent; that liver disease occasionally appeared, but that in several cases the men were affected with insanity, as if the continued dry heat sooner or later influenced the brain.

4300. By producing a determination of blood to the head?—Yes.

4301. The long continued endurance of dry heat, which does not imply a malarious influence in many stations, becomes injurious by its continuance?—Yes.

4302. (*Chairman.*) Speaking generally, and taking India from south to north, what are the soils which you would point out as being inimical to health?—I could not off-hand indicate them; but, generally speaking, the combination of granite and iron is not favourable to health. The clay slate and sandstone formations are comparatively salubrious.

4303. Probably we shall find some information upon that point in the papers you have put in?—Yes. I found in the interior of Ceylon, at Badulla, to the south-east of Kandy, a delicious climate, on a table-land, from 40 to 50 miles in extent. The radiation of heat was not great, for exercise might be taken in the open air during the day without needing protection from the sun's rays. The interior of Ceylon appears to me to be a valuable place for the restoration or

preservation of health, and not only on account of its height, but from the insularity of the position, and from being exposed to all the breezes blowing from the south. In a strategical point of view, I might say that the concentration of a body of troops at that extremity of this wonderful empire, ready at any time for action, and to be diverged in any direction, would appear to me to be very advantageous; whereas when they are located at Mussourie and Simla, and other places along that range of mountains, they are placed at such a distance from any point in the centre of India as to be not immediately available; while there the Power which commands the sea commands the whole of the coast, and at any moment would have the means of sending a body of troops in any direction in a perfect state of efficiency.

4304. That is to say, to any part of the sea coast?—Or from thence by railways or river navigation into the interior; but I remember neither in Java, nor in Jamaica, nor in Ceylon—three of the most beautiful islands that I have visited—to have seen anything so perfect for a military reserve as the interior of Ceylon.

4305. (*Sir R. Martin.*) As uniting in those upper regions the purity of a mountain range with the atmosphere of the ocean?—Yes, on an extensive area, a table-land of about 50 miles in extent, with an average height of from 3,000 to 4,000 feet above the sea.

4306. And well calculated for agricultural pursuits?—Yes.

4307. (*Chairman.*) Of what station are you speaking?—I am speaking of Badulla and its neighbourhood, which certainly combine many advantages which I could not well point to in any other place, both for salubrity and readiness of access.

4308. (*Dr. Gibson.*) Do you think Badulla preferable to Newera Ellia?—Badulla is on an extensive plain, and extremely healthy, while Newera Ellia, I imagine, has a good deal of moisture.

4309. (*Sir R. Martin.*) Cold and moisture?—I think so. It is many years since I was there, but I should say that it was not so valuable as a military site as Badulla, which was healthy, on an open plain, and with fine country round. It appears to me, from what I have seen of encampments in different countries, that troops require a considerable area for exercise and enjoyment; *ennui* is less likely then to arise among soldiers than when they are confined to a limited plot; the mind is more tranquil when there is a large open space for action, exercise, and enjoyment, and plenty of wholesome air around them; but placed on a ridge or pinnacle, with no means of taking healthful exercise, or engaging in active employment, the mind reacts upon the body, and has to some degree the effect of undermining the physical stamina.

4310. That circumstance, together with extreme humidity, has been overlooked, has it not, in some of the selections which have been made in the northern hill ranges, and where troops have been placed on spurs, forming the front range of the hills, and bearing, therefore, the brunt of the south-west monsoon?—Just so.

4311. But wherever extensive table-lands may be found throughout India they would possess many of the advantages which you have spoken of as belonging to the same kind of soil and situation in Ceylon?—Yes, in some degree; take, for example, the table land near Nagpore; it is in a central position, nearly equidistant from Calcutta, Madras, Bombay, and Delhi. It has an elevation, I think, of about 1,200 feet, and is salubrious; rain falls every month in the year, and during the winter there is a hoar frost on the ground, where thin ice is formed; the nights are never hot, which is a great advantage; it is contiguous to a large river, and from what we know of the position of the troops there, and other circumstances, it seems to be one of the healthiest positions in India.

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4312. (*Col. Durand.*) Are you speaking of Nagpore itself?—Yes; of Nagpore and the district round it. It is rather an open district, and there is not much vegetation or trees. The site of the town itself is not salubrious.

4313. (*Sir R. Martin.*) That description applies also to the station of Mhow, does it not, and to various other localities in India, Poona, for example?—To Poona particularly, but Mhow and those stations more on the plateaux in the north-west certainly have a degree of heat, whether from terrestrial radiation or from being circumscribed by a great barrier, or from some other cause, which latitude does not justify. I think it not impossible that this increase of temperature is referable to the degree of terrestrial heat, which varies in several parts of the globe, and which I particularly noticed in Australia; it is probably owing to the crust of the earth, or to the structure of that crust being thinner and different from what it is in other places. We know that in several parts of Australia the thermometer indicates a degree of heat in the soil above that which is found in any other portion of the earth, as if Australia were a more recent formation or evulsion in the process by which earth has been raised out of the sea.

4314. The temperature of the different soils has been referred also generally to the geological characteristics of those soils?—I have not examined that matter, but it appears to me that where there is a subterrestrial or a submarine volcanic action that the temperature of the soil is influenced by the crust of the earth more than by the geological formation; in some parts of Australia the crust of the earth appears to be thin with numerous small extinct volcanic cones scattered over it, and yet with no large active volcanos—there is only one existing that we know of at Newcastle, in New South Wales, but in other parts of Australia there are small cones which indicate that there has been some extreme volcanic action near the surface of the earth.

4315. (*Chairman.*) You cite as two of the principal causes of unhealthiness in stations the dampness of the climate, owing to an injudicious selection having been made of position on the exposed sides of hills, and also an improper choice of sites as to the geological formation of the ground?—I do; I have seen in different parts of the globe in our colonies, and in other places, that attention has not been paid to the selection of suitable stations for the construction not only of barracks but of hospitals. During the last war in the West Indies hospitals were constructed upon sites which proved perfect pest houses; the sentries were sometimes obliged to be relieved several times in the night, for they were struck down by that poison which is termed malaria, which suddenly affected them, but now I trust that a better system will be established in the selection of suitable sites. In 1830 I wrote a small book upon the effects of climate on man, and I presented it to Lord William Bentinck, urging upon his Lordship a more efficient drainage of Calcutta, not only for the purpose of checking the spread of cholera, but also, if possible, to prevent its extension to Europe; and I remember a number of medical gentlemen in India who ridiculed the idea of supposing that cholera could ever reach a temperate country like Europe; they said that it was indigenous to a warm climate, and that although the nidus might be in Calcutta it would not be extended to a cold region. There is a tendency in diseases which spring from terrestrial poisons to spread themselves along rivers, coasts, or great tracks by some unknown agency, and nothing can be more essential in the formation of camps or the establishment of hospitals than as far as possible to place them out of the reach of such contingencies. There is a point which has been several times adverted to, as regards our military occupations in China. Chusan, which, as I mentioned before, is upon a clay slate formation, the granite ceasing about 300 miles north of Amoy, was at first deemed the grave of our European troops, and

I made a special examination into the question at Chusan, and found that it was not owing either to the unhealthiness of the climate nor to any prejudicial characteristics, but that the troops under Sir Charles Burrell were encamped on or near paddy ground, and that they were fed with putrid meat and rotten biscuit, which had been prepared at Calcutta. The meat was so putrid that the men put into their camp kettles any green herb that they could find, and drank the water out of the rice fields. They were sent every day in full marching order a distance of about two miles to get these provisions, and bring them back in the heat of the sun, and the result was that the Cameronian regiment was nearly destroyed; dysentery set in and deaths rapidly ensued among the men, but no officers died, because they had good provisions, and were exempt from the causes which operated so unfavourably upon the men.

4316. (*Sir R. Martin.*) The officers were not quartered in the rice grounds that you mentioned, but they were quartered in a town?—Yes.

4317. (*Chairman.*) Is there any other circumstance that you wish to mention as affecting the healthiness of sites for troops?—Generally speaking, as far as my observation has gone, I have found that an elevation contiguous to the sea has a great advantage; there is a purifying influence near the sea shore from the frequent change of currents of air, and that is an important advantage.

4318. But would there not be in such a position the dampness of which you have complained?—It is not a dampness which is inimical to the human constitution if there be abundance of food; the races throughout the globe who live near the sea, having plenty of food, attain as high a degree of longevity and strength as any other portion of mankind. There is a position near the entrance of the Indus which probably hereafter may be of great importance to us strategically as well as commercially. Kurrachee appears to me to be low, and, for a military station, liable to frequent recurrences of cholera or other diseases; but there is some comparatively high ground near the entrance of the Indus which is open to the sea breeze, and is free from the hot air that frequently comes down the valley of the Indus; it appears to me to be a very eligible position.

4319. Do you mean immediately above Kurrachee, where Fort Munora is?—Yes.

4320. Within what distance of Kurrachee is it?—Munora Point, where the fort is situated, is at the mouth of the harbour, about 3 or 4 miles from Kurrachee. I think that it is a valuable position, and well worthy of further investigation; it commands the harbour. I do not know that I ever saw a more insalubrious position than Fort William at Calcutta—it is below the level of the river. I am, indeed, surprised that the troops are efficient there for six months in the year. There is a magnificent hill country in Upper Assam suited for a military station—if it be the design of Her Majesty's Government to locate large bodies of European troops in entrenched positions, and not in driblets; that, as a commanding strategical position, would become a point of great importance for the maintenance of our power.

4321. How far from Calcutta is the high land in Assam of which you have spoken—considerably more than a day's journey?—Not by railway; and there is also a navigable river. Sir James Hogg told me that he had traversed a part of that country.

4322. (*Sir P. Cautley.*) Do you mean near Sudya?—No; higher than that. It is that block of table land round which the Brahmapootra winds.

4323. (*Dr. Farr.*) Will you be good enough to point out on the large map the position of some of the principal military stations which I will mention. Fort William, Dinapore, Cawnpore, Meerut, Agra, Umballa, Subathoo, Loodiana, Simla, Darjeeling, Secunderabad, Poona, and Trichinopoly?—Yes.

4324. Will you be kind enough now to mention the principal mountain ranges and table lands of India on which you think British troops might be stationed, beginning with Bengal?—Beginning with Bengal, some part of the Rajmahal hills about Bhogulpore seem to be very healthy and favourable for the location of troops. That position commands to a certain extent that valley, and there is the densest population there of any part of India; probably the valley of the Ganges contains altogether not less than 40,000,000 of inhabitants, and this high portion of the country, this elevated land, seems to be very eligible, and in a commanding position.

4325. Do you think that there will be a railway carried up to that part?—Yes.

4326. Do you think that, the Delta of the Ganges being unhealthy, some of the troops stationed there ought to be placed upon a higher range of hills?—Yes. Sooner or later, I think, that Calcutta will be the mere mercantile capital of India; that it will be like Liverpool in England, and the seat of government, sooner or later, must be placed higher up, and in a more central place in India; therefore, placing a large number of troops here does not seem so advisable as concentrating them more towards the centre of India.

4327. Will you be good enough to describe briefly the physical geography of the Rajmahal range of hills, its meteorological characteristics, and other circumstances connected with the locality which it is important to take into account before placing troops there?—The physical geography is very much indicated on the map by the commanding elevations.

4328. What is the elevation of those hills to which I have pointed?—The elevation ranges from 2,000 to 3,000 and 4,000 feet, and in some places as much as 5,000 feet.

4329. But this range of hills near the Ganges?—They range from 1,500 to 2,000, and in some places 3,000 feet.

4330. Are there table lands on which troops might be stationed?—We are not sufficiently acquainted with that country to say whether there is much table land.

4331. Is the country fruitful?—Very much so; but there are forests of great extent there.

4332. (*Sir P. Cautley.*) Is there not a great want of water there?—Yes, there is a deficiency of water; but in the paper that I have already handed in you will find a description of the different ranges given, and in many instances their geology, and also the numerous rivers that flow into the sea, with their various tributaries.

4333. In a meteorological sense, is there anything peculiar in that central range of hills; is there much rain-fall?—Towards the centre of India there is less rain than would be supposed. The line of tropical India is south of the valley of the Nerbudda, and continued in that direction, the remaining portion, nearly equal in extent, is north of the tropic of Cancer; but I think that the hottest portion of our globe is in the neighbourhood of the tropic. I certainly have always felt, when coming towards the equator, that I got into a cooler region than when near the tropic of Cancer.

4334. (*Chairman.*) When you say that it is extremely hot do you mean that there is greater heat during the hot season?—Yes.

4335. But is that so if you take the average heat during the whole year round?—No, it is not. At Singapore, for example, there is an average temperature throughout the year of from 73° to 88°, scarcely varying; but of course, in passing further north or south from the equator there is a great alternation of temperature.

4336. (*Dr. Farr.*) What is the rain-fall in that region to which you have been referring—is it considerable?—It is so described in the paper I have

handed in. The greatest fall of rain generally takes place where the clouds burst on the Western Ghauts. The clouds also come up the Bay of Bengal with tremendous force, and burst on the Youmadoung range. Every monsoon is generally in that direction, and so the quantity of rains that falls there is enormous.

4337. What is the distribution of rain throughout the year at those points?—It falls at particular seasons, but the period of the monsoon varies; for instance, the period when the monsoon first breaks in one place is different from that at which it breaks in another. It bursts first with great violence, and then it becomes mitigated for a time; hence there are in India what are called little rains, which are the precursors of the larger ones. The limit of perpetual snow varies much.

4338. Do you know anything about the salubrity of these ranges of hills with respect to the health of Europeans?—The health of European troops in some parts of the Deccan is nearly the same as that of European troops in any other country. At Poona, which has an elevation, I believe, of only about 1,400 or 1,500 feet, the troops appeared to be in as good health as I had seen in any part of the world.

4339. The circumstances are different at these points. In the one case there are sea breezes blowing over a high mountain range, and in the other there is a range of hills near the malarious valley of the Ganges?—Yes, but the sea breeze penetrates to a very great extent, even to that distance from the ocean.

4340. Then I suppose, as you go up to Delhi, higher up the Ganges, the circumstances are different, as the land gradually rises?—Yes, there is a healthy region in Bundelcund. Generally speaking, the finest portion of the population of India are those who occupy Malwah, and that comparatively high table land: the Rajpoots, a people who from a very early period have been the most powerful race in India, probably came into India among the early emigrants from Scythia, and have maintained their puissance and their vigour, except where the use of opium has diminished it. The deeds of heroism which those men have performed, and their endurance in courage and constancy, are unsurpassed in the annals of any country on the globe. They are living in a climate, warm, it is true, but in a region about 2,000 feet above the sea. There is another point to which I will refer. I do not entertain the idea that the children of European soldiers, or their parents, in India, may not be able to preserve the stamina necessary to carry out the policy of the dominant race. I think it is a mistake to suppose that because children born in the heat of Bengal or in Bombay, and who have no physical stamina, and do not live unless they are sent to Europe, that therefore children born in a different climate would not thrive; because the stamina and power of the Rajpoot race, from whatever period they came into India, has remained undiminished. They possess great physical strength, stately forms, and in mental power possess all the attributes of highly civilized men.

4341. You are of opinion that they have not at all degenerated?—I think they have not. They appear to me in their origin to have come from a colder region, and they have maintained their pristine power and vigour.

4342. As a general rule, the salubrity of the valley of the Ganges increases as you gradually ascend?—Yes.

4343. The unhealthiest places being the deltas of the rivers?—Yes; and any one who has been there must have seen the distinguishing characteristics of two races. The Mahommedan, who is a superior physical being, and is, generally speaking, superior intellectually, yet from residing for some time there becomes weak, timid, and comparatively abject, which are the characteristics of the Bengalee; but take the

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Mahomedan or Hindoo of Upper India, whose food is nearly alike, and you have a different class of men altogether,—men possessing great power and force of character, unlike the feeble race who live in a low, swampy, moist region.

4344. (*Sir P. Cautley.*) But that would rather operate, would it not, against your recommendation as to Ceylon?—I am speaking here of a low swampy region and of extensive delta, not of the plateaux of Ceylon.

4345. I allude to the superior strength and vigour of the people in the north of India; they are very different from those in other parts?—So are the Kandian race in the upper portion of Ceylon. There is a wild race there which has never been tamed, and who have a degree of ferocity and strength which is very remarkable; and even the Kandian race fought us in 1803 and subsequently with great determination, almost equal to the New Zealanders at the present time; they are a race who seldom come down to the lowlands. Humboldt in his personal narrative speaks of the difference of the people of the *tierras calientes* from the people who inhabit a higher region, the latter differing in physical power and vigour from those in the lowlands; and he says, that although a few days labour in the lowlands would procure them food for a year, they will not remain a single night in the lowlands, but go back to their mountain region to enjoy the salubrity it affords.

4346. (*Dr. Farr.*) What is the food of the people in Upper India?—The food of the people of Upper India is principally wheat and legumes of different kinds; the food of the people in the lower region is generally rice; but I cannot ascribe the difference to rice alone, for I found, particularly in China, a race of people living almost entirely upon rice, with the addition of a small quantity of animal food, who possessed great strength. The coolies at Ningpo will raise a weight that a London porter could with difficulty lift, but their food is rice, using some animal food with it. The Chinese eat a meal twice every day, consisting of some animal food mixed with a large quantity of rice.

4347. They do not live exclusively on rice?—No. But the better class of Hindoos, the Baboos of Calcutta, eat animal food; they consume kid, and eggs, and fish, and milk.

4348. (*Sir R. Martin.*) And always butter made from buffalo's milk?—Yes, ghee; but they are a timid, unwarlike, and astute race. We know that they are subtle to a degree, but without physical power or stamina.

4349. (*Dr. Farr.*) Going up into the upper regions of India you still meet with a warlike race, do you not?—Yes; but certainly the finest race, as possessing all the higher characteristics which distinguish man, are the Rajpoot race, a people who at a former period subdued a great portion of this more central region, and were the chief antagonists of the Mogul and Mahomedan power. The Mahomedans were able to maintain their dominion of India for several centuries, by means of fresh hordes who were brought in from the adjacent colder regions. Their troops were continually recruited by large bodies of new forces; and it was by these superior races that they maintained their dominion.

4350. They fixed on Delhi as their capital, and not on the delta of the Ganges?—Aurangzebe occupied this region.

4351. I mean that the Mahomedans did not come down and place their forces on the delta of the Ganges?—Certainly not; they maintained their seat of power in the upper region.

4352. (*Sir R. Martin.*) You are probably aware that Montesquieu and other European philosophers state, that the superior physical qualities of the inhabitants of the higher regions are the necessary result of physical geography; and that the political and military revolutions in India have resulted from the physical geography of the country; that the high

grounds were occupied by the conquerors, and the plains by slaves and cowards?—There is scarcely a subject that has caused me greater perplexity than in endeavouring to account for that subjugating power, because if we look to the Swiss and to the Dutch, the one race living in a mountain region and the other in a region scooped out of the ocean, we see the qualities of mind very remarkably brought out in both; and in the struggle between the Germanic and the Belgic races the Dutch have evinced a persistent energy which sets at nought a theory of mere physical geography. There must, therefore, be a very powerful force in what is termed *Race*; and if the qualities of race be preserved by the nature of the locality in which they are situated, then you have it transmitted from one generation to another with an intensity such as I have endeavoured to describe as being manifested in the Rajpoot race.

4353. Malte Brun has stated, that it is necessary to add another fact to the observation of Montesquieu, namely, that in Hindostan and throughout the Himalayas there is no temperate region; that it is all extreme heat?—There is no region, except at considerable elevation, that can be called temperate; where the grape can be grown for the production of wine you may describe it as a temperate region, and you certainly cannot ascribe that characteristic to any part of India; for although the grape is grown in the northern districts it is a fleshy fruit, and unsuitable for the sustenance of man in the shape of wine.

4354. (*Chairman.*) You do not apply that observation to Cabul?—No, but I do not consider that a temperate climate.

4355. (*Dr. Farr.*) Will you point out the Valley of Chenée on the map?—Yes; supposing every 300 feet of altitude represents a degree of latitude, and a country rising to a certain altitude, you have a corresponding variation of climate, but that is very distinct from a temperate region at a certain distance north or south of the equator which produces fruits and products necessary for the sustenance of man.

4356. (*Sir P. Cautley.*) In Kunawur, where grapes grow in great abundance, there is no monsoon?—In the loftier altitudes of the Himalayan range you get into a region so arid that leather actually crumbles in the fingers like tinder, and a slain animal could be reduced to dust in twenty-four hours.

4357. From the evaporation being so rapid?—Yes.

4358. (*Dr. Farr.*) You have spoken of the rain gauge limit, can you point out the position where you think that would be on the Himalayan range or on the Ghauts?—I do not know how far, on the Himalayas, it extends, but on the Ghauts the elevation is between 3,000 and 4,000 feet, and the rain begins to diminish at 3,000, except at Mahableshwur, where I think it is at nearly 4,000 feet; the rain-fall there is excessive, but on the more southern Ghauts, at 5,000 feet, you are nearly exempt from rain.

4359. At Poona, how is it?—There, there is an uncertain fall of rain.

4360. You do not consider, I suppose, that the rain, in itself, washes men away, or that it is very injurious to health?—I think that the quantity of rain that falls is to be tested by the degree of evaporation, and that it is an imperfect criterion of climate to speak of a certain number of inches of rain if you do not take into consideration the evaporation which takes place. I will give an illustration of that. The Isle of Man lies in a channel exposed to the breeze that comes in from the north between Scotland and Ireland; the quantity of rain that falls is very large, but the evaporation is so great there that it has no effect on the people or the climate: the island being about eight miles broad a large cloud may cover the whole of that island, and eliminate the entire moisture as it passes over it; and so in other counties. The cloud draws up the moisture from the earth, and as it were distils the rain.

4361. A cloud is the mere condensation of the moisture evaporated from the sea and earth?—By whatever means it is formed a cloud has its collection of moisture, and the quantity of rain falling in different countries is to be viewed in reference to the evaporation which takes place.

4362. In those higher regions there is that evaporation, that being in proportion generally to the atmospheric pressure?—If there be a free action of the wind.

4363. But independently of that, the evaporation would be greater up there than down in the delta, would it not?—Unless there be a free circulation of air when the atmosphere is saturated with moisture it does not escape. Where there is a perfect current of air blowing, then the evaporation is rapid, and the quantity of rain falling is then comparatively of less importance.

4364. A large quantity of rain is only unhealthy as it sets organic matter in fermentation, which then gives out the poison of malaria; but a great deal of rain does not imply that a country is unhealthy?—Generally speaking, in Africa I found that it was so. I was in Delagoa Bay, on the east coast of Africa. We went into that bay with three vessels of war in 1823, and we lost the greater part of the crews from fever. We had not sufficient men left to get up the anchor of one vessel. We went back the next year at the dry season, and the men were employed night and day. I accompanied them up the rivers in every direction, and we did not lose a single man; but we were not there when the solar rays had acted upon the intense moisture, and the malarious influences which dank vegetation gives rise to.

4365. What would be the point at which you think it likely the rain gauge limit would be fixed, so that we might ascertain whether, if the troops were stationed at different places on those hills, they would be beyond the influence of the rain gauge limit or within it—take, for instance, Darjeeling?—That is a region of much moisture.

4366. Have you any idea of the point at which the rain gauge limit would be there?—I have not. I have given in a return showing the fall of rain at Darjeeling, which is upwards of 100 inches in the year.

4367. Is there any information of that sort to be found in the Indian publications?—The materials collected in that return have been obtained from all the accessible documents that I could find at the India House. The difficulty at Darjeeling is in getting a sufficient quantity of flat ground at a proper range above the sea to form an encampment upon. Darjeeling is near the very focus of the fall of rain in the south-west monsoon. It is true you are better off certainly in the rainy season upon the high ground than upon the low ground; but it is only to a comparative extent better than the lower region.

4368. (*Sir R. Martin.*) But very improved localities, including table lands, are now being found in the Darjeeling range, which are said to be of great promise?—At what height are they?

4369. Between 5,000 and 7,000 feet?—Those would, I think, be beyond the rain limit.

4370. (*Dr. Farr.*) So soon as the monsoon winds have passed over the high mountain ranges they become dry, do they not, as nearly all their moisture is precipitated?—The Coorg region, which is from 4,000 to 5,000 feet high, possesses a climate above the rain gauge, and possesses a bold, healthy mountain race, a people with energy and force of character.

4371. (*Sir P. Cautley.*) There is great difference in the rainfall between that place and at Delhi. The rainfall at Delhi is, I suppose 25 inches, or say 30, whereas the rainfall there is about 120 inches?—I think that at Delhi it must be between 50 and 60.

4372. (*Dr. Farr.*) At Delhi the temperature is not low, and therefore the vapour in the atmosphere is not precipitated?—No, and as I stated at the beginning,

the aspect has a great deal to do with the climate—*R. M. Martin, Esq.*
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4373. What is the elevation of Cashmere?—I think it is between 5,000 and 6,000 feet above the sea in the centre of the valley.

4374. The winds will have passed over the Himalayan range before they reach Cashmere, and consequently in Cashmere the atmosphere will be comparatively dry?—I doubt that from its being so sheltered round by a great wall of mountains. Although Cashmere was the favourite residence of the moguls,—their summer residence,—I think it was not a salubrious one.

4375. What is the climate of Cashmere as far as you have learned?—It is characterised by moisture and heat.

4376. In the winter what is the temperature?—It is cold.

4377. But on the whole Cashmere is a healthy country, is it not, and the race fine and vigorous?—No, I do not think it is so.

4378. The people on some of these high mountain ranges are very unhealthy and feeble, are they not?—On a portion of the Himalayas the people are feeble, partly from the extreme tenuity of the air, and probably from being very imperfectly fed; but the people at Coorg, for instance, are a fine race, handsome, brave, and enduring; and so is that peculiar race which is found on the Neilgherries, the Todawars, who are probably more like New Zealanders, or the people in the interior of Madagascar. The people who inhabit the table-land of Madagascar are a light-coloured race, with long silky hair; they are very handsome, have a martial step, and the look of an ancient Roman.

4379. In the Deccan generally the people are more vigorous than in the valley of the Ganges?—Yes.

4380. Can you point out on the map what is called the Terrai?—It lies along the Lower Himalayas, where there would be great moisture; it is covered with forests and dank vegetation, yielding at all times a pestiferous gas.

4381. (*Sir R. Martin.*) It is covered with long grass, is it not?—Yes, and underwood.

4382. (*Dr. Farr.*) What is the breadth of the Terrai?—It varies from 20 to 30 or 40 miles, according to the retreating spurs of the Himalayas.

4383. Does the Terrai run all down the range?—Yes, it extends more or less all along.

4384. And at the foot of all the great hills in India something like the Terrai always is to be found?—Yes. Along the Malabar coast there is an unhealthy region, owing to the vast quantity of water that pours down from the ghauts over the dank vegetation which is to be found in deep valleys, where the rays of the sun very seldom penetrate.

4385. Those points are all unhealthy, are they not?—Yes, to a certain extent; but there is a circumstance that occurs to me, which complicates the question of salubrity and insalubrity. There is a small island on the coast of Africa called Zanzibar, and it appeared to me, when I visited it, more like a terrestrial Eden than anything I had ever seen. It is as flat as this room, and well cultivated by the Arabs from Muscat, by means of a large immigration of slaves. It was covered, when I was there, with sugar cane, rice, mango-trees, and spices of various kinds. Many of the seamen of the squadron to which I was attached, attracted by the beauty of the place deserted. We could never send a watering party on shore without their doing so; and we offered a reward of 10 dollars for each man who was recovered; but if a seaman slept one night upon that island he generally died within a week.

4386. What kind of water did they procure for the island?—The water which the inhabitants drank.

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4387. Did they get the water from wells or from streams?—I cannot say at the moment. The commodore and a large party of officers went on shore and slept one night at the Sultan's house, and they all died within a week. But in that island there was no apparent cause for disease; it was well cultivated, and yet it was so fatal.

4388. (*Sir R. Martin.*) Was rice cultivated largely?—I cannot say very extensively; sugar cane was. I believe it is now more healthy, and that we are able to maintain a consul there, and there are some French there; but it was fatal, as I have described, to Europeans, so that the subject of salubrity is one of considerable difficulty.

4389. (*Sir P. Cautley.*) It does not follow, does it, that rice cultivation is injurious to health?—I did not perceive it so in China. I went up several of the rivers there, and I did not find that it was so.

4390. In Tanjore, and in other places, where irrigation is going on, there appears to be no great unhealthiness arising from rice cultivation?—No. In rice cultivation there is a continual product of vegetable life carried on, and there is no decomposing or decaying vegetable matter. The crop is reaped, and the ground is cultivated again almost immediately.

4391. In Upper India and in Italy it is well known that malaria does arise from rice cultivation?—In examining the early history of Italy, there is great difficulty in explaining why a large portion of the country became depopulated, whether it was from the absence of people, or the want of cultivation; but the diminution of population and the unhealthiness of parts of Italy do not appear to be owing either to rice cultivation or to anything that I can trace. I did examine into that question, as to the ancient population of Italy, but was not able to arrive at any satisfactory conclusion.

4392. As a general fact in the northern part of India, and in Italy, the rice is considered an injurious cultivation, whereas in Tanjore and the Madras districts, and in parts of China, it is not found to cause unhealthiness?—At the time when I was in China I went among the rice grounds, but did not hear they were peculiarly insalubrious.

4393. Therefore it would appear that the unhealthiness must arise from some other cause?—There is a cultivation of dry rice as well as wet rice, and I imagine that the rice of Italy has been dry rice. In China, in some districts, it is reaped in the water in boats.

4394. (*Dr. Farr.*) Do you know anything of the region of the Irrawaddy?—I have not been there.

4395. What was the information upon which you constructed this map?—From various sources. Sir Arthur Cotton examined it, and he told me that I had well delineated the country. He said that I had quite caught the features of that region.

4396. But had you any authority for it?—I had maps of different kinds, but I do not venture to say that this is an accurate delineation; it can only be considered as an approximation to it. I had the maps of the trigonometrical survey, and also many revenue surveys; I have not made merely imaginary parallel lines of ranges, but I have had various maps before me that I collected at the India House of different regions, some of them in manuscript. Mr. Walker, Geographer to the East India Company, furnished me with several materials, and perhaps I may state to the Commission that after this was completed (I had previously made a lesser one), I wished a Committee to sit upon it; and I proposed Mr. Walker and Mr. Edward Thornton to examine into it, that I might endeavour to correct the defects. Mr. Thornton, who certainly

has paid great attention to the topography of India, and Mr. Walker, who has been for many years hydrographer, could not find out anything but this, that they considered the approximation of the Sooliman range to the Indus was too near; but then I had great difficulty in endeavouring to delineate the altitude of this range with reference to the country and the valley of the Indus. There appears to be a very valuable position near the Takti Sooliman for a military station, well worthy of being investigated.

4397. (*Chairman.*) But the Takti Sooliman is beyond the British boundary?—I did not consider that.

4398. (*Dr. Farr.*) Can you point out the position of Cabool on your map?—It lies in that valley, opposite the Hindoo Coosh.

4397. (*Dr. Sutherland.*) Are evening fogs common in India?—They are, in all the low, damp countries.

4400. Are there certain regions of India that are free from evening fogs, and others where they always prevail?—I found no evening fogs at Poona, the soil there being very dry, and the region elevated; but in Bengal, in the whole of Lower Bengal, the fog at night, the moisture precipitated is considerable, and the Hindoo, in going out at evening, throws the end of his muslin robe across his mouth, and breathes warm air through the muslin to avoid the injurious effects of that fog.

4401. To what height from the ground does it extend?—I had a pinnacle on the Ganges cruising about for the purpose of investigating the country before writing my history, and I always found near the river a very dense fog at night; so much so, that I closed my pinnacle to avoid breathing the noxious air; but I found little, if any, on the western side of India. The monsoon blows with greater intensity there than it does in a comparatively inland position.

4402. Have these fogs in your opinion any effect upon health?—They certainly affect the natives of India; and a peculiar disease called beri-beri, is very much caused by damp; I examined anatomically several persons who had died of the disease, and I found an enlargement of the spleen, it being gorged with blood; the native soldiers were particularly subject to it, when placed in damp positions, or in foggy regions. I found it the case in the low grounds of the coast of Ceylon.

4403. You would therefore, I presume, consider it necessary to avoid the localities where these fogs prevail, or at all events that the troops should sleep above the level of the fogs?—Quite so; all the lower stories, barracks, or hospitals that I have examined in tropical parts of the world were unhealthy. A pestiferous gas arises from the earth in the tropics where there is vegetation and moisture which is inimical to health and life; this gas does not rise to any great extent, but slowly comingles with the surrounding atmosphere.

4404. Have you ever observed the lower story in a fog while the upper story was more or less out of it?—Yes, and it is observable that the Hindoos endeavour, as much as possible, to sleep in an upper story, or if they do sleep in the lower story they wrap something entirely round the head, to prevent their breathing anything but the warm air; that having a peculiar power of neutralizing the poison in a miasmatic atmosphere.

4405. (*Sir R. Martin.*) The occupation of the lower floors in barracks and hospitals is most objectionable upon the plains, and in alluvial countries, but not at all so on the mountain ranges?—Not at all; I slept at Badulla and other places on the ground floor, and was perfectly healthy.

4406. (*Chairman.*) Is there anything else that it occurs to you to state?—No.

The witness withdrew.

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4407. (*Chairman.*) I believe you have resided about 20 years in India?—Yes.

4408. Have you not published a report upon the hill stations and climates of India?—I have written some papers on the subject of hill climates. I resided for nearly five years at various hill stations, viz., during three seasons in the Himalayas, one season in the Neilgherries, and one at Newera Ellia, the sanitarium of Ceylon.

4409. And those reports have been published?—Yes.

4410. By the Indian Government?—No, I supplied to the Indian Government extra copies which were sent home, but the reports were published in this journal, "The Indian Annals of Medical Science," which I have here; it was established about eight years ago, and was supported very liberally by the Government, who took a certain number of copies. One of my reports related chiefly to the prevailing diseases in the Simla group of hills; the other was connected with the topography and health history of Murree; but I printed various other reports which were received from other medical officers—some official, others which had been sent to me privately, and in the last number of the journal there is a very interesting account of Darjeeling by a medical officer who had been in charge of the station for three years.

4411. (*Sir R. Martin.*) And which you desire to put in evidence?—Yes; it is very brief, and I think it will be interesting to the Commissioners to see it; it is an exceedingly satisfactory account, and I know it to be perfectly trustworthy.

4412. (*Chairman.*) You say that you have some acquaintance with the Neilgherries, you resided at Ootacamund, I presume?—Chiefly at Kotergherry and at Cunoor.

4413. Did you see anything in the climate or in the circumstances of the country in the Neilgherry hills which induced you to think that it would be inexpedient to quarter there a large body of European troops?—Nothing.

4414. It is accessible on all sides by railways, is it not?—Yes, it is very accessible, and it has the advantage of being very near the sea; it is an inter-tropical hill station, and is, I think, more salubrious than some of the Himalayan sanitarium.

4415. There is ample room for a station?—There is ample table land there; the residents can drive about in carriages, which they cannot do at most other hill stations, and the cost of provisions, which is in general high at the Himalayan stations, would not be so considerable there: the railway will have the effect of equalizing prices everywhere in India.

4416. But there is a good deal of cultivation on the hills themselves, is there not?—Yes; on the Neilgherries there is a great deal of cultivation, and a great deal of pasture land.

4417. So that a considerable part of the supply of provisions for the troops would not require to be brought from the plains?—No; I should think that a good deal might be got there, but the indigenous native population is very sparse, and, therefore, the market is not a large one: almost everything comes from the plains; the cultivation is probably not much in excess of what the local demands of the native population generally are.

4418. If a large station were established there the native population would probably not long remain so scanty as it is?—The emigrant native population would no doubt increase, but the indigenous native population are absolutely dying out; and the hill climate is not popular with the native servants; they feel the cold, and suffer from it in consequence of their apathy and disregard of warm clothing.

4419. How is that climate with regard to rain?—There is for invalids a great advantage in the Neilgherries in this respect, that you can move from one side to the other, and thus escape the rains altogether.

4420. (*Dr. Gibson.*) Why is the original popula-

tion becoming extinct in the place to which you have referred?—I think it is probably from their social institutions and habits. They breed in and in, and five or six brothers will have but one wife among them. They are a very peculiar race, and very Jewish in countenance.

4421. It is not from disease that they are becoming extinct?—No; they are a very fair, and handsome race, but they are very indolent and prejudiced, and will undertake no labour in the fields; they sell the produce of their cattle for grain to the emigrant native races who cultivate the land there.

4422. (*Sir R. Martin.*) Peculiarity of race and distinction of caste tend to diminish the population?—Yes.

4423. (*Dr. Farr.*) Were there many Europeans in the Neilgherries when you were there?—There was besides ladies and children a very large number of officers there on sick leave, so large that there were two medical officers in charge of them.

4424. Were they invalids?—Some officers came upon private leave, but the majority of them were there on sick leave.

4425. The climate there has a very salutary effect upon invalids, has it not?—Yes; more so, I think, than in any other hill station I have been at.

4426. What class of cases is most benefited there?—Chiefly persons suffering from debility and dyspepsia, and the sequelæ of fevers, in fact almost all cases except organic affections of the heart and brain; the altitude of the place seems to affect these injuriously. The altitude of Ootacamund is nearly 8,000 feet; Kotergherry is 7,000, and Cunoor only 6,000.

4427. Did you observe that ill effects from the altitude were produced on the health of some persons subject to head affections?—I had no such cases under my own care: medical officers generally avoid sending up such cases to the hills.

4428. Are such cases produced by solar effects or from congestion?—I think from the rarefied air.

4429. (*Sir R. Martin.*) Diminished atmospheric pressure?—Yes, and the mountain air is very stimulating.

4430. (*Dr. Farr.*) Is there any class of diseases generated in those regions?—None that I am aware of.

4431. Not diarrhœa?—No; I looked over the annual reports for 10 years back, and could find no note of that diarrhœa which prevails in some of the Himalayan ranges.

4432. Had they any cholera at that height?—I believe they had scarcely any; occasionally there were sporadic cases, which had occurred among natives coming up from the plains; there were two such cases at Kotergherry when I was there. I believe there has been one epidemic of cholera at Cunoor which is the lowest station of the Neilgherry group.

4433. How do they obtain the water that they use?—They have abundant springs and rivulets.

4434. They do not procure it from stagnant wells?—No.

4435. Is the water not likely to be rendered impure in any way by a mixture of offensive matter?—No; they have a large lake at Ootacamund, which is formed by the drainage from the high mountains around. I have heard no complaints of the water there.

4436. Do they get fruit and vegetables and everything of that kind that is necessary?—Yes, the vegetables are good and abundant.

4437. Is scurvy not likely to occur?—No, the vegetables are as good as can be procured in England.

4438. Do you think that European labourers would enjoy their health at those elevations?—I think they would; it might be well to cease labour at noon, or from about eleven till two o'clock, when the direct rays of the sun are powerful, but they are not more powerful than they often are in the streets of London on a summer day.

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4439. Do you think that English labourers could be employed in any other culture at those elevations?—I think they might be employed without injury to health in various field operations.

4440. Going there with their wives, do you think that they might have families who would survive to occupy that part of the country?—I think certainly they might.

4441. And to cultivate the land?—Certainly. Whether the race can be perpetuated in the hills without degenerating is a moot point; but assuredly children can be reared there in as perfect health as they would be in England, but being without the associations of home they would neither be Englishmen nor Scotchmen, nor Irishmen, but they would be physically as strong and healthy.

4442. (*Sir P. Cautley.*) You are probably aware that English dogs taken into that country always degenerate, even in the Himalayas?—I was not aware of that, nor do I know whether, if the breed is kept pure, they degenerate in the hills.

4443. It certainly is a remarkable fact, that in all parts of India the dog degenerates from the original stock?—In the plains I know that he becomes long backed and long nosed.

4444. And it is the same in the Himalayas?—I have seen only one pack of hounds in the hills; it was in high health and condition, and kept for hunting elk at Newera Ellia in Ceylon.

4445. (*Sir R. Martin.*) Are you acquainted with the results of the extensive employment of the 74th regiment out of doors in the Neilgherry mountains?—No; I am not.

4446. They were found to be in an extraordinary state of health, men, women, and children?—At Newera Ellia, in Ceylon, there were three very enterprising gentlemen, the Messrs. Baker, who came out with a view to colonize there; they took a quantity of machinery out with them, and also English labourers; they established a brewery, and erected saw mills, and spent a very large sum of money in making clearances; but the soil turned out so very unfertile that the speculation was a losing one: there was, however, no difficulty in respect of the ability of their English labourers to work in the open air.

4447. (*Chairman.*) But that was at an elevation of 6,000 or 7,000 feet above the sea, was it not?—Yes. Their greatest success was in their brewery, but as both the malt and the hops were imported from England, the profit was very inconsiderable.

4448. (*Dr. Farr.*) The higher regions of Ceylon are healthy, are they not?—Very healthy. During the time I was there, from April until the end of September, the rain-fall was excessive; but notwithstanding the great cold and damp, there was no diarrhoea among the troops in the dépôt, on the contrary, the complaint among the men was habitual and excessive constipation, often causing hæmorrhoids to a very painful extent. I mention this fact prominently, because the hill stations generally, from their dampness and coldness, have had a bad notoriety for bowel complaints: here however there was a remarkable illustration of the absence of diarrhoea or dysentery under conditions of great elevation and dampness.

4449. Would you fix upon Ceylon as a sort of sanitarium for India?—Certainly not. I do not like Newera Ellia as a station for troops; taking it altogether it is far inferior to the Neilgherries, and provisions are very expensive.

4450. (*Sir R. Martin.*) The climate is cold and moist?—Yes.

4451. (*Dr. Farr.*) Did the European population employed in culture enjoy tolerably good health; I mean in Ceylon generally?—In the hills they did; there are some settled there who cultivate the ground chiefly growing potatoes, and dealing in dairy produce.

4452. Is not that the case in the plains?—They could not do anything in that way in the plains.

4453. (*Sir P. Cautley.*) I believe Point-de-Galle

is one of the most healthy places in the world for troops, is it not?—Yes, it is; I was a month at Point-de-Galle; and had charge of the garrison there for a medical officer who was absent on leave for a short time: it was very remarkable that although there was constant communication by ships with Madras and Calcutta, where cholera is endemic, there should not have been known to be a case of cholera at Galle up to 1852. I believe that since then there have been some cases, but the place has certainly been very exempt from cholera.

4454. (*Chairman.*) Passing northward from the Neilgherry hills, is there any hill station in the neighbourhood of Bombay, with which you are acquainted?—No. I have not visited any of the hill stations in Bombay. I may mention that the principal object of my appearance here to-day was simply to say that I had paid some attention to the means of decreasing the mortality among European troops in India; and I might just briefly state the direction in which I have thought a great economy of human life might be best effected. During my 20 years' service in India, I have seen the great anxiety of the Government to do all that could be done in the way of effecting economy of European life, and certainly within the last 20 years there has been a marked decrease in the mortality, for although that period has been one of almost constant warfare with exposure to all the risks of new stations and temporary barracks yet from the calculations that were made up to the end of 1854 the decrease in the mortality of European troops in 12 years is calculated to be 20 in 1,000.

4455. (*Dr. Farr.*) The decrease was 20 in 1,000?—Yes, over what it had been shown to be by an examination of previous returns.

4456. In Bengal?—Yes. Now it has always appeared to me that much of this decrease has arisen from one very admirable arrangement that was made by the Government, viz., that the European troops should always arrive in India, or in Calcutta at all events, in the beginning of the cold weather, and not as before, in the hot season, when as soon as they arrived I saw them sent up the Ganges in country boats, in which they were exposed to fearful mortality and risks. Next to this measure was their mode of transit by steamer up the Ganges, whereby the dangers of the journey have been immensely diminished. After these I would cite the improvements in barracks, and certain sanitary arrangements connected therewith, of which the Commissioners are no doubt well aware. Also in the diet of the soldier I think there has been a great improvement, especially in giving it more variety, and in adding one pound of vegetables, which has contributed much to the preservation of health; for example, scurvy is much less common now than it used to be in the European army.

4457. When was the addition of vegetables ordered?—I cannot give the date, but I will supply it. I may now state that the direction in which I think further effort should be made to decrease the mortality would be to diminish the number of European troops as much as possible at the recognized unhealthy stations, now occupied in Bengal, and the upper provinces. In the valley and delta of the Ganges climatic influences are so inimical to European life that I do not think that the most advanced sanitation as regards barracks, drainage, food, and water supply, will largely affect the high rate of mortality which seems to be the penalty we must pay for our foreign occupation. To hold the sultry and malarious plains of Bengal with European troops, and with a death rate that will approach the English standard appears to me to be hopeless. If, therefore, it be politically necessary to have large bodies of troops in the plains, I recommend that they should be massed at those stations which are recognized to be healthy, such as Sealkote, Jullundur, Meerut, Rawul Pindi, Hazareebaugh, Bangalore, Poona, Moulmein, and a few others. But upon every regiment coming out to India I think it should have a regimental convalescent dépôt upon the hills.

This would be its mountain home—its one fixed abode amid all changes of stations and chances of war, to which the sick and ailing, the feeble women and the more feeble children would from time to time be sent off when communication has been opened up by railways. In every regiment in the plains there are apart from the sick, perhaps 200 or 300 men in ill health and weakly, to whom such a change would do much good. They are not absolutely ill, but they are out of health, pale, anæmic, and often in hospital. Such men being rarely equal to duty are almost useless in the regiment. In them disease is insidious and most fatal, being little amenable to treatment, and they are the first to be carried off when an epidemic sweeps over a station. The bracing mountain air would soon set them up, and many valuable lives would thus be saved. Then, as respects the officers, there are always several in every regiment in a condition of depressed vitality, although not so ill as to be driven away on sick leave, which would be cut from their period of service. These officers should be selected to do duty with the regimental sanitary reserve, and one of the field officers should always command. Here should be deposited all the heavy records of the regiment; here should be the principal regimental school, the workshops, and gardens. I am sure that by this means the invaliding and the furloughs to Europe would be much limited, and there would be a great saving of life without any increase of expense upon the existing system of convalescent depôts and hill cantonments. With such prospects in view in the event of failing health that all are liable to the Indian command might become popular, which I am sorry to say it is not at present either with officers or men.

4458. (*Chairman.*) You propose, in short, that the hill stations should be used, not as quarters for healthy troops, but as sanitarium for the unhealthy men of each regiment?—Yes, for the ailing and weakly men of each regiment. The objections to convalescent depôts for the army generally are well known. The officers are strangers to the men, and discipline is with difficulty maintained. This does not apply to hill cantonments, to which complete regiments are sent, but in these corps many of the men are strong and well, and do not appreciate the change; they prefer large and favourite stations, such as Meerut and Umballa. When regiments are ordered on service, it would be a great advantage to be able to send to regimental hill depôts all the weakly men, with the women and children, instead of leaving them in large barracks in the plains, where discipline is scarcely possible, and disease is certain, often to a lamentable extent, as has been lately the case at Chinsurah and at Dumdum. The recruits who suffer very much from ill-health might also be drilled at these establishments before proceeding to join their regiments; for it is a very common sight in India to see a batch of recruits drilled into their graves by an injudicious commanding officer or over zealous adjutant.

4459. (*Sir R. Martin.*) The drilling of young soldiers on the plains is productive of much disease, is it not?—Yes. Growing lads are most susceptible of disease when weakened by fatigue. They ought either to be drilled in England or on the hills, where all the reserve depôts of Indian regiments might be stationed.

4460. (*Sir P. Cautley.*) They complain greatly of evening drill in India, do they not?—Yes. I believe that that arises a good deal from the drill being undergone after taking a heavy meal.

4461. (*Sir R. Martin.*) With respect to a regiment on the plains, it appears that every man on the muster-roll is twice in hospital, or more, per annum, so that in the course of a certain short time the whole of the men would require to be sent to the nearest mountain range on account of ill-health?—Yes, that might be the case at unhealthy stations, but it is not probable, as many of the admissions into hospital are for trivial ailments. The statistics of the hill can-

tonments do not afford a just criterion of the sanitary condition of the hills, as regiments have been almost invariably sent there in a most unhealthy condition, generally from Peshawur, where the men have suffered from malarious disease.

4462. And they have been much reduced by Peshawur fevers?—Yes; but at Rawul Pindi, Meerut, and Jullundur there is a very low death rate, at Rawul Pindi especially.

4463. But that is in an elevated position?—Yes; 2,000 feet above the sea level, but still we view it as being on the plains of the Punjab, so with Bangalore in the Madras Presidency.

4464. (*Chairman.*) What stations would you refer to as being notoriously unhealthy?—Almost all those in Lower Bengal, Dum-Dum, Chinsurah, Fort William, Berhampore, Dinapore. Fort William has now the most spacious barracks in the world, but the mortality there is still about 69 in 1,000. Cawnpore is notoriously bad, Allahabad is worse still; and I think that at such stations if two companies of infantry and a company of artillery were quartered in a defensible position, they might afford a protection even more effective than that of a whole regiment in a scattered cantonment as at present.

4465. Your proposal amounts to denuding Lower Bengal altogether of European troops?—I would have reserves in the hills for a third or a half of the whole force.

4466. (*Dr. Farr.*) You would use the hill stations not to preserve the health of the men, but to restore invalids to health?—Yes, to restore men in failing health; I think that the Government cannot well afford to keep in the hills men who are fit for duty; I think that the best way of preserving the health of regiments is to send away all men who require a change, while those who are in good health should remain to perform the duties in the plains.

4467. (*Sir R. Martin.*) But the duties that are performed by European soldiers in India in times of peace are of a most trivial kind, are they not?—No; at some of the stations in India the duty is pretty heavy in times of peace; I have seen men only two nights in bed at times.

4468. (*Dr. Gibson.*) And in the plains three or four nights?—Yes; if there has been sickness in a regiment of course that throws the duty more heavily upon the men who remain well.

4469. (*Sir P. Cautley.*) Have the Europeans themselves any objection to the hill stations?—I have never heard any objection urged, except that they are more isolated from other companions than at large stations in the plains, and that they cannot get little things which they want cheaply, such as bacon and eggs, fowls, ducks—small luxuries in their opinion.

4470. Do they not complain a good deal of the confinement in the hills?—I am not aware that they have complained of that; but they complain of what they feel everywhere, the weary idleness of their lives, that there has been so little done in the way of giving them occupation; I have often thought that the Indian Government might hold out some encouragement for the occupation of the troops, and to men who desire to settle in the hills, by giving to them contracts for the supply of shoes, clothing, and harness, also for brewing beer or ale. The cost might be greater than under existing arrangements, but Government would benefit in other ways.

4471. You would recommend workshops to be established, and that tools should be supplied by the Government?—Yes; and that gardens should be provided. I think that a great deal might be done in that way with very little outlay, and it would be popular with the men.

4472. (*Dr. Gibson.*) What would you do with the men who had actually suffered from illness, and had contracted organic disease?—With regard to those who had severe organic disease I think that they should be sent by the long sea route to England, for by that change they have the best prospect of recovery. I fear that officers and men are often sent away when

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beyond the reviving power of any air. Even in chronic dysentery it is doubtful whether removal of a soldier be ever beneficial, because the cure depends upon the healing of ulcers, which careful nursing does more for than any medical treatment.

4473. But what would you recommend with regard to men suffering from only a moderate amount of organic disease?—I would send them to the regimental sanitary depots in the hills, the mountain climate being beneficial whenever there is but a moderate amount of organic disease. For the sick of the army the only changes I recommend are the hills and the long sea voyage by the Cape.

4474. (Dr. Farr.) They very often die from chronic dysentery, do they not?—It is by far the most fatal disease in India, in fact five-sixths of the mortality in the army arises from abdominal affections,—diarrhoea, dysentery, cholera, and hepatitis.

4475. To what do you chiefly ascribe dysentery in India?—I think there is no doubt that it arises from the malarious influence of a tropical climate.

4476. Do you mean the temperature?—From a high moist temperature, which aggravates the forms of the disease.

4477. Still that disease is not prevalent in some of the hottest parts of India, such as Trichinopoly?—It is true that you may have great heat without malaria.

4478. And without dysentery?—Yes.

4479. Do you think that the water has anything to do with its production?—I think that bad water is one of the exciting causes, but it is only one of many, as exposure to the vicissitudes of the climate, intemperance and bad food.

4480. Do you suppose that dysentery is caused by a poison of some kind?—Yes; that to which we give the name of malaria; the dysentery which accompanies or follows malarious fevers is of the most fatal description.

4481. Is that more likely to exist in the air or in the water?—I think that it is more likely to exist in the air than in the water, for, you see people in the very best circumstances, living in comfortable homes, and eating the best food, and drinking the best water, and yet they get dysentery and die.

4482. But less frequently than others?—Yes.

4483. And among the officers less frequently than among the men?—Decidedly so; for the officers are less exposed, and are never crowded together like the men; and in my experience the most influential cause of dysentery and cholera is over crowding in barracks. In jails also I have observed the most appalling mortality from bad air, but I have not been able, with the same clearness, to trace extensive diseases to impure water supply, either in India or in China, where I long served, and which I think the worst country in the world for dysentery.

4484. Does dysentery often originate in the hill stations to which you have referred, or diarrhoea?—At Simla, Kussowlie, Subathoo, Dugshai, and the whole of that group of stations, there has been a great deal of diarrhoea, but it has been very much diminished of late by sanitary arrangements, connected with improved conservancy of the stations. When I was at Simla the conservancy was as bad as it could be; the ravines were full of dead animals and the whole ordure of the population, consisting of many thousands. When the Governor-General and Commander-in-chief and the whole head quarters' staff and establishments came up to Simla, of course that increased the population very largely, yet there were no adequate arrangements in the station for the people.

4485. And the same thing, I suppose, occurred as always does occur, when you place a large body of men in a locality without making the necessary arrangements to keep it in good order?—Yes.

4486. (Sir P. Cautley.) But there are great facilities in those hill stations from the precipitous nature of the ravines, for throwing the ordure into them, in spite of any conservancy?—Yes, there requires to be a conservancy and preventive police; there were no

public places for the people to go to except to those ravines, and the effluvium was as strong there as it would be on going into a sewer, for in that rarified atmosphere evaporation is very rapid.

4487. The water would be likely to be polluted by these impurities?—Yes; the water is very scanty there during the dry season; in a paper that I wrote upon hill diarrhoea, I attributed it chiefly to the want of proper conservancy.

4488. (Dr. Gibson.) Was it observed when the troops went to those stations that they were attacked subsequently by diarrhoea?—There is no sanitary history of Simla on record, so I could only trace the history of the disease by referring to old residents, and they used to say that it gradually increased as the population had increased, but I have no other authority for saying this.

4489. What conclusion have you come to upon that subject yourself?—I came to the conclusion that the chief cause was the want of sanitary precautions.

4490. Not that it was the inevitable result of living at those elevations?—No.

4491. Nor the temperature?—No.

4492. Nor the damp atmosphere?—No; in the early occupation of the hills the authorities seemed to think that because the climate was cold, the men might be crowded together, and all sanitary arrangements neglected with impunity—they were thus crowded at Kussowlie with fatal results. Landour is exempt from hill diarrhoea, so is Nynce Täl and Darjeeling; at Dugshai, within 20 miles of Simla, it does not prevail to a large extent, indeed the regiments there have had a much lower death rate than at any other station.

4493. With regard to the food and vegetables, and other things necessary for preserving health, do the men get everything of that kind?—There is no want of that now, they have got soldier's gardens. The first movement in that direction was made by Colonel MacMurdo when I was at Simla in 1850 and 1851.

4494. Do the soldiers cultivate the gardens themselves, or are the vegetables supplied by the natives?—It is 10 years since I was at Simla, so I cannot speak positively on that point, but I have heard that they do cultivate them.

4495. Did you observe that scurvy was at all prevailing?—I observed none among the native population, nor among the resident officers.

4496. Did it prevail among the men?—It had prevailed among the men who came up with the disease on them; one of the regiments the 29th Foot, came with a scorbutic taint, and it suffered very much from dysentery and scurvy at Kussowlie.

4497. Is it generally found that invalids are attacked by those complaints in the hill regions?—I am not aware of that, either from personal observation or from perusal of numerous reports from hill sanatoria; but it is well known that whenever men have been long confined in hospital, they are liable to fall into an anæmic or scorbutic state, and this would be likely to occur at convalescent depôts among the chronic sick.

4498. (Sir R. Martin.) With regard to several regiments sent to the Himalayan hill stations with unfavourable results as to diarrhoea, you have, in your report, mentioned that they had previously been in a very bad sanitary condition?—Yes; extremely bad.

4499. That is from diseases previously contracted on the plains?—Exactly.

4500. Would not that go to establish that the mountain ranges will be always found best for the preservation of European health rather than for the cure of tropical disease?—I have no doubt that they would be better for the preservation of health on the principal that prevention is better than cure; indeed, I am confident that on the slopes of the Himalayas the British army might be maintained in as high health as it is in England; and judging by the history of the march of the regiments to the relief of

Delhi, the sudden transition from the hills to the burning plains in May can be well borne.

4501. But, from your experience of mountain climates, which has been considerable, you rely more upon them for the preservation of health than for the cure of disease?—I consider them of great importance in the cure of disease. That is my own experience, and I would beg to refer to the report on Darjeeling, just handed in, where it is stated that in the convent there with an average of 28 children and 11 adults, there had been no deaths during 13 years, although many of the inmates had come from the plains with advanced organic disease. Compare this with the mortality among children in Bengal, which is 83 in 1,000 per annum!

4502. There are large extensive table lands being discovered, are there not?—I am not aware of any in the neighbourhood of Darjeeling; more towards the eastward there are in the Cossya hills.

4503. Does not the dislike which you mentioned, as existing on the part of European soldiers to certain of the hill stations, arise from the circumstance, that they are placed on the spurs and ridges of mountains, where there is not sufficient table land to give them occupation or amusements?—I am not aware that that has been urged, but I can well believe that it is so. If they could be placed on table lands in the interior they would not be exposed to malarious emanations from the valleys, but the difficulty is to find table lands at high elevations.

4504. (*Sir P. Cautley.*) They are not so easily approachable?—No. Supplies become very dear, and when you go so far into the interior as Chini, in Kunawur, the troops could only remain there from April to September.

4505. (*Sir R. Martin.*) Are not table lands being found now in various parts of India?—Hopes are entertained that among the Rajmahal hills some elevated plateaus suitable for sanatoria may be found. On an isolated hill—Parisnauth—2,500 feet high, and of easy access from Calcutta, a convalescent depôt is now being established. The civil surgeon of Balasore has lately reported favourably of a hill range 40 miles from that station, but it is encircled by a dangerous belt of jungle.

4506. That is the terrai on the lower grounds?—Yes.

4507. The time that would be required to pass through it would expose the men to malaria?—Yes; and the expense of clearing it, in order to make it safe, would be very great. I believe there are many of those places not yet discovered, where you cannot have the height that you have in the Himalayas, but where you will have a healthy medium climate like that of Bangalore, in the Madras presidency, Belgaum in the Bombay presidency, and Rawul Pindi in the Punjab.

4508. (*Sir P. Cautley.*) What do you think is the best way of testing the salubrity on those hills of which you have been talking, the hills near Balasore particularly?—We have no means of testing them, unless by sending people there.

4509. What people would you send there, Europeans or natives?—It would be a risk for both, and we are scarcely justified in sending natives when we would not send Europeans.

4510. (*Sir R. Martin.*) Would it not be as well to send native workmen to those places first, to test them, and then to send Europeans afterwards?—It would be a very good test to employ the natives of the district, who are less susceptible of disease than strangers, but it is to be remembered that we have often found that stations which upon first turning up the soil have proved unhealthy, become very healthy afterwards. There is now, for example, Pegu, the most healthy division for European troops in India. When I was last at Rangoon the European regiment then had only 20 men in hospital.

4511. (*Chairman.*) But it is surrounded by marshy country, is it not?—Yes; in the immediate neighbourhood there is rice cultivation; but the barracks

are well elevated, and there is a beautiful clear open space all round.

4512. (*Col. Durand.*) What is the soil; is it on laterite?—Yes, I believe so.

4513. (*Dr. Farr.*) What is the elevation?—I suppose about 100 feet.

4514. Above the river?—Yes.

4515. Was the place well drained?—Yes, it was excellently drained, and everything has been done that the present knowledge of sanitary matters could suggest.

4516. Do you know what the mortality has been?—I cannot give you the latest returns.

4517. Do you know anything of the Lawrence institution?—I have known nothing of it for several years past. I only knew it in the first years of its establishment, when the health of the children was excellent.

4518. They have been visited by epidemic cholera since which has been very fatal?—Yes; I believe so. The hill ranges may be occasionally visited by cholera. At Murree, another hill station, it has lately been, but it is not endemic cholera, nor sporadic that prevails there as in the plains. In the hills it appears as an epidemic, just in the same way as it sweeps over Europe every five or seven years.

4519. It is not so fatal there, is it, as on the plains?—The disease there is quite as fatal as in the plains.

4520. Does it attack so many people?—At Murree, out of 254 men there were 42 attacked, and 31 died.

4521. But it does not so frequently ascend to those high stations and attack them as it does the stations on the plains?—No; it very rarely attacks them, it is quite exceptional. No case has occurred at Darjeeling or Nynce Täl. Altitude seems, certainly, to have great effect as a preventative against the attacks of cholera.

4522. The same thing was observed in London. In London you are probably aware that the mortality was chiefly affected by the water?—Yes.

4523. Did you observe anything of that sort in India?—No; but bad water is a common exciting cause there.

4524. Little attention appears to have been paid to the chemical analysis of the water in India?—Not much attention.

4525. (*Dr. Gibson.*) Have you served with European troops in India?—Yes; and I served for four years in China with Queen's troops, in the first war.

4526. Have you served with native troops?—Yes; a short time only. I have been on staff employment during most of my Indian career, and in the course of duty it has been my fate to see more of India and China than almost any other medical officer.

4527. Have you been superintending surgeon?—No; but as personal surgeon to the Governor-General for nearly eight years, I had unusual opportunities of seeing the country and gaining experience in it.

4528. The diseases of the European and of the native troops differ in character, do they not?—Yes; they are much more simple with the natives; and in general more amenable to treatment, save as respect cholera, which is equally fatal in natives and Europeans. But on service out of their country natives suffer as much as Europeans—it was so in China and Burmah.

4529. It requires a good deal of experience, does it not, to enable a medical officer, going out with troops to India, to become familiar with the diseases of the country, and to treat them properly?—Assuredly it does. I know of no more responsible medical charge than that of a British regiment, and this responsibility is often painfully felt on first arriving in the country, when epidemics of cholera, of sun-stroke, of fever or dysentery are most liable to break out.

4530. It is very desirable, is it not, that he should have the advice and assistance of experienced medical officers who have served with European troops?—Certainly. I believe that much of the health condition of a regiment depends upon the selection of

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an experienced surgeon and judicious commanding officer. I once served with a British regiment in which intemperance prevailed to a lamentable extent in consequence of lax discipline. At a morning parade there was read a despatch from the Duke of Wellington, in which his Grace stated that he had examined the returns of crime and punishment in the regiment for the four months it was stationed in Bengal, and he believed that in the whole records of the British army there was nothing to equal it, yet in the evening of this day 27 men were flogged for being drunk on duty in an enemy's country. After a change of commanding officers all this crime and punishment nearly ceased, and in the health of the regiment there was a corresponding improvement. It requires great moral courage in the surgeon to lay bare such a cause of disease.

4531. However good the professional knowledge of the medical officers may be, they require instruction, on their first arrival in India, in the treatment of the diseases of soldiers, do they not?—I think that that is very advisable; for without previous experience no one can have confidence that he is doing right.

4532. And he should have the benefit of the advice of experienced medical officers?—Assuredly.

4533. Do you think that a deputy-inspector should be a man who had had much experience of the diseases of India?—Yes, most assuredly. I think that no one should be appointed deputy-inspector in India unless he had had several years experience in the service. I have known some who came out knowing nothing of the country or of the local regulations, and who thus found themselves placed in a very painful position.

4534. Do you not think that that experience should have been recently acquired?—It had better be recent, but much depends on the officer selected—his professional abilities and his capacity to observe.

4535. It is of the utmost importance to the safety of European troops in India, is it not, that the inspecting officer should possess such a knowledge as to be able to instruct the medical officers on their arrival in India how to make the necessary sanitary provision for the troops?—Yes; such knowledge of local sanitation is most valuable and necessary, but deputy inspectors should give this instruction not so much in the manner of an order as of friendly professional advice.

4536. (*Col. Durand.*) With regard to the value of experience, both in commanding officers and in medical officers which to some extent may be said to bear upon the internal discipline and habits of a regiment, what is your opinion with regard to frequent reliefs of troops?—I think that ten years' service is a very fair time for a regiment to be abroad, and that is about the present rule.

4537. In India would you advocate frequent changes from station to station?—Certainly. If a regiment is at an unhealthy station it is absolutely necessary; but if at a healthy station I can see no necessity for frequent changes, for it puts the officers to great expense, and the men also. No regiment should remain at an unhealthy station beyond two years, for by that time the men are saturated with malaria, their health condition deteriorates rapidly, and their diseases are little amenable to treatment. This happens even with natives; thus at Barrackpore, after the second year, the mortality increases so much that by order of the Government every sepoy regiment is relieved after two years' duty there.

4538. (*Sir P. Cautley.*) Therefore you would recommend that troops should remain at healthy stations only?—Yes, for any length of time. If it be politically necessary to have large bodies of men in the plains, I think they should be grouped in the healthy stations, where they could remain for several years without material deterioration of health.

4539. (*Dr. Farr.*) Do you think that the present rate of mortality in the Indian army may be much reduced?—I think that it may be brought down.

4540. What is the present rate of mortality in

India?—In Bengal I believe it is 69 in 1,000, and in the whole of India 62 or 63.

4541. The mortality of men at the same age in the healthiest districts of England is seven in 1,000?—Yes.

4542. And generally in England 10 and 11 per 1,000?—Yes.

4543. Do you imagine that the mortality in the army in India could ever be reduced to anything like that rate?—I think it might be reduced to 20 or double the English rate.

4544. On what grounds do you think it might be reduced to 20?—I think by limiting the European force at all unhealthy stations, by occupying only recognized healthy stations in the plains, and keeping about half of the force, with most of the women and children, in regimental depots on the slopes of the Himalayas and the mountain ranges in the Madras and Bombay presidencies.

4545. If you had the power of placing troops in any part of India that you thought healthy, do you think that you could reduce the mortality to about two per cent.?—Yes. I think so.

4546. That is the result of your observations and experience, which have been extensive, in India?—Yes; of course with good barracks and sanitary arrangements.

4547. Taking the present barracks and the present sites of military stations, do you think that the mortality could be reduced to anything like that rate by effecting all the sanitary improvements that you could in the present barracks?—I do not think so.

4548. To what extent do you think the mortality could be reduced if the troops should remain precisely in the same position that they now occupy, using all the possible expedients of which we can avail ourselves, such as supplying them with pure water, every means of cleanliness, and good food?—I think that it might be brought down to 40 from 62.

4549. Then you look to a very great improvement in health from changing the stations of a great body of the troops?—I do.

4550. The diseases of India are not very controllable, are they, under medical treatment?—Fever is now very successfully treated. Dysentery in a sound constitution and when early treated is on the whole controllable; much depends on the epidemic constitution of the season, and the state of health of the patient. Malarious dysentery is a most uncontrollable form, and dysentery in a subject tainted with scurvy is almost invariably fatal.

4551. Do you think that it is a good deal influenced by the medical treatment?—Yes. I have no doubt of it, but much more, as I have said, by the type of the disease and the diathesis.

4552. It is much more easy, is it not, to prevent that disease and other diseases of the same class than to cure them?—No doubt of it.

4553. You therefore would wish to operate chiefly by prevention?—Yes, there would be much more success from prevention than from treatment. I have no doubt of it.

4554. (*Dr. Gibson.*) Do you think that there are a sufficient number of stations in the plains in which to maintain a great body of troops and to reduce the mortality to two per cent., having stations established on the hills for the weak and feeble men?—Yes. I think so, taking our experience of such stations as Rawul Pindi, Sealkote, Jullundur, Meerut, Agra, Hazareebaugh, Bangalore, Poona, and Belgaum, all of which may be improved by proper sanitary arrangements.

4555. (*Dr. Farr.*) Independently of climate, the sanitary condition of nearly all the stations is bad?—There has been a very great deal done of late years towards improvement in that way.

4556. Still comparing them with what you would imagine cities ought to be to be healthy, you would say, for example, that the drainage was very defective in nearly all those stations on the rivers?—Unfortunately it is so, but the engineering difficulties

are very great ; in Calcutta, for instance, almost insurmountable. An attempt on a great scale is now being made, but it is doubtful if the great sewers which have been built can be flushed.

4557. And in cities where they have the power of draining, the power is not exercised and drainage is neglected?—Of late years there has been a great deal done in that way wherever Europeans are stationed. I may refer for proofs of this to the admirable papers of my friend Dr. Chevers recently published in the *Indian Annals of Medical Science*.

4558. With regard to the water supply, there is no difficulty found in England, but nothing of that kind is done in India?—Nothing is done in the same form

as in England. In India we depend mainly on tanks for our water supply.

4559. When the same sanitary principles are applied to India which are now applied in England, you would expect a great reduction in the mortality from that circumstance?—I have no doubt that it will be affected by it. I believe in most regiments now they do filter the water, and in many private families they boil and afterwards filter it.

4560. Would you recommend that to be done?—Yes ; whenever by analysis or by experience it was proved to be unwholesome.

4561. (*Chairman*.) Is there anything more that occurs to you?—No.

The witness withdrew.

Saturday, 15th June 1861.

PRESENT :

THE RIGHT HONOURABLE LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.

Sir RANALD MARTIN, C.B., F.R.S.

J. B. GIBSON, Esq., M.D., C.B., D.G.A.M.D.

Colonel DURAND, C.B.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.

JOHN SUTHERLAND, Esq., M.D.

Dr. HENRY LETHEBY, M.D., examined.

4562. (*Chairman*.) You are medical officer to the City of London?—Yes, I am the officer of health for the City of London, and also professor of chemistry in the medical college of the London Hospital.

4563. I need not ask you whether you have turned your attention to the question of the purity or impurity of water?—I have turned my attention to that question, and I may say that it has been a prominent subject of investigation by me.

4564. (*Dr. Farr*.) Have you come to the conclusion that water is a frequent cause of disease?—Yes, I think I may say that, not only myself, but all the officers of health of the metropolis are of opinion that bad water is a frequent cause of disease.

4565. And that it aggravates some of the diseases?—Yes, there is no doubt of that.

4566. (*Chairman*.) Do you mean that impure water itself produces disease, or merely that it predisposes to disease?—It does both. I believe, in the first place, when there is a natural tendency to disease, the condition into which the water will bring the alimentary canal will tend to establish that disease, or set on foot ; and that decomposing organic matter, in certain conditions of decay, in the alimentary canal is sufficient, without any other agency whatever, to cause disease.

4567. (*Sir R. Martin*.) So that next to impure air you would rank it as one of the most powerful causes of disease?—I am disposed to think it is before impure air, as being one of the most powerful causes of disease.

4568. (*Dr. Farr*.) Dysentery is not now prevalent in London?—It is not.

4569. It was very prevalent and fatal in the 16th and 17th centuries?—Yes, and long since then. Indeed it has been more prevalent and fatal than it now is up to the time that present changes took place in the water supply.

4570. Cholera has been an epidemic very prevalent in London?—Yes.

4571. It is supposed to have been introduced from India, but we have had epidemic cholera very prevalent in London, have we not?—Yes. Eliminating all other sources of disease, as regards elevation, as regards the density of population, as regards the habits of the people ; there still remains another source, namely, the water supply, which has materially affected the proportion of cholera deaths in two different visitations. I allude to the visitations of 1849, and 1853-4, and to the water supply of the

Lambeth and the Southwark Companies on the other side of the river.

4572. What is the character of the evidence upon which that opinion is based?—It is based upon enquiries made by the late Dr. Snow, and also upon the personal investigations of others, as to the comparative mortality from cholera during the epidemics of 1849 and 1854, when in certain districts on the south side of the Thames, the character of the water supply, and that only, was observed to influence the severity of the disease. In 1849 both the water companies (namely the Lambeth and Southwark) derived their water from the Thames close to the sewers of the metropolis. The Lambeth Company received its supply from the river at Hungerford Bridge, and the Southwark from the Thames at Battersea. In both cases the water was largely impregnated with decomposing organic matter ; and the districts supplied with it suffered great mortality from cholera. In the low lying districts it amounted to from 125 to 171 per 10,000 of the inhabitants. But in 1854 the Lambeth Company had changed its source of supply from Hungerford Bridge to Thames Ditton, a point far up in the river beyond the reach of the tide and the influx of sewage. Whereas the Southwark Company received its supply as before from the Thames at Battersea. During the visitation of that year (1854), Southwark suffered as usual a mortality of 171 per 10,000 of the population, but the district supplied by the Lambeth Company lost only from 19 to 28 per 10,000. And it may be mentioned that the two companies were competing for business in the same district, and often supplied the same streets, so that neighbouring houses were furnished with water by the different companies. Here, therefore, was an experiment on a large scale, where in the same district about 300,000 persons, rich and poor, of every condition and occupation, with every circumstance alike but that of the water supply, and yet the mortality from cholera among them was very different, for wherever the Southwark water with its sewage impregnations went the mortality was large, but where the Lambeth supply of comparatively good water was sent the mortality was small.

4573. The difference was enormous?—The difference was very marked. I think Mr. Simon made a very careful investigation of the facts, and I believe he said it was three and a half times greater among those supplied by the Southwark Company than it

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was among those supplied by the Lambeth, the district of supply being the same. I think that was the result of his investigation, but Dr. Snow's tables show a greater difference.

4574. According to the registrar-general's return that same result seemed to be produced week after week?—Yes, it did.

4575. What was the difference of water supplied under those two circumstances?—The proportion of organic matter, as well as the condition of it, was very different, and the difference arose from this, that in the one case they derived the water from the Thames above the tidal influence, and above the point where the sewage was introduced into the river, and in the other case during the cholera visitation they derived it from within the tidal influence of the river.

4576. The water which proved so fatal during the cholera epidemic was mixed with a large quantity of sewage matter?—There is no doubt of that.

4577. You are not aware of any analysis which has been made in this country, or in India of the waters of India?—I have no knowledge of the composition of the waters of India beyond this; I have a general knowledge that they are derived from shallow wells, and it is well known that in a warm climate, where vegetation is very luxuriant, the water derived from those shallow wells must be impregnated with decomposing organic matter. I have no positive knowledge of that, but it is the case with the shallow wells of London. I have examined a great many of the shallow wells of London, and I find that the water abounds with organic matter.

4578. (*Chairman.*) Is there not a difference between the quality of the water taken from shallow wells in London, where the site has been built upon many centuries, and the water taken from an equally shallow well in the country, where the soil has been either lying waste, or simply turned to agricultural purposes?—Yes, that is so; but I think where there is luxuriant vegetation and the well is shallow, that the decomposing vegetable matter is very far more injurious than the decomposing animal matter. We do not find that the soil has the power of oxidizing decomposing vegetable matter to any thing like the degree that it will oxidize decomposing animal matter.

4579. (*Dr. Farr.*) If the land is high and the water in the shallow well is not pure, the water in the lower land of course will not be pure?—I should think not, although I can scarcely answer that question without a knowledge of special circumstances.

4580. Have you analyzed the water of any of our marshy districts?—Yes, I have.

4581. What is the character of the water?—It is always charged with very large quantities of decomposing vegetable matter. The water at Plumstead, and the country about Woolwich, I find contains from four to five grains per gallon of vegetable matter.

4582. Do the waters from shallow wells usually look clear and fresh and rather inviting?—They do because of the presence of carbonic acid, which gives them a sparkling quality, and because of their temperature and their slightly saline taste. The Broad Street well which was so hurtful in 1854 was much frequented because of the freshness of the water, but when the wells are situated in a comparatively thin stratum they often have a brown or a green tinge.

4583. Is it the fact that some of the wells near church yards which are exceedingly popular in the city, and which are frequented a good deal, and to which people send for water, contain a large quantity of organic matter?—They do not contain much organic matter, but they contain a large quantity of nitrate which has been produced by the oxidation of decomposing organic matter.

4584. Organic matter had existed in the water, and had been oxidized and converted into nitrate?—Yes.

4585. If it had not existed in a state of nitrate it would be visible?—It would.

4586. Then it would be noxious?—No doubt of

that; and no one can say when the work of oxidation may cease. Therefore it is that shallow wells in a district yielding organic matter are dangerous.

4587. (*Col. Durand.*) That is where there is an excessive supply?—Yes, when from excess of organic matter, as after a heavy rain-fall, it passes into the wells unchanged; some of the city wells contain as much as 25 grains of nitre per gallon, all of which is derived from our ancestors.

4588. (*Sir R. Martin.*) Then you know of no instance of surface wells in the area of London which contain pure water?—No, I know no surface well at all in London containing pure water.

4589. Not even the Kensington well which is so much frequented?—No, there is no shallow well at all in London, which contains pure water. Shallow wells round London on the average contain 60 grains of saline matter to the gallon, and I have known them to contain as much as 150 grains of saline matter, and yet the water is drunk. It contains a large quantity of nitre and decomposing matter.

4590. (*Dr. Farr.*) Are pumps used in the city for drinking purposes?—Very largely.

4591. (*Chairman.*) Water which has been made unhealthy by the presence of organic matter gives no warning either by smell or taste?—Very rarely indeed, particularly in the case of vegetable organic matter, although water charged with much animal organic matter will soon putrefy and become tainted.

4592. (*Dr. Farr.*) Are there any ordinary means of detecting the presence of organic matter in water?—Yes, I have brought some distilled water with me, and I will test it in comparison with the water of the house.

4593. Is this a mode of analysis which is in common use now?—Yes, for although it does not actually determine the quantity of organic matter it will tell us whether or not there is a large or small quantity of organic matter. It is a good comparative test.

4594. Is organic matter dangerous to health?—Decomposing organic matter is dangerous to health, but living organic matter is not so dangerous.

4595. Water comes in contact naturally with the stomach in the intestinal tube?—Yes.

4596. It is precisely those parts which are affected in dysentery, cholera, diarrhoea, and other diseases of that class with which water comes in contact?—Yes, organic matter, of course, in one form is a nutriment; we live on organic matter, but when organic matter is undergoing certain kinds of putrefaction it is highly dangerous.

4597. What is Dr. Snow's theory?—His theory was that the matters discharged from the bowels during cholera were capable of producing cholera; they got into the water, and they gained access to the human body by food, and by water which had become accidentally contaminated by the evacuations, and thus they were the cause of the disease.

4598. (*Sir R. Martin.*) That was supposed to have been traced by Dr. Snow, near Golden Square, was it not?—Yes. It was remarked by him during the outbreak of cholera in St. James's during the autumn of 1854, that the area of the disease was chiefly about a certain pump, the Broad Street pump. That of 73 persons who died of cholera during the first two days of the outbreak, 61 had been drinking the water of the pump; and that the disease did not show itself in the houses of the neighbourhood where the water was not used. These observations were confirmed by Dr. Lankester and Mr. Whitehead, and it was afterwards ascertained that a cesspool drained into the well.

4599. (*Dr. Farr.*) That was the case with the Broad Street pump to which you refer?—Yes.

4600. I believe several hundred people died?—Yes.

4601. Nearly all of whom lived in the neighbourhood of this pump?—Yes; and it was remarkable that those of the neighbourhood who did not drink the water were not nearly so severely visited by the disease. This was observed not only in private

houses, but also in the factories and in a brewery of the neighbourhood.

4602. The deaths ceased when the pump was shut up?—Yes; I think so.

4603. I believe people living at Hampstead used to send for water from this pump, because they liked it so much?—Yes, I have heard so.

4604. I believe one fatal case of cholera at Hampstead was traced to that water?—I think there were two, a lady and her niece.

4605. (*Chairman.*) You have shown the manner of testing the impurity of water; do you think the process you have used is one that can be easily adopted by any person with little medical experience?—Very easily adopted; the only difficulty is in getting that solution (permanganate of potash). That now, however, is made on a very large scale for disinfecting purposes, and is sold as Condry's disinfecting fluid, so that I should think it might be got almost everywhere now. A year or two ago it was a very rare chemical solution, but it is now very common.

4606. Would you recommend that every medical officer should be supplied with some of that preparation?—Yes, I should; I know no other simple means of recognizing the presence of organic matter without evaporation.

4607. You think that the water should not be allowed to be used without being tested in this way from time to time?—I think not.

4608. (*Sir R. Martin.*) Would you recommend it also for disinfecting purposes in barracks and hospitals?—Yes, it has a very good effect that way, although it is rather expensive when used in sufficient quantity for such a purpose. The water supplies of London are now very much better than they were. A few years ago we should have had occasion to use 20 or 30 drops of that solution, whereas I have shown you that two drops are sufficient.

4609. Do you believe in a purifying influence with regard to the presence of living animals and vegetables in water, as to the tank which is so commonly in use in India?—Yes, there is no doubt they feed upon the dead matter and convert it into living matter, which is by no means so injurious as the dead matter.

4610. (*Dr. Farr.*) That green scum gives off oxygen?—Yes.

4611. That has almost the same effect as this disinfectant?—Yes, because oxygen is produced by all green matter, vegetable and animal.

4612. (*Sir R. Martin.*) In these stagnant tanks of which I have spoken, the presence of vegetable and animal matters supply the influences which in rivers are produced by currents?—Yes, they effect oxidation; and not only do they oxidize the dead matter, but they operate on it, and convert it into living matter, which is by no means so injurious as the dead matter.

4613. (*Dr. Farr.*) Condry's fluid destroys all organic matter, whether it is living matter or not?—Yes, that is the best test that I am acquainted with for the purpose of examining water charged with organic matter. If it is necessary to use half a dozen drops of that solution, it is a sign that the water contains a good deal of organic matter.

4614. Which may under certain circumstances prove noxious?—Yes.

4615. What other methods are there of ascertaining the presence of organic matter?—Another simple method is to introduce a little nitrate of silver in the water, and expose the solution to the light; if organic matter be present it will be blackened.

4616. Another method is by evaporation?—Yes; and there is another by applying a solution of gold. If a few drops of chloride of gold be added to the water, and the water be stood in the light for about an hour and a half, the organic matter becomes apparent.

4617. What is the strict chemical mode of determining the amount of organic matter in water?—By evaporation and ignition.

4618. You determine by the amount of loss, the amount of organic matter which it contains?—Yes; taking care not to confound the loss of volatile matters, nor organic, with those which are.

4619. Having the means of determining the presence of organic matters in the water, have you any means of purifying the water (take the Thames water, for instance, as it is now), and of bringing it readily into a state so that it may be used with safety?—Yes; in the first place, if organic matter is present in the water in a suspended form, it is very easy to get rid of it by filtration through sand, or by the filters which are made by Ransome. A rough filter may be made by putting a glass stopper into the neck of a large funnel, and then a handful, or perhaps a pint, of well-washed sand. If the water is filtered through that sand, it is deprived of all suspended organic matter. Artificial stone is prepared by Ransome, by burning sand with a soluble silicate; it is very porous, and filters water very rapidly.

4620. (*Sir R. Martin.*) With facility, do you think?—Yes, but it only removes mechanical impurities. It will not filter it from chemically dissolved organic matter, which is quite as dangerous as the suspended organic matter.

4621. (*Dr. Farr.*) What we see in the Thames is organic matter in suspension; it is visible to the eye?—Yes.

4622. That would be removed by a filter of this kind?—Yes. Then another form of filter is a hollow ball of animal charcoal; it is made by mixing the ground animal charcoal with a little syrup or coal tar, and burning it into a globular form. If that is put into a vessel of water, and the interior of the ball connected with a syphon or a piece of flexible tube hanging over the edge of the vessel, the water filters very rapidly through it, and the charcoal arrests the mechanical impurities, and causes the oxidation of the organic matter. This is effected by the oxygen which is always dissolved in the water.

4623. (*Dr. Sutherland.*) Are not these stones apt to become dirtied by use?—Yes.

4624. How do you propose to cleanse them?—To cleanse the surface let the water pass through in the other direction, which carries off the impurity.

4625. Then there is no difficulty in cleaning them?—Not at all. They make these charcoal filters in various forms. They have been made in the form in which you here see them for travellers who are likely to use water impregnated with organic matter.

4626. Who are they made by?—They are made by many people. There was formerly a patent for them, but the patent right has expired.

4627. (*Dr. Farr.*) Is it animal charcoal?—Yes, bone charcoal.

4628. (*Sir R. Martin.*) Is that preferable to vegetable charcoal?—Yes, vegetable charcoal is not endowed with anything like the oxydising power which bone charcoal has.

4629. What is the price of the small filter used by travellers?—I do not think they are above 1s. 6d. or 2s. each. They have improved this still further by the introduction of peroxide of iron and magnetic oxide of iron into the filters.

4630. (*Chairman.*) You have shown a form of filter which you say will purify a considerable quantity of water, and remove from it all unhealthy taint?—Yes; I showed you, in the first place, a stone made by Ransome which has the power of effectually removing mechanical impurities from the water, but it does not touch the dissolved organic matter. The other has the power not only of removing mechanical impurities, but also of oxidizing the organic matter. I add to that, that they have been improved lately by the introduction of the peroxide of iron. They use charcoal, with peroxide of iron, which is found to have the power of carrying it out very effectually.

4631. Those can be bought at a very small cost in any quantity?—I think so. I do not know the exact price, but I know they are very cheap.

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4632. (*Dr. Farr.*) The filter which you have shown might be easily used by an army on the march?—Yes, very easily; any number of them might be set going in a few pails of water.

4633. Would you recommend that as one of the best means of obtaining pure water in an alluvial plain, for instance?—Yes, for that is the only means, to my knowledge, of effecting it, except by distillation.

4634. Should you think it necessary to pass all the water consumed by a regiment in a garrison through filters of that description?—Yes, I think it could be very easily done.

4635. Would not that be costly?—Not at all. Suppose one of these is capable of filtering, we will say, a couple of gallons of water in the day, I think that would be a sufficient supply for the drinking purposes of half a dozen men.

4636. In India the men probably require more than the usual supply?—I should give each man a gallon a day for drinking purposes, but I do not think there is any necessity for using this for drinking purposes, or rather for cooking purposes when the water is boiled.

4637. Would not boiling the water be another way of getting rid of the presence of deleterious matter in water, and a better way?—Yes, it would change the condition of the organic matter, and render it for the time inert.

4638. Which would not be superseded?—I can scarcely say that, for it must be borne in mind that the heat only acts for a short time; putrefaction again sets in in twenty-four hours or so.

4639. Could water once filtered in this way be stored for use, and be kept for a reasonable length of time?—Yes, I think so.

4640. (*Col. Durand.*) Then do you consider that the boiling of the water only suspends the action of corruption?—That is all.

4641. (*Dr. Farr.*) It would destroy the ova of the guinea worm and other creatures of that sort, would it not?—I should think so; but I have no actual knowledge of that.

4642. As Health Officer of the city of London, do you think it one of your most important functions to look after the water supply of the city?—Yes.

4643. Should you think a city which derived all its water from wells in a good sanitary condition?—No, I should think not, unless the wells were very deep and below the reach of surface impurity.

4644. Do you consider that the great improvement in the health of London is a good deal owing to the present improved supply of water?—Very probably so, in a great measure.

4645. If you look over the old bills of mortality, you will see that in the seventeenth century dysentery, diarrhoea, cholera, and all those diseases which are now so fatal in India, were almost as fatal in the city of London?—Yes.

4646. To what do you ascribe the prevalence of those diseases in that century?—To various circumstances. In the first place the habits of our ancestors were not cleanly. They were not cleanly in their persons or in their houses, and they lived in an atmosphere of filth. Their houses were covered with rushes, in which all the dirt of years was undergoing decomposition and giving off its noxious fumes into the air; and cesspools also were, at that time, a very peculiar source of impurity. I think too that their clothing had a great influence on the production of disease. At that time water was scarce, and habits of cleanliness were unknown. The products of disease were widely scattered, and they found a ready nidus for their growth. Besides which the water, scanty as it was, was bad, and I have no doubt that a good supply of water has had a very great influence on the health of the city.

4647. In places where the water is bad, and the supply is insufficient, people are naturally dirty?—Yes, that is so.

4648. (*Sir R. Martin.*) The apartments of the

houses in ancient times were also very confined?—Yes; a great number of circumstances tended to produce those diseases, and it is very difficult to set them down to any one cause.

4649. (*Dr. Farr.*) Those diseases reigned for centuries in London?—Yes, for centuries.

4650. Therefore you do not feel that because similar diseases have prevailed for a long time in India, they cannot be removed?—I should think they might be removed; but I speak with reservation, because I am not acquainted with all the circumstances of an Indian life. I only speak of water as being one great cause of disease; there may be others equally potent.

4651. Is not malaria a cause of disease?—Yes.

4652. All the circumstances which are known to affect health would have to be taken into account in any sanitary measure by which it was sought to decrease the mortality?—Yes.

4653. In India, the mortality is five or six per cent. among men between the ages of 30 and 40; what is the corresponding mortality of the city of London?—It ranges from 1·2 to 1·6 per cent. in the several districts of the City. In the whole city it is about 1·3 per cent., which is just one-fourth of the mortality of the soldiers in India.

4654. What are the chief circumstances to which you direct your attention as health-officer, in keeping the city of London in a good state of health?—To every circumstance that tends to pollute the air, and lower vitality, and engender disease, as for example, to the accumulation of filth in the houses of people or in the public way; to the drainage of the soil; the trapping of every opening into the drains and sewers; the overcrowding of the houses; the management of offensive trades; the ensuring a good supply of good water; and in point of fact, to every circumstance that will tend to keep down, or to keep out, as it were, the introduction of decomposing matter into the human body, whether by the air, the water, or the food.

4655. With reference especially to food?—Yes.

4656. You ascertain the quality of food exposed to sale?—We seize two or three tons of unfit food every week.

4657. Is overcrowding another cause of disease?—Yes; everything that tends to vitiate the atmosphere; everything that tends to promote putrefactive decomposition, and to prevent a proper supply of pure air. All those circumstances come under my consideration.

4658. Is the drainage of the soil important?—Undoubtedly it is.

4659. Particularly of an alluvial soil?—Yes.

4660. You think those equally important, and that all those elements should be taken into account?—I do, because experience has proved to us that the drainage of the soil has much to do with the healthiness of a district.

4661. (*Sir R. Martin.*) Do you regard the relative elevation of the ground as an important element?—Yes.

4662. Was not the mortality from cholera manifestly affected by the relative elevation of the ground in various quarters of London?—It was.

4663. As an element *per se* separate and distinct from air and water?—That was so.

4664. (*Dr. Sutherland.*) It seems to follow from what you have said, that pure water being at all times of very great importance to health, it is, if possible, of still greater importance during epidemic seasons?—Yes.

4665. Then in all districts where epidemic diseases are likely to prevail, or have prevailed, it would follow that the water should be as pure as possible?—Yes.

4666. Then it would appear also to follow, that if there are large districts of country in which epidemic diseases prevail, such, for instance, as fever, cholera, diarrhoea, and dysentery, that the utmost care should be exercised in the selection of water sources?—I think so.

4667. Would you think it safe in a case of that

kind to select water sources without previous chemical analysis?—No, I think it would be most dangerous to do so.

4668. Has there not been a very great improvement in the manner of collecting and distributing water in this country?—Very great.

4669. Has it been one of the objects of that improvement to deliver the water to the consumer purer than it would otherwise be delivered?—Yes.

4670. Therefore the two things appear to go together, the selection of a healthy source, and the delivering of pure water?—Yes.

4671. Supposing in an epidemic country you have superficial wells dug in a soil containing a large quantity of organic matter, and suppose the mode of drawing that water is by throwing buckets into the well, drawing the water up, spilling part of it upon the surface, part of the water being washed into the well again, and suppose that the water so drawn up is carried in skins, and distributed to the consumers, what do you think is likely to be the sanitary result of such a proceeding?—That I could hardly speak to, except from an examination of the water, but I should say the mode of distribution is very objectionable, and is likely to give the water organic impurities, and to make it indeed worse than it originally was. The soaking of the water from the soil back again into the well, and the redistribution of it in skins, must be a means whereby an additional impurity must be given to the water independently of that which was in it before.

4672. So that in a country where epidemic diseases prevail you would object, in a sanitary point of view, to that mode of distribution?—Yes, I should object to that.

4673. Have you any information as to the production of intermittent fever by the use of water from marsh lands?—Yes; the use of water in marshy districts is certainly among the causes of the intermittent fever of those districts.

4674. In a country where that intermittent fever prevails it would become a matter of very great importance to see that the water is not impregnated with any organic matter, and to separate that from the source?—Yes, I think there would be no doubt about that. If we start with the principle that pure water is necessary to preserve health, we are then in a condition to apply that to every circumstance connected with the collection and distribution of water. A supply originally bad must have a special contrivance to make it good; or a supply originally good, if fouled by any improper mode of collection or distribution, may be the cause of danger. The water supplied to a neighbourhood ought to be, as far as can be, the best. I do not speak of saline impurities, but I am speaking of organic impurities.

4675. Supposing that it were stated to you that in a district where dysentery, cholera, and fever prevailed the water was drawn from wells and contained seven, eight, or ten grains of organic matter per gallon, what should you expect?—I should expect disease, and should be very much surprised if there was not disease.

4676. Will you be so good as to look at that analysis of waters at Secunderabad, and state your opinion. The well near the hospital contained 2.64 grains per gallon of organic matter. The barrack well contained 3.44 grains per gallon of organic matter. The tank contained eight grains per gallon of organic matter. The well contained 11.28 grains per gallon of organic matter?—The first of these, the well water near the hospital, is not a bad water, it only contains $10\frac{1}{4}$ grains of total impurities, of which nearly three grains, however, are organic. The barrack well contains nearly $3\frac{1}{2}$ grains of organic matter. I look upon that as approaching the line of danger, when we come up to three or four grains of organic matter per gallon. The next, the tank, contains eight grains of organic matter, and the next, the well, $11\frac{1}{2}$ grains of organic matter. There is no doubt that water of that quality is capable of producing a great deal of disease.

4677. What do you think of the use of iron pipes for conducting and distributing water in camps and cantonments?—I think them better than lead, for two reasons. In the first place you have the possibility, and, I may add, the probability of the water becoming charged with lead; and, in the next place, there is the power in iron pipes of improving the quality of water by catalytic oxydation.

4678. Supposing we are not in a condition to use charcoal, are there then any means of combating the evil which would arise from organic matter?—There are several modes of destroying the organic matter. There is a native mode in India which, I believe, is very successfully employed, the rubbing the vessel in which the water is collected with the berry of the *Strychnos potatorum*; I think the native name is Tattan Kottia.

4679. (*Sir R. Martin.*) They use red hot irons in their vessels for rain water; do you approve of that also?—It might be serviceable on account of the heat and the oxide of iron. Alum has the power of neutralising the effect of organic matter. A soldier, perhaps, has no means of clarifying water, but a pinch of alum put into water will tend to neutralize the action of organic matter. A better means than that even, is to add sulphuric acid to the water, so as barely to acidulate it, and then you completely neutralise the morbid action of organic matter.

4680. (*Chairman.*) Does the sulphuric acid give an unpleasant taste at all?—Not at all; it is not to be recognized with its taste; it has the effect not only of destroying organic matter, but has a special action on the alimentary canal.

4681. That is not a costly article?—Not at all; sulphuric acid is to be met with everywhere.

4682. It would not be difficult to transport the quantity required for this purpose?—Not at all; each man can be provided with alum or sulphuric acid, and he would use it himself. He will take care not to use it to too great an excess, because if he does he will make the water acid, which may be disagreeable to him, but it will not hurt him.

4683. You do not consider these modes equally good with the charcoal?—I do not; they are merely preventatives or palliatives; the other destroys the organic matter.

4684. You recommend the modes you have last suggested as expedients on march?—Yes.

4685. But the charcoal filtering would be the most effectual remedy at a station?—Yes.

4686. (*Dr. Gibson.*) Does the alum precipitate the organic matter?—It does to a certain extent, but if used immediately without waiting for precipitation it neutralizes the action of organic matter; it has the power of preventing it.

4687. (*Sir R. Martin.*) By its free solution?—Yes, and by its combining with the organic matter and forming an inert compound, and by its astringent action on the alimentary canal.

4688. (*Dr. Gibson.*) Do you think the use of sulphuric acid is better than alum?—I think the sulphuric acid is very potent certainly, although it does not precipitate anything, but it neutralizes the action of the putrefying organic matter. Those who are visiting Paris cannot use the water in Paris unless they put sulphuric acid or alum in the water.

4689. (*Dr. Farr.*) The water supply of Paris being derived to a large extent from a dirty canal?—Yes.

4690. Has your attention at all been directed to any other disinfectants?—It has been directed to nearly all the disinfectants.

4691. Do you think them of any use?—I do not think they are, for water.

4692. I mean for the sewers?—If your object is not to disinfect, but to keep the sewage from putrefying, so that no bad odours may be evolved from it, in the course of its discharge there are several things which will stop its putrefaction, and give you an opportunity of transporting the material without any danger, but I do not know of any substance that can

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be used in reasonable quantities which has the power completely of arresting putrefaction.

4693. What do you recommend as the most useful?—Carbolic acid of coal tar.

4694. What is that commonly called in commerce?—It is commonly called creosote. The creosote of commerce is taken from wood tar, but this is the creosote of coal tar; creosote is the common name of it, and it is a powerful antiseptic; it is the chief constituent of the dead oil or tar used for preserving timber.

4695. Is it easily made?—It is easily made from gas tar.

4696. And it is inexpensive?—Very inexpensive.

4697. Applying it to sewers or cesspools, does it prevent putrefaction?—It does.

4698. And destroys the putrid matter?—No, it stops putrefaction; it does not destroy the organic matter.

4699. That is what is commonly meant by an antiseptic?—Yes.

4700. Is that the article known in commerce as McDougall's powder or fluid?—It is.

4701. Is that used for stopping decomposition?—Yes.

4702. Would you recommend it for that purpose?—Yes, I would, for we have tried it very largely in some of the sewers of the city, and with a good effect.

4703. (*Sir R. Martin.*) Is it preferable to Condry's solution?—Condry's solution is more powerful as a

deodorizer; it is a true disinfectant, and oxydizes the putrid matter, whereas McDougall's liquid simply prevents putrefaction.

4704. Have you any experience of the qualities of water from artesian wells?—Yes.

4705. Do you know anything of the artesian well on the plain of Grenelle?—Yes, I have examined that well, and the artesian well which supplies the Trafalgar Square fountains, and one or two of the deep wells of London.

4706. What is your opinion of them relatively to other waters?—They are very good waters; almost all of them are soft waters, particularly if they come from the lower stratum of the chalk, the greensand which is under the chalk. They all of them contain alkaline and carbonate of soda. They are good waters for most purposes, although they are objectionable in those cases where alkali is objectionable. Such waters cannot be used for brewing pale ale, although very good porter can be brewed from them. Then, again, the sugar bakers of London cannot use these waters. Nevertheless they are soft waters, and good drinking water, for they do not contain any organic matter, or but very little.

4707. Should you recommend the extension of artesian wells?—Yes, where they are accessible, but no general proposition can be made with regard to artesian wells. An artesian well can only be made in a locality where you can get down to a stratum which is capable of delivering water to a higher level. You cannot have an artesian well everywhere.

The witness withdrew.

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DR. ROBERT DUNDAS THOMSON, Esq., M.D., F.R.S., examined.

4708. (*Chairman.*) I think you are medical officer of health and analyst of food for Marylebone?—I am.

4709. You have been a medical officer in the marine service of the East India Company?—I have been.

4710. You served in India and China about 30 years ago?—In 1832 and 1833.

4711. Your personal experience has been on board ship rather than on shore?—Yes.

4712. You have had some opportunities of observing the effect of locality upon disease, have you not?—I have.

4713. Is it within your knowledge that the amount of disease in the different corps of the Indian army varies very greatly?—Very much indeed.

4714. Can you speak from your personal knowledge of the efficiency of removal from one locality to another as a means of cure to those already affected in the East?—Yes, particularly in reference to low marshy districts. I have had a good deal of experience in China, and I have known cases where removal to a considerable elevation seemed to cut short the attack of the disease.

4715. (*Sir R. Martin.*) The progress of the disease amongst the men?—Yes. I may also mention that it did not appear to me when the men were immersed in this marshy atmosphere, that medicine had much effect upon them. I have tried quinine, bark, arsenic, and other medicine without effect.

4716. When they were removed from the poisonous locality, the medicines speedily took effect?—Yes.

4717. (*Chairman.*) The cases which you speak of are cases of ague and fever?—Yes.

4718. Have you had an opportunity in London of observing the effects of elevation on diseases of the cholera class?—Yes, I have directed my attention a good deal to that subject. In consequence of its being brought to my attention by the Board of Health in the year 1854 I visited many of the localities in which cholera occurred, and my attention was particularly directed to the subject of elevation.

4719. If I may judge by some tables which I have

before me you found a very marked decrease in the mortality the higher the elevation?—Yes.

4720. Have you got the table here?—I have got one table here which is compiled from the cases of cholera in 1849 and 1854. I have taken it from Dr. Farr's report. Where the elevation was from 100 to 350 feet the deaths were 13 per 10,000; from 80 to 100 feet, the deaths were 15 per 10,000; from 60 to 80 feet, 26 per 10,000; from 40 to 60 feet, 31 per 10,000; from 20 to 40 feet, 49 per 10,000; under 20 feet, 96 per 10,000.

4721. That was on the occasion of particular epidemics?—The epidemics of 1849 and 1854.

4722. Do you think that that difference in the mortality arose solely from difference in elevation; are not the more elevated situations selected from reasons of convenience by the more well-to-do classes, and by those who have better means of averting disease than other classes?—Yes.

4723. Therefore the character of the houses and the character of the inhabitants has something to do with that decreased mortality?—Yes, to a slight extent. We have some of the lowest classes in the city, that is, the poorest classes, at an elevation of 85 feet and nearly 100 feet. It is modified to a certain extent by the character of the people. I may mention that in the year 1851 the total mortality in Marylebone was 236 per 10,000, and in 1861, 223 per 10,000.

4724. That was for the year 1860, was it not?—That was when the census was taken; the mortality is for the year 1860.

4725. What do you consider to be the effect of sewage upon the soil upon which the town is built?—I believe that has a good deal to do with the state of health of the town. At a great elevation you have much better drainage than at a low elevation. In low positions you have the sewage soaking into the surrounding soil, and particularly on the river side you have the sewers tide-locked. I drew this conclusion from a careful examination of the wells of London, and other towns, where I found the wells very much contaminated with matter in the form of ammonia and nitric acid. That ammonia and nitric

acid are the representatives of a decomposing state of animal matter derived from the surface. These tables show the quantity of ammonia in some of the wells.

The PUBLIC STREET PUMPS in ST. MARYLEBONE.

—	—	Total Residue.	Organic Matter.	Ammonia.
1	Oxford Street, by Park Lane -	80'32	10'52	'868
2	" " Park Street -	42'64	4'96	'214
3	" " North Audley Street -	77'68	8'88	1'130
4	" " Marylebone Lane -	85'12	6'48	'868
5	" " Bond Street -	65'84	5'44	'572
6	" " Harewood Gates -	45'44	5'44	'648
7	" " Princes Street -	66'72	4'56	'338
8	" " Market Street -	90'40	5'36	'620
9	" " Berners Street -	114'48	7'04	2'230
10	" " Newman Street -	126'32	12'96	2'046
11	" " Star Brewery -	85'44	6'48	1'288
12	Edgeware Road, by Earl Street -	113'84	33'20	'715
13	" " John Street -	114'00	19'60	1'646
14	" " Queen Street -	100'40	12'96	1'378
15	New Road, by Lisson Street -	93'44	7'52	'965
16	" " Stingo Lane -	68'96	8'48	'540
17	" " Gloucester Place -	110'24	16'80	'701
18	" " York Place -	53'36	7'76	'503
19	" " Nottingham Place -	67'92	5'68	'379
20	" " Devonshire Place -	80'40	9'52	1'709
21	" " Portland Road -	58'08	7'84	'799
22	Lisson Grove -	123'36	22'64	1'571
23	Bryanstone Square -	96'24	10'08	'448
24	Wigmore Street -	72'40	4'24	'303
25	Cavendish Square -	92'48	7'68	'826
26	Vere Street -	80'64	8'48	'771
27	Great Titchfield Street -	133'76	7'60	1'702
28	Riding-House Lane -	87'12	11'36	1'481
29	Marylebone Lane -	53'04	7'20	'820
30	Poley Place -	64'32	7'36	1'295
31	All Souls' Church -	63'36	10'40	'441
32	Upper Marylebone Street -	105'76	10'16	2'294
33	New Cavendish Street -	56'64	6'48	'357
34	Weymouth Street -	81'92	7'52	'572
35	Charlotte Mews -	111'84	8'08	1'461
36	William's Mews -	72'80	6'56	1'061
37	High Street -	63'92	5'92	1'171
38	Allsop's Mews -	126'96	16'16	1'598
39	New Street -	85'44	11'60	1'316
40	Taunton Mews -	128'32	18'72	1'219
41	Park Road -	90'64	14'48	'806
42	St. Mary's Church -	87'92	5'28	'489
43	Park Crescent -	100'32	15'92	1'006
44	Castle Street East -	110'80	8'96	2'783

4726. (*Col. Durand.*) Is not the level about the Edgeware Road rather a high level?—Earl Street is from 100 to 120 feet.

4727. I mean relatively speaking to other parts of London?—The condition of wells would very much depend on the nature of the sewers, and their proximity to the sewers.

4728. (*Dr. Farr.*) The sewer contents filter into the wells?—Yes, in many cases.

4729. (*Sir R. Martin.*) Your observations with regard to elevation go to establish as a fact that the source of contamination of both air and water are enormously increased upon the lower level?—They are very much increased.

4730. As a result of locality too?—Yes. I considered this as one of the most essential points to which I could direct my attention, and I gave it as my opinion that the wells were highly injurious to the public.

4731. Is it not the fact that a number of these wells have been shut up?—I have not moved much further in the question, because the large arterial sewers will drain most of these wells. I think the sewers will be one of the most important things for London in that respect.

4732. (*Dr. Farr.*) Is the popular opinion that the waters of these wells are healthy likely to be injurious?—I should think so.

4733. Does the vestry of Marylebone believe that the waters are at all noxious?—The least educated men believe that they are not noxious. The quantity of ammonia is very considerable, and represents a very large quantity indeed of organic matter in the first stage of decomposition. The original matter is organic matter.

4734. (*Dr. Sutherland.*) You do not produce these tables with the view of showing the water which you prefer for the public?—No.

4735. But rather what you would avoid?—Yes.

4736. Can you state what is the usual depth of these wells?—From 12 to 20 feet. We have some 150 feet deep, which were supposed to be artesian

wells. I had one of these wells opened, and I found that it was filled with surface water, and that although they had been sunk 150 feet they had never reached the chalk. It was surface water.

4737. Will you describe the manner in which these surface wells get into that state. What is the process which takes place by which water, which might originally be comparatively pure, gets into that impure condition?—The organic matter on the surface and that percolating from the sewers gradually changes from the first condition into ammonia, and the carbon or charcoal of the original water changes into carbonic acid and dissolves the lime. This ammonia gradually passing through a porous soil is changed into nitric acid. The best tests are the presence of ammonia and nitric acid.

4738. (*Sir R. Martin.*) These two are most sure tests?—Most sure tests.

4739. (*Dr. Sutherland.*) Whatever tends to keep the surface in a foul condition, whether it be defective drainage or defective surface cleansing, will, of course, according to your principle, tend to increase the impurity of the water in the wells more rapidly than would otherwise occur?—Certainly.

4740. (*Dr. Farr.*) I believe you began your researches in Glasgow, when you filled the office of Regius Professor of Chemistry there?—I did.

4741. Did you find the wells of Glasgow as impure as those of London?—I found them very impure.

4742. Did the representation made by you and others induce the people of Glasgow to incur the expense of getting a better supply?—In the first instance there was a proposition made by one of the magistrates to expend a large sum of money in constructing new wells, and they came to me for advice upon the question. I examined a number of these wells, and I considered them highly detrimental to health. They sent the water from a number of them to me to make an analysis of. I reported on them, and found large quantities of nitric acid and ammonia, and they ceased to carry out the project. Various sources were examined for the supply of pure water, of which I had the charge in a chemical point of view, and now Glasgow is supplied with the purest water, I believe, in the kingdom, the water of Loch Katrine.

4743. What quantities of impure matter are found in that water?—When the water was first introduced the quantity amounted to as much as $3\frac{1}{2}$ grains in a gallon. Having examined the water taken from the loch some years before I was rather surprised to find it was so much, because I had before found that it was only $2\frac{1}{2}$ grains.

4744. Was that organic matter?—No, the total quantity of solid matter left in a gallon of water.

4745. That was the result you arrived at by analysis?—By analysis with great care. I found some streams had gained access to it in its passage to the town. In March last I found the water in the City of Glasgow to be of the same composition as the water in the loch itself; the total impurities were 2.35, of which 0.605 is organic.

4746. I believe the City of Glasgow incurred considerable expense in introducing this water?—Very large expense; they spent about three-quarters of a million.

4747. (*Sir R. Martin.*) What was the material of the pipes?—That was another question which we had investigated. It caused a great deal of opposition to the introduction of the water before Parliament. I assisted in the experiments, and we found that the water acted readily upon the clean surface of lead; after some time this action ceased, and we found that an alloy of lead and tin was much less easily acted upon than pure lead, and accordingly in my report I recommended that an alloy of this description should be used for the supply of houses, although, at the same time, I considered it was advisable that lead should be entirely abolished for cisterns.

4748. (*Dr. Farr.*) Is there not a notion that pure

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water acts on lead more rapidly than impure water ? —There is no doubt it does act more readily on the fresh surface of lead.

4749. Do you expect any evil to result from that in the case of Glasgow, which now gets its water from Loch Katrine ?—The cisterns not being new, being old cisterns, the lead is not acted upon by the water, so that no prejudicial effect has resulted from the use of that water.

4750. Are there any economical means of obviating any inconvenience of that kind ?—The only remedy is to paint the cistern or have a slate cistern.

4751. Is it not the fact that the water goes rapidly through the pipes so that very little lead could be absorbed by the water ?—That would be the case.

4752. Are the people of Glasgow satisfied with the result of this great expenditure ?—I believe they are. I believe, in fact, that the most economical process that can be adopted for a town is to bring in a good supply of water at the expense of the corporation.

4753. Should you think that the troops stationed in London are in a better condition now than they were formerly owing to the better water with which they are supplied ?—I have no doubt of it.

4754. Should you think that if the water in India was procured, as you know it is, from the tanks and wells, that it would be likely to be injurious to the health of the soldiers ?—I think so. My experience of the tanks has been quite shocking.

4755. Do you think that impurity is at all represented by the wells of London which you have analysed ?—They are very much more impure.

4756. What are the chief sources of impurity ?—In the first place the tanks are open, and persons bathe in them. There is continually a quantity of organic matter which gains access to the water, and these waters are generally quite turbid.

4757. What renders them turbid ?—The matter which gains access to them, because the water is not protected.

4758. Is not the water disturbed by the constant dipping in of buckets ?—Yes, and the dust flies in.

4759. Are they uncovered ?—They are quite uncovered ; people walk down by steps into these tanks and bathe in them.

4760. How are they affected in the rainy season ?—Impurity is washed into them.

4761. How are those waters introduced into the tanks ?—There is the surface drainage.

4762. Like the ponds in England out of which cattle drink ?—Yes, very frequently these tanks are in the solid rock. I have seen these tanks excavated in the rock.

4763. The quality of the water varies in different parts of the town ?—No doubt.

4764. Have you any examples of the ill effects of sewage upon water ; can you give any proof that that induces the diseases which are very prevalent in India ?—I may mention that I went to Broad Street in the district of Soho, and took samples of water.

4765. Was that from the instructions of the Board of Health ?—Yes ; I took samples of water from many of the houses where persons had died of cholera, and in some of those houses I found actually the dead bodies of the poor patients.

4766. That was not one of the poorest districts of London ?—No ; I was very much struck with the peculiarity of one water, and that was the water which had been supplied by the New River Company. Having found the quantity of impurity in this water very large I sent my assistant from the St. James's district on the same day to the New River Head to take water from the reservoir. I found the water at the reservoir to be of a totally different composition from the water I had taken from the houses. I repeated this experiment frequently, and I found that the amount of impurity of the water taken from certain houses in the Soho district was 28·64 ; 2·02 was the organic impurity, while the composition of the New

River water was 17·22 total impurity, and the organic impurity was 1·46. When this statement was first published in a short *resumé* of the proceedings of the Board of Health the New River Company denied the accuracy of my analysis. I repeated my analysis, and I found similar results, and after a long paper controversy they at last admitted that the water which I examined was actually derived from a well in the Hampstead Road, pumped not into the reservoir at the New River head, but pumped by a pipe which gained access to the New River pipes by a lateral communication, so that every day it varied.

4767. You detected that difference by the analysis ? —With the greatest facility. The peculiarity of the residue of this water was that it was fusible. If I took a small portion of the residue and put it into a candle it fused, whereas that of river water never fuses under the same conditions. River water contains so much lime that it is infusible ; wherever you have a large quantity of alkali, as in artesian wells, it would fuse, and sea water in the same way would fuse.

4768. In this particular district people lay dead of cholera in almost every house ?—A very large number.

4769. To what do you attribute that large number of cases of cholera in that particular locality ?—I think it was very much connected with the water.

4770. There was a pump, was there not, in Broad Street ?—Yes.

4771. Do you know the composition of the water in that pump ; it was a shallow well was it not ?—Yes ; 92·06 was the total impurity, 7·8 was the organic impurity.

4772. A committee of the inhabitants with the assistance of Dr. Snow investigated all the cases, did they not ?—Yes.

4773. Did they not find that a good many of the people had been using the water of that pump ?—A very large number.

4774. Is there not an instance of a person sending from Hampstead for the water of that pump ?—There was a very remarkable instance of that. A lady who had been in the habit of residing in that district went to reside at West End, Hampstead, and she expressed a wish to have some water from that pump ; the water was brought to her, and she was very soon afterwards attacked with cholera, although no case of cholera had previously appeared in Hampstead.

4775. There were one or two other cases of the same kind, were there not ?—There was another case at West Ham which I also investigated. A report was brought to the medical officers of health that cholera had broken out just beyond the metropolitan boundary three or four years ago. I forget the exact year, but there was no cholera at the time within the metropolitan boundary. I went down there and we found a block of houses in which cholera had appeared in almost every house, and we could not trace it to any greater distance. Although not within the metropolitan boundary, a medical officer of health, Dr. Elliott, had been appointed some time before, and he had the good sense to examine the water supply, and removed the handle of a particular pump, and after the removal of the handle of that pump we could not ascertain that any new case of cholera occurred.

4776. Is there not a case of a boy who accidentally passed that pump who tasted some of the water and died ?—Our attention was directed to the Registrar-General's report (for the returns are not published of West Ham) which noticed the death of a boy from cholera in Poplar. Upon a careful investigation of that case we found that the boy on the preceding Sunday, I think it was, had passed West Ham with his father, and after getting beyond this block of houses his father missed him, and looking back saw him drinking at the pump. When I went there I requested the handle of the pump to be restored, and I took a bucket and got a friend of mine to pump up the water. The bucket was quite full of organic matter ; there was an immense quantity of organic matter, and upon examining the source of this water

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we found that it was simply the surface drainage from the neighbourhood containing a considerable quantity of river water. Creeks pass up in this direction; it is intersected by creeks.

4777. Have you any other great example shewing the influence of the Thames water upon the mortality at the time the cholera was prevailing in London?—Yes; a very remarkable case occurred on the south side of the river, in the district supplied by the Lambeth and Southwark water companies. I found that the Southwark company's water was of a different composition to the water of the Lambeth Company. When I applied a piece of muslin over the mouth of a supply pipe in my laboratory, I got a large quantity of human excrement.

4778. You mean your laboratory in St. Thomas's Hospital?—Yes.

4779. That was the water which the patients in St. Thomas's Hospital were using?—Yes.

4780. What date was that?—That was in 1854, at the time of the outbreak of cholera; I had examined it previously, and found it exceedingly impure, containing a large quantity of organic matter. Upon going to the houses in Lambeth supplied by these two companies indiscriminately I was enabled to tell, upon analysis, which houses were supplied by the Lambeth and which by the Southwark Company, but by no other means except by analysis; the people did not know it.

4781. The two companies had been for a long time in competition?—Yes.

4782. And had pipes down in almost every street?—Yes.

4783. They sometimes supplied alternate houses?—Yes.

4784. So that the population supplied by the two companies was almost precisely in the same condition?—Precisely in the same condition; on the same occasion I got some of the occupiers of the houses to show me their water receipts in order to corroborate my chemical analyses.

4785. From what part of the river did the Southwark Company get their supply?—From Vauxhall Bridge.

4786. At what part of the river did the Lambeth Company obtain their supply?—From Teddington Lock, at Hampton. The number of houses supplied by the Lambeth Company was 24,854.

4787. Is that from a return supplied by the company itself?—I think so. The number of houses supplied by the Southwark Company in 1854 was 39,726. The houses supplied by the Lambeth Company contained a population of 166,206, and those supplied by the Southwark Company, 268,171. The deaths from cholera, in the Lambeth houses, were 611, and in the Southwark houses, 3,476. The deaths estimated by the Lambeth ratio, in the Southwark district, were 976, and, therefore, I conclude that there were destroyed by the Southwark and Vauxhall company 2,500 persons. The cholera deaths of the population in the Lambeth district were 37 to every 10,000, and in the Southwark district they were 130 to 10,000, which is one to three and a half.

4788. What you have just referred to relates to the epidemic of 1854; will you now refer to the previous epidemic of 1848–49; what was the state of things as to the water supplied by these two companies?—The water supplied by both these companies was then derived from the impure sewage water in the river.

4789. From what point of the river did the Lambeth company then take their water?—I think opposite their works in Lambeth, near Hungerford Bridge.

4790. That was a most impure water?—Yes; in 1848–49 there were 125 deaths in 10,000, in Lambeth, and 118 deaths in 10,000 in the Southwark district. The Southwark company at that time took their water higher up than the Lambeth company, hence the mortality in Lambeth was greater. Probably a larger quantity of impure water was supplied at that time to Lambeth. I analysed the various metro-

politan waters in 1854 for the Board of Health, and obtained,—

—	Total Impurity in Degrees or Grains per Gallon.	Organic Impurity.	Mechanical Impurity.
Southwark { Min.	22'50	1'86	} considerable.
{ Max.	72'66	4'80	
Lambeth - -	17'49	1'36	—
Chelsea - -	60'17	5'41	—
West Middlesex -	19'00	1'93	—
Grand Junction -	17'95	1'90	—

4791. It is generally admitted now, is it not, that the excessive mortality in cholera, in any district or country, arises partially from impure water?—I think there is no doubt of that.

4792. What were the special elements in the water to which you ascribe the diffusion of impurity, and the fatality of this disease in the two years of epidemic?—To the organic matter.

4793. Should you expect the mortality in London from cholera to be as great at any future time as it was in the years 1849 and 1854?—I should not expect it to be so great when the water is pure.

4794. You are aware that dysentery, cholera, any fever are the most prevalent diseases in India and the most fatal?—Yes.

4795. Do you think that the mortality from those diseases would be likely to be reduced by giving them better water?—No doubt of it.

4796. You would not be satisfied if the population of Marylebone obtained its water from the same or nearly the same source as the army in India now gets its water?—Certainly not.

4797. Should you think that a dangerous state of things?—Very dangerous.

4798. Should you expect the mortality to be higher than it now is in Marylebone?—Very much higher.

4799. Should you think it worth while to incur any expense in supplying them with better water?—I should think it essential that the best water should be supplied.

4800. Do you think that the health of the population can ever be secure unless the water is of good quality?—No. Perhaps I may mention that I reported to the East India Company, some years ago, as to the qualities of certain waters prepared by distillation; I reported with General Sir Robert Napier. A number of waters which had been distilled principally from sea water were sent to me by Sir Robert Napier; they had been distilled by a patent apparatus which professed to compress a quantity of air during the distillation into the water; I examined all these samples, and found that the quantity of air compressed, when they reached me, was not greater than the distilled water in my own laboratory, because supposing you could compress air into water, it would only be a temporary expedient; directly you expose that water to the air it would pass into the atmosphere.

4801. What was the object of that process?—To make it more palatable.

4802. It was in order to get rid of the impurity in the water by distillation, and then to render it palatable?—To imitate natural water by compressing air into it.

4803. It would not affect the sanitary condition of the water?—No, it would merely make it more palatable water when distilled.

4804. Have you any experience of the effect of water in the East?—Yes. When I went to China I recommended the commanding officer to pay particular attention to the supply of water. The old mode of supplying water was to take it direct from the Canton River. I volunteered to go with the boat's crew, and select the water myself. Accordingly, on various occasions, we proceeded up the creeks into the interior, and there remained until ebb tide. I took my tests with me, and gave the order when the water was to be filled in. It was rather in those days a difficult matter, because the natives were in the habit of attacking us, and we were obliged to go armed.

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But still we pursued that mode, and we had not a case of cholera in the ship, although in other ships cholera did exist, and we were afraid of its being communicated to us. I had no great faith at that time in water alone being the cause of disease, but at the same time I thought it was necessary to take this precaution. I may mention another case in which I consider water was connected with cholera. On arriving at Bombay, 12th May, it was reported that no cases of cholera existed in the town. The temperature was then at 80°, and the wind westerly, with a clear sky. On the 15th the disease appeared in the town. Cases of diarrhoea were frequent on board ship in the harbour about the 24th. The first case of cholera occurred on the 7th June, and terminated fatally. The wind was now south-westerly, and the monsoon being about to set in, which it did on the 14th, with rain. On the 8th two cases of cholera occurred; on the 15th there was another case of cholera, and on the 16th a fatal case. These men had been working in the hold, and using Bombay water. In the hold the heat and closeness were very great, and the abominable odour of sharks' fins, part of the cargo, was very annoying. The portion of the hold where the men had been stowing cotton I found extinguished a Davy lamp. From this period no Europeans were allowed to stow; and on the 18th they were replaced by Seedies, powerful Muscat men. Cholera disappeared from the ship. The Seedies worked for some days, and then left for shore, and were reported to have died of cholera. The water of Bombay I found to contain much organic matter, having been taken from a tank. A large tank used by the natives may be shortly described as being cut out of the solid rock, containing water which is usually muddy, produced by the agitation excited by the natives entering for the purpose of carrying the water and for bathing; taste, warm and earthy; temperature, 80° to 85°. The large tank I recollect which was much used for the supply of water had on its banks several faquirs who had resided there for years. One of these, who had made a vow to allow his nails to grow for 12 years, attracted my attention by the remarkable appearance of his nails, which resembled ram's horns, in being twisted and indurated to the length of six inches. I was desirous of getting a specimen of his off-cast nails for my museum, but he replied that it was part of his vow to throw them into the tank, where also all excretions were deposited, and where his ablutions were performed, according to his own statement. These waters contain much organic matter in solution; a considerable amount in suspension, and some common salt—sulphate and carbonate of lime.

4805. It was not generally known then that cholera was conveyed through water?—We did not consider that water alone was capable of producing disease.

4806. It is a very old doctrine that pure water is essential to health, is it not?—The Indian theory is that water is the cause of disease. I found that very common amongst the natives.

4807. (*Sir R. Martin.*) The designation given by natives to climate is air and water?—Yes, I understand that that is so.

4808. (*Dr. Farr.*) What are the readiest means of detecting any impurity in water which are now employed?—In the first place, you have to ascertain if any animal matter has gained access; that depends on the quantity of ammonia and nitric acid.

4809. Have you an easy way of ascertaining the presence of organic matter?—Not a very easy way; that is a difficult process.

4810. What kind of process do you employ?—I distil the ammonia.

4811. Is that for determining the quantity of organic matter, or merely for determining its presence?—To determine the quantity which has originally gained access.

4812. You think it necessary to distil the ammonia in order to do that?—To get at the quantity you must do it. The quantity was so great in a portion

of the Southwark water that I actually distilled it over and crystallized it, and converted it into sulphate of ammonia.

4813. From what source is the ammonia derived?—In the river I consider it is derived from urine.

4814. What process do you recommend for purification?—In the first place, filtration to remove the mechanical impurities. I have succeeded in removing the colouring matter by means of animal charcoal to a considerable extent.

4815. That is quite effectual in removing the organic matter?—To a certain extent it is.

4816. All kinds of organic matter?—No, only the colouring matter.

4817. Is not organic matter rather a vague term?—It is a mixture.

4818. Would not that include an infinite number of substances?—No doubt.

4819. Which would vary in almost every instance in their effects upon the human body?—No doubt.

4820. It is necessary therefore to remove them all, in order to be quite sure that none of them are noxious?—It is.

4821. Do you recommend anything in preference to the filter?—The common mechanical filter on a large scale will remove the mechanical impurities.

4822. Do you know of any mode of getting rid of the organic matter in solution?—I know of no mode of getting rid of the organic matter in solution except boiling it, that is to say, to destroy its vitality.

4823. If you had the water from an Indian tank, constructed in the way you know they are, how would you proceed to purify it, so that it might be used by the soldier with impunity?—I would not recommend the use of tank water for the soldier, but if you could not get any other water, I would filter it and I should boil it, and then all the germs of organization, whether animal or vegetable, would be destroyed.

4824. (*Col. Durand.*) Which would you do first, boil or filter?—You might boil first, but it would perhaps be better to filter first, because you would have a quantity of filthy matter in your boiler.

4825. Of course you can get water purest in the highest ground and stations?—Yes. Perhaps you will allow me to explain the division I make of the different kinds of water. I divide water for domestic purposes into three heads, which I can illustrate by this diagram. I have got three curves here; the lower one, the yellow, represents the pastoral drainage, the red one represents the agricultural drainage, and the third represents the well drainage.

4826. So that on the hill stations you get pure water?—Yes, it is not contaminated with any agricultural impurity, such as manure and latrine matter.

4827. On plains covered with agricultural fields you get a certain quantity of impurity from the surface?—Yes.

4828. Is that the case with the wells also?—Yes; the difference between these is this, that the pastoral water during rain becomes pure, and the agricultural water during rain becomes more impure, and so does the well water. The lower curve represents Loch Katrine. Then there is the Manchester water and the Dublin water.

4829. The water which is now supplied to London is derived from an agricultural district?—You may consider these experiments as representing the condition in summer.

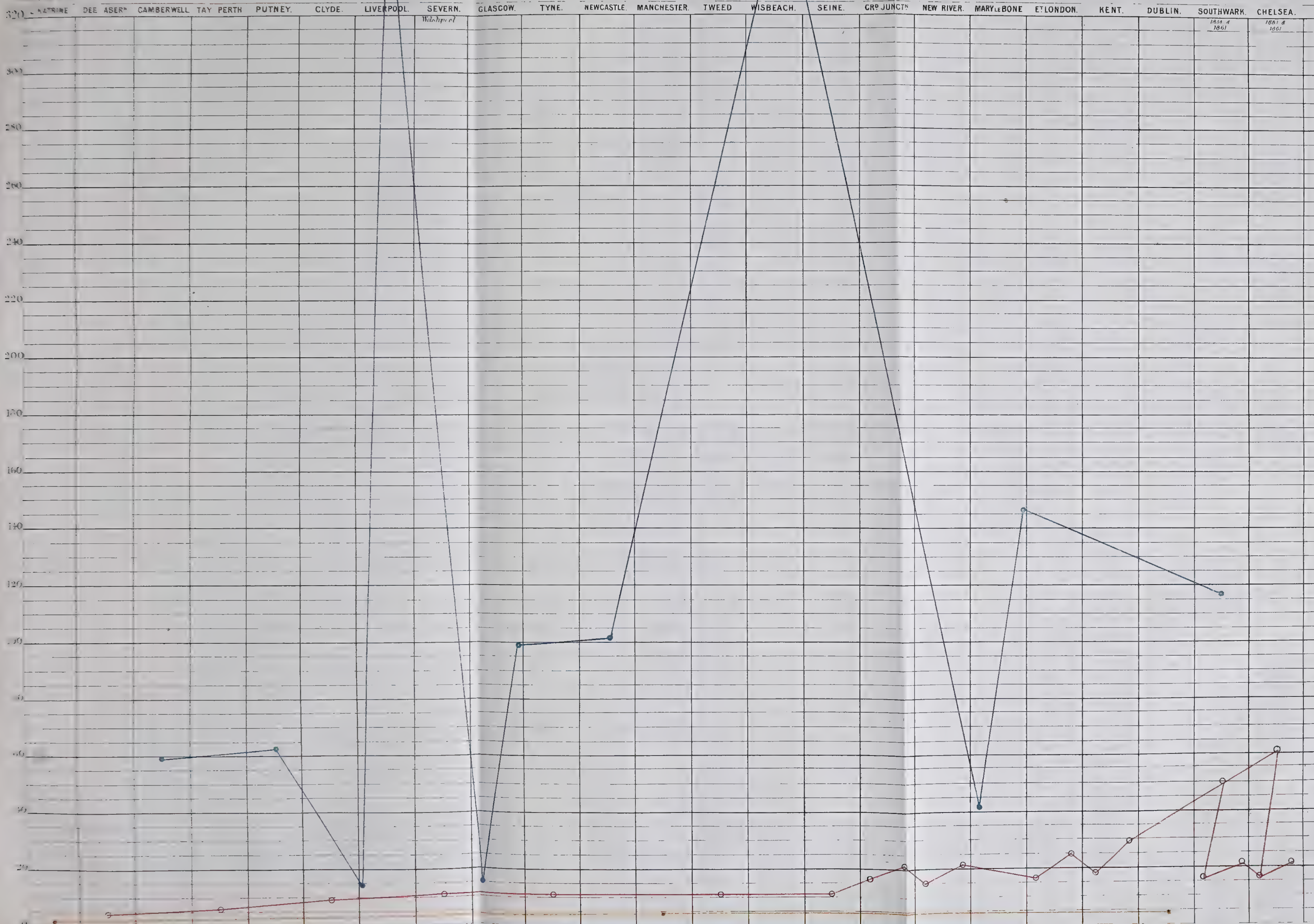
4830. (*Chairman.*) According to this line there seems to be very little difference in the pastoral water?—Loch Katrine has always the same composition.

4831. The maximum of impurity represented by that diagram is 4810?—That is a well at Wisbeach, the water from which was sent to me during the prevalence of cholera. Cholera was very bad in that place, and people were supplied from that well.

4832. Generally a well in a marshy district is impure?—Yes; I supplied that analysis, and I was

BLUE LINES ARE THE WELLS
 RED LINES THE AGRICULTURAL WATERS

WATER SUPPLY
 OF LONDON
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astonished at the quantity of organic matter that there was.

4833. I see well water in Liverpool is represented at 13.8 ?—13.8 up to 417. The last was such a remarkable case that the surveyor of the town was kind enough to measure the distance for me from the river to the well, and he made it 1,000 yards. The well in the Vauxhall Road terminating 1,050 yards from the river contained 417 grains of total residue per gallon. Another well in Batchelor-street, 760 yards from the river, contained 299.45 grains of total residue per gallon. I believe the reason of the well furthest away containing the largest quantity was, I have understood, that there is a creek which approaches the Vauxhall Road well, and therefore this does not give us the exact distance of the percolation. But at Smithfield, 800 yards from the river, the quantity of residue in the gallon was 226.25 grains. That was less than at 760 yards.

4834. (*Col. Durand.*) About Liverpool there is a good deal of flat ground—the Liverpool marshes, and places of that sort ?—Yes.

4835. (*Dr. Sutherland.*) Suppose you were about to apply practically the principles which you have been alluding to, in the selection of water sources, will you state the order, beginning with the purest, in which you would select the sources ?—I would, before all others, take a pastoral water, that is to say, a mountain drainage, the drainage from land in its natural state. Next to that would be agricultural drainage, which would be probably a river. In other words, the pastoral drainage would represent the sources of the river, and the agricultural drainage would represent the river on its passage through agricultural districts. Of course the wells are most impure.

4836. What do you say to rivers ?—The rivers are the next most impure, and the least impure is the mountain drainage.

4837. Then they stand in this order : first pastoral, then agricultural drainage, and then rivers ?—Rivers are often agricultural drainage.

4838. Then would there be the natural springs ?—Natural springs are none more nor less usually than pastoral drainage.

4839. Will you state, with regard to the geological formations, the order in which the formations begin to give impure water ?—The purest water is obtained from the primary rocks, such as granite, and mica, and clayslate, such as you have in the Highlands of Scotland. In the river Dee, at Aberdeen, the water has four degrees of impurity, coming from the slaty districts. These are rocks which there is very great difficulty in decomposing, because they resist the action of the atmosphere.

4840. These occur in the pastoral drainage ?—Yes, agricultural drainage would represent a soil which is supplied with artificial manure, such as is represented by the Thames. That acts as a great sewer for the whole of the agricultural portion of England through which it passes.

4841. What do you say to calcareous waters ?—Chalk ?

4842. Yes ?—Those are very objectionable.

4843. What do you say to water passing through sands ?—It would depend very much on the nature of the sand ; generally sands supply pure water.

4844. Will you state what class of impurities increase in the different soils, beginning again with the worst ?—Taking the agricultural during rain, you have a large quantity of organic matter, and likewise a large quantity of soluble salts brought down from the agricultural districts. I think the proportional increase is pretty nearly the same of the organic to the inorganic matter.

4845. In fact the impurity that you would especially direct your attention to in a case of that kind is the amount of organic matter ?—Principally so.

4846. The amount of inorganic matter being of comparatively less importance ?—I generally find that the two bear a certain relation to each other.

4847. In a country or district in which an epidemic disease, such as cholera, is very apt to prevail, at what point do you consider organic matter to be very unsafe ?—It would depend very much upon the nature of the organic matter ; if it were sewage matter it would be very unsafe.

4848. Supposing it were animal matter ?—I should consider animal matter, that is, matter derived from animal *débris*, to be very injurious. Of course you must take into consideration the situation.

4849. What quantity per gallon should you consider unfit in such a country as India when bowel disease prevails ?—Any quantity is objectionable.

4850. Suppose you had five or six grains of organic matter per gallon in water drawn from wells, what should you say to that ?—If I was certain that it came from sewage, I should say that it was dangerous water.

4851. What is your opinion with regard to vegetable matter which comes from decomposing leaves or grass ?—That is not so dangerous.

4852. What quantity should you consider might be used in water with safety ?—It is very difficult to form an estimate ; our great object is to get as little as possible.

4853. You judge from the analysis as a whole ?—As a whole, taking into consideration the source of the water.

4854. Will you refer to these analyses, to which I have already referred Dr. Letheby, in a return from Secunderabad, and state your opinion of the water in use there where dysentery prevails, and is very severe at times ?—I do not see any statement of what the nature of this organic matter is.

4855. It is not stated ?—I should require to have the quantity of ammonia and nitric acid before I gave an opinion.

4856. In order to acquire a thorough knowledge you must have two analyses ?—You must have a very delicate analysis.

4857. It appears to follow from what you have stated that if ever you are examining water sources in such a situation you should have the water analysed as to its qualities and also as to its quantities ?—Certainly.

4858. (*Col. Durand.*) In the plain of Bengal, where the vegetation is very rank, and the level of the water is very near the surface, of course that is a condition very unfavourable to getting good water ; the rains are very heavy there, and, therefore, you have a very large supply of rain water if you take means to collect it. I wish to ask your opinion as to the application of rain water where you cannot get pastoral water or agricultural water ?—I should think rain water is the best of all ; it may not be so palatable. Our great fault with regard to rain water is, that we do not catch it soon enough.

4859. (*Chairman.*) Rain water is very apt to be tainted by the manner in which it is collected, by falling on to the roofs of houses ?—Yes ; that might be very easily avoided.

4860. (*Col. Durand.*) What would be your suggestion as to the best means of collecting it. I mean to say, chemically speaking ?—You might have iron tanks, as on board ship.

4861. Iron plated ?—Yes ; or slate, as may be most convenient.

4862. (*Dr. Farr.*) What means would you have of storing the water ?—I should think it might be collected on flat roofs very easily. The quantity that falls on Fort William, for instance, is very large.

4863. The rain water as it falls undergoes no change ?—If it is received in iron or slate tanks it will undergo no change.

4864. Glance at that plan of India ; what parts of India do you think likely to supply the best water for troops ?—All the elevated grounds. You can get an enormous quantity, for instance, from the Khasia hills to the north-east of Calcutta ; you have from 500 to 600 inches on the southern frontier of those hills, and as you go northwards to the Assam valley, the

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quantity diminishes, because the air from the Bay of Bengal, which is skirted by mountains, strikes against the edge of the ridge and precipitates its water.

4865. In the Deccan the water is generally very good?—The quantity in the Madras district is very small, and that is the reason why it is necessary to use the rivers for irrigation.

4866. The water is intercepted by the ghauts?—Yes; but some of the returns which I have seen with regard to the quantity of rain that falls in the Madras Presidency state that it is exceedingly small.

4867. Do you think that it is necessary to direct special attention to water in India?—Yes.

4868. Both in determining its quality where large numbers of troops are stationed, in purifying it, and taking care to supply the soldiers with the pure water?—I consider that very important.

4869. That is not the only thing to which you would direct your attention if you were asked to recommend measures for improving the health of the army?—There are a great many other modes.

4870. Will you just enumerate those which you think important from your experience as health officer of Marylebone, and from what you know of India?—I have generally noticed inattention to the disposal of sewage in barracks, which is very objectionable. I find, for instance, it is usual to collect all the matter from the closets into a cesspool.

4871. (*Chairman.*) Are you speaking now of England or India?—I am talking of my experience of barracks in this country. I think it is essential that the sewage should be carefully removed.

4872. (*Col. Durand.*) And that you consider the more important from having a great number of men together?—Yes.

4873. (*Chairman.*) We have had it in evidence that the custom is to transport it by hand once in every 24 hours?—Yes; what I have seen for instance in Bombay is very objectionable; the sewage there passes into the sea; and you can smell it at low water because it is not properly carried away.

4874. (*Sir P. Cautley.*) Is there not great difficulty with regard to the sewage at Bombay?—Yes; but it is most essential that it should be attended to with reference to the health of the locality. I have seen it so offensive that you cannot go to look at some of the most beautiful scenery in consequence of the smell. The native burying grounds are in a very objectionable state.

4875. (*Chairman.*) The graves are very shallow?—Yes, you can see the jackalls pulling the bodies up.

4876. (*Dr. Farr.*) Have you any other suggestions to make with reference to the health of the troops in India?—Those are the principal points. There is one other point which I think it important to notice, namely, the want of occupation for the soldiers in a plain. The men would be probably more healthy if they had games of recreation; and their time would be occupied in some better way than it now often is.

4877. (*Chairman.*) Do you think that want of occupation predisposes to disease?—Yes; another point is that from the absence of pure cool water I believe the men are very much inclined to drink.

4878. (*Dr. Farr.*) You attach importance to that?—Very great.

4879. Do you think drinking increases the mortality in India?—I think so from the returns I have had before me, and the attention I have paid to the

The witness withdrew.

Dr. ARTHUR HILL HASSALL, M.D., examined.

Dr.
A. H. Hassall.

4897. (*Chairman.*) I need not ask you whether you have had a large experience in the examination of water, both chemically and microscopically?—I have had great experience in the examination of water for many years past.

4898. You have conducted a series of investigations into the state of the water supply of London under the directions of the General Board of Health?—Yes, in 1854.

subject. It has been proved that abstainers have an advantage of 19 per cent. over those who drink.

4880. (*Dr. Gibson.*) Many of the barracks in England have cesspools; how often do you think they ought to be emptied?—I think the soil ought to be removed at once; and I think water should be supplied to every closet. The poorest inhabitant in Marylebone is now supplied with a closet and water supply.

4881. (*Dr. Farr.*) Do you mean to say that the accommodation of the poorest inhabitant is better than the accommodation of the soldier in barracks?—Much better.

4882. That is to say in your district?—Yes, the barracks in my district; I speak particularly of the barracks at St. John's Wood.

4883. Have you examined them recently?—I have, and I have complained to the officer in charge.

4884. (*Dr. Gibson.*) A good deal of time must elapse before the cesspools can be altogether discontinued, on account of the great expense that must be incurred in providing all the barracks of England with water closets. How often do you think they ought to be emptied?—I should like to see them removed. If the barracks were completely under my control I should remove them at once.

4885. I believe you give them 14 days to do it in Marylebone?—Yes.

4886. At whose expense was that?—The owners.

4887. (*Col. Durand.*) Do you not think that where there is such a supply of water as there is in London that the latrines for troops should have a flow of water so that there should be no such thing as removal?—Quite so; there are various appliances. We have very often above 1,000 paupers in our workhouse, and we have no difficulty at all in managing the closets there.

4788. (*Dr. Gibson.*) Do you think that three months is too long to allow these cesspools to remain unemptied?—Certainly.

4889. (*Chairman.*) You would consider one month, whether it is 30 days or 31 days, too long?—I do.

4890. (*Dr. Farr.*) Do you think if they were emptied once a week that would be unreasonable?—They should not be emptied less frequently in my opinion.

4891. (*Chairman.*) Whatever necessity there may be for such frequent removal in England, it would be greatly increased in such a climate as India?—Very much.

4892. (*Dr. Farr.*) There is a territory at the base of the mountains in India which is very unhealthy; can you give any explanation of that?—I believe it is very similar to our marsh districts; it is only after the rains that it is so very unhealthy.

4893. The pastoral water comes in?—Yes, and then decomposition takes place, and you have miasmata.

4894. The point of contact between pure water and organic matter appears always to be most injurious?—Most injurious.

4895. Another point appears to be where the rain water meets the sea water?—Where the organic matter comes in contact with the saline matter.

4896. (*Sir P. Cautley.*) Next to good drinking water do you consider that proper drainage is the necessary thing for improvement?—Perhaps drainage would come first; it is so very essential, I scarcely know which should be first considered. It is indispensable in establishing a station to select a point where there is good drainage and good water.

4899. With especial reference to its effect on cholera?—Yes.

4900. You have examined the water of each of the Metropolitan water companies?—Yes.

4901. And also that taken from deep and shallow wells of London?—I have.

4902. Have your investigations led you to receive it as an undoubted fact that impure water is in many cases the source of disease?—Certainly.

4903. That has been proved by the mortality in the two cholera epidemics in London?—Yes, especially the epidemic of 1854, in the case of the water of the Southwark and Lambeth company, and also that of the well in Broad Street.

4904. Will you state the details of either of those cases?—The result of an extensive inquiry into the amount of mortality from cholera in houses supplied by the Southwark and Vauxhall Water Company was that there was a much greater number of deaths in the houses supplied by that company than in those supplied by the other companies.

4905. The class of inhabitants being precisely the same?—All other circumstances being equal as far as could be determined.

4906. What was the result of your inquiry in reference to the Broad Street well?—The result of my inquiry in that case was, that a great number of deaths arose from drinking that water; in other cases where that water was not used the persons escaped.

4907. Your general experience is unfavourable, I presume, to the quality of the water in shallow wells?—Most unfavourable. I have found that the quantity of solid matter per gallon in the water of the shallow wells in London varies from 60 to 180 degrees. The water from the Thames, as now supplied by the water companies, contains about 20 grains of solid matter per gallon, and this can be hardly regarded as a very pure water.

4908. We are rather now inquiring into the sanitary state of the army in India than into the water supplied by the water companies of London. Should you say that the water supply derived from shallow wells at Indian stations, not in the neighbourhood of great towns, would be probably or necessarily impure?—I think they would be probably impure; but it would altogether depend upon the character of the soil in which the wells were situated. If that soil contained much organic matter then the water in the wells would inevitably contain a considerable quantity of organic matter which it would take up by percolation through the soil. The condition of the water in shallow wells would entirely depend on the soil in which they were placed.

4909. From what distance round does a shallow well collect impurity?—I can scarcely answer that question. The point has never been determined precisely; but I have no hesitation in saying that it may collect impurity from a distance of very many yards.

4910. Do you think that if there were some impurity or a cesspool at a distance of 100 or 200 yards of the well that it would very probably affect the quality of the water?—I should say within 100 yards, and if the impurity were very great, and if it was a very large cesspool, I think the water would be polluted at a greater distance than 100 yards.

4911. A great deal would depend on the character of the soil?—Exactly.

4912. If the land were simply agricultural land would there be any appearances antecedent to the examination of the shallow well of that water being impure?—I think it would be very doubtful whether the water would be fit for use for drinking purposes, because agricultural land must contain a large amount of organic matter necessary for the growth of the crops upon it.

4913. You say that in consequence of the habit of manuring land that there must be a certain amount of impurity; do you think that there would be impurity even if no manure were used?—I think if a well in England was sunk in the middle of a field that the water in that well would be unfit for drinking purposes.

4914. Should you be of the same opinion if the well was sunk in the middle of a common?—It would not be so impure in the middle of a common; but still there is always a quantity of organic matter in and on the soil of commons which would tend to render the water more or less impure.

4915. We have had it stated in evidence that the

purest of all water is that which comes from mountain land, is that your opinion?—Yes, that is so. In most cases, if the bed through which the water passes is of a rocky nature the water would arrive in a tolerable pure state.

4916. What probably would be the character of rain water at an Indian Station?—If it could be collected on a surface that was not liable in itself to become contaminated, the water would be I should imagine of a pure quality. It would certainly be very soft, and although contaminated with some organic matter the amount would not be large. Rain water is often spoilt in this country through being collected from the roofs of houses.

4917. Before it is stored for use it comes over the roofs of houses, and then through pipes with which no care is taken?—Yes.

4918. Taking the case of a station on the plains of Bengal, where there is an abundant rain-fall, and where, consequently, any amount of water supply can be obtained from that source, the only other source of supply being from wells, and generally not very deep wells, what do you think should be done to insure the purity of the water?—If it could be collected on a sandy surface or a sandy bed I think then the rain water would be tolerably pure.

4919. The rain water?—If it were really a sandy surface, containing but little admixture of organic matter.

4920. Where it is necessary to use well water what precaution would you recommend in using it?—The well should of course be covered to prevent any matter getting into the water.

4921. Would you recommend filtration?—Filtration would be a protection to a certain extent.

4922. Would not filtering be a complete and effectual protection if it were done thoroughly?—Filters are very apt to get out of order after they have been used for a short time. It would be effectual for a certain time, and no doubt an improvement of the water would be effected with a proper mode of filtration.

4923. I do not understand you to answer my question, whether filtration would be a proper protection, in the negative, or whether you think the filtration would not be done effectually?—The objection to filters is, that after a time they are not so effective as at first. The filters require to be cleansed and renewed periodically. Neither will filtration remove in many cases all the impurity from water.

4924. It very often happens, does it not, that no warning is given by taste, smell, or appearance of the existence of impurity?—It is frequently the case with the water of wells. Well waters are most grateful, as far as their flavour is concerned, because of their coldness.

4925. (*Dr. Farr.*) Did you examine the waters of the Thames during the cholera epidemic?—I did.

4926. With the microscope?—Yes.

4927. What did you find in those waters?—I found that they abounded with organic productions of different kinds, both animal and vegetable, dead and living. The quantity was very large indeed, both in the water of the Thames taken at different points, and the water of the companies taken from the service pipes of houses, and from the cisterns.

4928. Have you any plates showing what you discovered in the waters?—I have a book which contains the reports made for the Board of Health at that time. At the end of the book there are a series of plates exhibiting the living productions present in the waters.

4929. In the water which is known to be supplied to the people of London?—Yes.

4930. And which they used for domestic purposes?—Yes.

4931. Did you find anything which showed that the contents of sewers were contained in suspension or solution in those waters?—I found the remains of various vegetable substances, and also the remains

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of fœcal matter, which were found in the waters of certain companies.

4932. Matter which had evidently passed through the stomachs and intestines of the population?—Yes, which had passed into the sewer, from the sewer into the river, and was taken from the river and supplied by certain of the water companies. I instanced, in particular, the water of the Southwark and Vauxhall Water Company. There are figures of the matters discovered by the microscope given in that book. I think in plate 19, and also in plate 23 the muscular fibre discovered in the water supplied by certain of the water companies is represented. This no doubt proceeded from the fœcal matter contained in the sewage discharged into the Thames, and which was taken up again by the Southwark and Vauxhall and others of the water companies.

4933. That was the character of the water supplied in the Belgrave district, and in the better parts of London?—It was supplied to a very large district of London.

4934. In 1854?—Yes.

4935. There was a time when that water supplied to London was procured from the river, when, if not so impure as it was in 1854, it was still so impure as to contain the contents of the sewer?—Yes.

4936. At Chelsea the Chelsea Water Company derived its supply from the river near the mouth of one of those large sewers?—The condition of that water was quite as bad at that time as that of the Southwark and Vauxhall Company.

4937. In places where the population is not particularly cleanly the water is likely to be contaminated, is it not?—It is likely to be contaminated from various causes; there are various causes which lead to a contamination of the water in cisterns.

4938. In India the water is obtained from tanks and sources of that kind?—Yes.

4939. Is the water in which people sometimes bathe likely to be at all affected by matters from cholera patients and others?—Yes; very likely indeed.

4940. Is it possible that some diseases might be propagated in that manner?—There is reason to believe that they might. The experiments of some German observers went to show that cholera might be produced by administering minute portions of cholera excreta to animals. I do not know whether those experiments have been confirmed.

4941. You think it dangerous to take water from the Ganges or shallow wells during the cholera epidemic?—Exceedingly dangerous.

4942. If a regiment had been in a certain station, and had suffered severely from cholera, you think it would be dangerous to place another regiment in that station, which would have to use the water tanks which had been frequented by the first regiment?—I think so.

4943. Can you suggest any means for detecting impure water by the microscope?—The examination of water with a view to determine its quality should be partly microscopical and partly chemical. The water should be examined by the microscope as soon as collected: a few drops should be placed in a glass cell, and be examined with the half and quarter-inch object glasses, by which means any organic productions contained in it will be discovered. These productions will, however, be better seen and be obtained in larger numbers by pursuing the following method:—Half a gallon of the water collected in a scrupulously clean glass bottle should be set aside for some six or eight hours, so as to allow of the subsidence of any sedimentary matters it may contain; this should be carefully collected and submitted to microscopical examination. When the quantity of sediment is very minute it may be thus obtained. All but about half a pint of the half gallon of water originally set aside should be poured off so as to disturb the sediment as little as possible. The

remaining half pint should be transferred to a conical glass of suitable size, and after three or four hours all but two or three drachms of this should be decanted, and these should be placed in a still smaller glass for subsidence. The chemical examination need be conducted only so far as to determine the amount of solid matter contained in the water. For this purpose an imperial pint of the water should be evaporated nearly to dryness. The residue should be transferred to a small porcelain or platinum capsule of known weight; the dish in which the pint of water has been evaporated should be thoroughly cleansed with distilled water, the rinsings being added to the contents of the capsule. The whole should then be evaporated to complete dryness, and the capsule and its contents weighed. The difference between this weight and that of the empty capsule gives the amount of solid matter, inorganic and organic, to the pint of water; and this, multiplied by 8, furnishes the amount per imperial gallon. By burning off the organic matter and weighing the capsule again, the amount of organic matter per gallon may be ascertained approximately. If the amount of residue, organic and inorganic, exceed some 30 grains, the water in most cases may be regarded as impure. The determination of the amount of organic matter in any water is an operation of considerable nicety, and can only be accurately performed by a practical chemist. However, it is not in general difficult to arrive at a tolerably safe conclusion as to whether the organic matter in any water is in small or large amount. Thus, if during the progress of drying the residue of the evaporated water this residue does not turn brown or black, but remains white, or brownish only, then the quantity of organic matter in the water is but small; if, however, it does turn deep brown or black, and if, especially, it chars and burns, giving out a disagreeable smell, the amount is considerable. By the above means, and where no chemical assistance can be procured, a tolerably exact opinion as to the quality of any water may be arrived at. The examination of water by the microscope is very simple, and might be practised by any person of intelligence; though I think it better not to limit the examination to the microscope. It is well that the water should be examined chemically to the extent of ascertaining the amount of solid matter in the gallon. An hospital assistant or an assistant-surgeon could carry out a process of that kind.

4944. Both chemically and microscopically?—Yes.

4945. It would be necessary to supply them with a microscope, would it not?—It would, but microscopes are very cheap now.

4946. What can a good microscope be procured for now?—You can get a very good one for 3*l.* 15*s.*, you might get a very excellent instrument for that sum, suitable for detecting not only the organic matters in water, but the impurities in articles of food.

4947. Do you consider the analysis of food important?—Yes, most important.

4948 (*Dr. Sutherland.*) Have you given in your reply details of microscopical examination whereby the results would be uniform at all stations?—I have merely given a general process of examination by which supposing the water to contain any living organic productions, they may be discovered and their numbers approximately determined.

4949. Will you state the influence which darkness and exclusion of air have upon these organic beings?—If water is kept in darkness and light is excluded, these organic productions are not developed near so rapidly, but the organic matter passes through another series of changes and becomes converted into nitric acid and ammonia.

4950. So that closed tanks prevent development?—To a great extent; it is exceedingly desirable that all large receptacles of water should be covered and not exposed to air, light, and the heat of the sun.

The witness withdrew.

Saturday, 22nd June 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.

Sir RANALD MARTIN, C.B., F.R.S.

J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.

Colonel GREATHED, C.B.

Colonel DURAND, C.B.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.

JOHN SUTHERLAND, Esq., M.D.

Colonel WILLIAM THOMPSON, C.B., Commissary General, Bengal, examined.

4951. (*Chairman.*) How many years have you served in India?—34 years and upwards.

4952. In what presidency have you served?—In the Bengal Presidency.

4953. In the commissariat department?—I served for 26 years in that department.

4954. In what manner is the commissariat department at present constituted?—Officers are selected and appointed on probation; at the end of a year they are examined, and if they are found qualified, they are appointed permanently to the department.

4955. Are they selected from regimental officers?—Yes.

4956. In what manner are they examined?—By a committee of officers.

4957. Having once been appointed to the Commissariat service, do they leave it again?—No, not until they are promoted to the rank of major.

4958. On the average, what length of time does an officer remain in that situation?—From 20 to 25 years.

4959. Therefore, although the commissariat service is not in form, special and separate, yet, in substance, it becomes so?—Yes.

4960. Are you still connected with the commissariat service?—Yes, I am still Commissary-General of the army.

4961. This has been stated in evidence before the Commission, "It is necessary that commissariat officers should be specially instructed, for there is, I think, a great obstacle in the way of procuring good rations, in fact, the system of bribery which exists so generally among the natives has made it almost impossible, and the officers are open to that temptation, or they were when I was in India; I cannot say what it is now"?—The officers are specially trained to their duties, and if not found efficient they are turned out. As they have no voice in receiving or rejecting the rations, they cannot be open to any temptation in this respect; there are, however, regimental subordinates, who contractors believe can aid and influence in the receipt of bad rations; such may be what is referred to.

4962. Do you think that there is an effective supervision exercised by them over the native subordinates?—Quite so; the most perfect supervision.

4963. (*Sir R. Martin.*) They are required to render their accounts quarterly, are they not, to their superior officers?—They are required to render their accounts monthly to the audit office; there is an audit office in Calcutta.

4964. That, I presume, you consider to be the main guarantee against irregularities?—I do not think that there are any irregularities on the part of the officers of the department. The regulations of the service framed for the good of the soldier, if acted up to, are sufficient to prevent such, and to insure articles of best quality being provided.

4965. (*Col. Durand.*) What is your opinion with regard to the quality of the rations?—I think that all depends upon the commanding officer; it is solely and entirely in his power to raise the quality of the rations, if bad, to the proper standard, and to keep them at it. As commanding officer I should have no difficulty in obtaining for the soldiers under my command the best article the country could produce, by adhering strictly to regulation, prohibiting all subordinate interference with the rations, and never receiving a

bad article; for I would rather put the soldier to temporary inconvenience than allow the contractor to imagine that to prevent such inconvenience the bad article he tendered would be received.

4966. He has a remedy in his hands by being able to object to anything that is found to be bad?—Yes; everything is supplied by contract; as the contractor enters into a bond to supply an article of a first-rate quality, subject to the approval of the regimental authorities, it rests with commanding officers to reject any article disapproved of.

4967. (*Chairman.*) In that case the loss, I presume, falls upon the contractor?—Yes, he has to deposit security to the amount of one-fourth of his total year's expenditure, and upon five rejections taking place in a month he loses it; he also binds himself to pay a fine of 50 rupees for each rejection.

4968. (*Col. Greathed.*) I believe that the decision of the regimental committees is final?—Yes, it is final. Formerly the commissariat officer could interfere, and call for a station committee if he differed in opinion, but my predecessor, General Ramsay, had this order cancelled, to give full power to commanding officers.

4969. It is not in the power of a brigadier to interfere, is it?—No; the commissariat officer, if he thinks the article has been improperly condemned, can submit it for the brigadier's inspection, who, if he thinks the regiment is over fastidious, may point it out and report the circumstance to his Excellency the Commander-in-chief, but he cannot compel the regiment to receive what has been rejected, or otherwise interfere.

4970. (*Chairman.*) Have you known many complaints made of the quality of the rations, for instance, the bread?—Yes, the bread is the only article which there is any difficulty in getting always good, with reference to the difficulty in getting good soojie, as good bread cannot be made of the flour ground with the Indian hand-mill.

4971. It has been stated here by a witness that "the contractors will bring you morning after morning bread that is tainted, and your only resource is to buy flour for the men, and have cakes made of it, or anything that you can; of course they do not like it so well as even the inferior bread, and it ends in your being obliged to take the inferior bread"?—That can only be done for five days, as the contract is annulled after five rejections; inferior bread ought never to be taken, however inconvenient it may be.

4972. (*Sir P. Cautley.*) There is a difficulty in making good bread, is there not?—No, none whatever; the difficulty is in getting the soojie of good quality; there is no difficulty in making the bread if you can get that.

4973. (*Chairman.*) Can you confirm what is stated in this passage: The question is, "Your general estimate of the commissariat department in India would be good, would it not? In some places good, and in others bad; it depends upon the officers; I could name one or two who never had a bad loaf, and others who never could get a good one"?—No, I cannot, for I consider it rests with a commanding officer to get rid of a bad contractor by rejecting his supplies whenever they are bad, and not with the commissariat officer.

4974. I understand the reference in this case to be

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to the commissariat officer?—They have no power whatever over the quality of the rations.

4975. Then the duty of the commissariat officer is to find persons to undertake the supply?—Yes, tenders are called for by the officer, the acceptance or rejection of which rests solely with the Commissary-General. The lowest tender is generally accepted by the orders of the Government, unless there is something against the contractor; but then he enters into the undertaking which I have mentioned, that of making a deposit of a sum equal to one-fourth of the total expenditure of the year, and he may lose that if the regimental authorities condemn his supplies five times in 30 consecutive days.

4976. The persons having the power to condemn, viz. the regimental officers, have nothing to do with the original choice?—No, it rests entirely with the Commissary-General, who may accept any tender he thinks proper.

4977. Therefore there is a check upon the contractors?—Yes.

4978. (*Dr. Gibson.*) The commissariat officer does not superintend the quality of the ration?—He has to supervise and to visit the bakery, and to see that the material is what it ought to be; but still he cannot punish without the intervention of the military authorities; he cannot fine a contractor.

4979. (*Sir P. Cautley.*) Supposing he found that the materials which the baker was using were bad, what would be his course of proceeding?—Then he would call upon the military authorities for a committee to condemn the materials, if the contractor after being warned continued to use bad materials.

4980. (*Col. Greathed.*) There is a commissariat officer or a non-commissioned officer always present at the issue of the rations, is there not?—Always; and a commissioned officer has to inspect the rations once a week at the very least; and there is always a non-commissioned officer or a warrant officer who does so every day.

4981. (*Dr. Gibson.*) Has the commissariat department any connexion with the hospitals?—Yes; everything is supplied by the commissariat.

4982. In what way?—In the same way, by contract.

4983. Do they look also to the quality of the articles supplied, as to whether they are good or bad?—That rests with the medical officer entirely; he may reject them if he disapproves of them.

4984. Does the commissariat officer endeavour to ascertain whether they are good?—Yes, by constantly visiting the rations and hospital; but he has no power to punish without a rejection report if they are not good.

4985. He supplies everything?—Yes; through contractors.

4986. Does he supply hospital utensils?—Yes, clothing and everything.

4987. (*Col. Durand.*) What is your opinion with regard to the meat rations that are supplied?—The meat is grass-fed.

4988. (*Sir R. Martin.*) Would it not be economy to feed the sheep better?—No; it would cost about eight times as much.

4989. (*Chairman.*) Are the men supplied with a considerable variety of food?—I fancy it is the same as at home. Meat, bread, vegetables, rice, tea, coffee, sugar, and salt; those are the articles supplied to the soldier.

4990. With regard to the meat, complaints have been made that it is always the same?—They have mutton twice in the course of a week.

4991. And for the remainder of the week, beef?—Yes.

4992. What is your opinion as to the cooking?—The men have their own cooks, and they can cook the meat in any way they like.

4993. So that they can obtain a variety in that way?—Yes.

4994. The beer, I believe, is almost entirely sent out from England?—Yes.

4995. There have been various attempts made, have there not, to brew beer in India?—Yes; and there are two breweries now, I think; one at Kussowlie, or near to it, and the other in the hills, at or near Mussoorie; but I do not think the men like it so well as the English beer.

4996. They have never succeeded, I believe, in making beer equal to English beer?—No.

4997. But it is cheaper, is it not?—Yes. I think the only objection to the beer is the expense to the men. I do not think they can afford to pay for it, although sold to them at the same price that is paid by the soldier at home, three annas and four pie a bottle; the average consumption is not more than a pint per man per diem.

4998. Notwithstanding that, does not the Government sell the beer at a loss?—I should say that last year they sold it at a loss of about 25 lacs of rupees.

4999. But that is partly made up, is it not, by the profit on the sale of spirits?—To a certain extent it is, not to any great extent.

5000. So that in point of fact the sum which you have just spoken of, namely the 25 lacs, has to be added to the pay of the army?—Yes, I should say properly so.

5001. (*Col. Greathed.*) What credit does the Government take to itself upon the sale of spirits towards balancing the loss upon the beer?—The canteens get it for two rupees; our present contract rate is one rupee four annas for an imperial gallon, and the profit is about one rupee; but then there is the carriage and the other contingent expenses that you must take into account.

5002. (*Col. Durand.*) And loss by wastage?—Yes.

5003. (*Dr. Gibson.*) Do you think that the connexion of the commissariat with the hospitals is satisfactory?—There are sometimes complaints; but I think upon the whole it is satisfactory.

5004. And the supply is well conducted?—I should say so, certainly; the only complaint which it is difficult to overcome is with regard to the meat. The mutton is poor, and cannot be otherwise as long as the sheep are not fed on gram and boossa.

5005. (*Sir R. Martin.*) Do you think that the improvement in the quality of the meat by gram-feeding would not compensate for the outlay for the gram itself?—I do not know; it rests entirely with the Government to accede this with reference to the expense.

5006. Comparing the meat which we have upon our own tables with the grass-fed mutton supplied to the soldier in India, should you not say that the difference is enormous?—Very great indeed.

5007. In weight?—No, not so much in the weight.

5008. But in quality?—Yes, it is different in quality.

5009. (*Dr. Gibson.*) Is any allowance made for the bone?—The bony part is cut out, that is, the ribs and the joints, but not otherwise.

5010. The meat is poor?—Yes, but it is the best procurable; there is no grass-fed meat to be got, equal to that which is supplied by the contractors, in the market; that is to say, supposing the meat is rejected, and the soldiers have to go into the market to purchase it, they cannot there get it so good.

5011. Is the meat supplied to the hospitals well selected?—No, it is the same, grass-fed meat.

5012. The prime pieces are not selected?—No; a sheep is sent whole.

5013. (*Col. Durand.*) Do the commissariat furnish wine and medical comforts?—Yes, entirely; those are procured from Calcutta, such as wine, sago, and arrowroot.

5014. (*Col. Greathed.*) Do you think, as a rule, that the mutton that is issued to hospitals is good enough for sick men?—I should say not.

5015. (*Sir R. Martin.*) You have had no experience anywhere of the system that prevails in the British army?—No.

5016. The commissariat department is also the department of transport throughout India, is it not ?—Yes, entirely.

5017. They carry everything ?—Yes.

5018. Both tents and food ?—Yes, ammunition, food, and everything, in fact, on the line of march.

5019. And the system works well ?—Very well, indeed ; we have never yet failed.

5020. In fact, the functions of the department are confined to the work of supply and transport ?—Yes.

5021. (*Dr. Farr.*) When was the present ration fixed for the Indian army ?—I cannot recollect, but it has been added to ; for when I first entered the department, the ration consisted merely of bread, meat, wood, and salt.

5022. Under the term meat, was there included mutton and beef ?—Only beef.

5023. Then it was bread, beef, wood, and salt ?—Yes.

5024. What year was that ?—In 1834 and 1835 ; then tea, sugar, coffee, rice, and vegetables were added to the soldiers' rations.

5025. At what date was that ?—The vegetables were added very lately.

5026. Do you know at what date ?—No.

5027. Was that by the order of Lord Dalhousie ?—Yes.

5028. (*Col. Durand.*) Do you find a difficulty in procuring vegetables in India ?—Yes, there is a difficulty in getting them at all seasons ; but that is owing to the taste of the men, who prefer potatoes, and the country vegetables are generally bad, at least they are not liked by the soldiers.

5029. (*Dr. Farr.*) What vegetables do you supply to the soldier now ?—Potatoes, whenever we can get them, but they are expensive.

5030. When they are not procurable, what do you supply then ?—Then we are obliged to supply the vegetables of the country which are in season, or dall is sometimes supplied.

5031. Your supply, I suppose, varies in different parts of India ?—Yes.

5032. What is the supply of vegetables in the mountain districts ?—Potatoes principally.

5033. What is the nature of the supply on the plains ?—There they get, in cold weather, cabbage and other European vegetables, such as carrots and turnips, but in the hot weather they get nothing but the country vegetables, and potatoes when procurable.

5034. Do they get any fruit ?—No ; fruit is supplied to men in hospitals, but not to soldiers in barracks.

5035. Are there any complaints of the commissariat supplies ?—Yes, they do complain of the vegetables.

5036. What is the nature of the complaint that is made ?—They want potatoes, and we cannot always supply them with potatoes. When they first come in they are very expensive ; in fact, the vegetable ration at Lahore at one time cost as much as the bread.

5037. Still you endeavour to supply potatoes when you can ?—Yes, when not too expensive.

5038. (*Chairman.*) Would there be any difficulty, in all the principal stations, in growing vegetables expressly for the use of the men in those stations ?—They have commenced that system now, growing vegetables of all kinds ; just before I left a quantity of seed was ordered to be sent to all stations where European troops are located, for this purpose.

5039. Is the use of potatoes largely increasing ?—Yes, it is.

5040. (*Dr. Farr.*) You would admit, I presume, that the supply by the commissariat down to the date when vegetables were ordered was very defective ?—I do not know ; vegetables were added to the ration in order that the soldier might not have any return money.

5041. Do you, as a commissariat officer, think it very important that the men should be supplied with vegetables ?—Yes, certainly.

5042. Is it not indispensable ?—Yes, I should say so, in India.

5043. The men, without a supply of vegetables, would become scorbutic and subject to many diseases, would they not ?—Yes, I think that when they did not get vegetables as part of the rations supplied by the commissariat, the men bought them themselves.

5044. Do you consider that part of the supply in a satisfactory state at the present time ?—Yes, as far as the country will admit of it.

5045. (*Col. Durand.*) And efforts are being made, are there not, to render it more satisfactory ?—Yes.

5046. (*Dr. Farr.*) With regard to the meat supplied, is it quite necessary to restrict the supply to mutton and beef ; could you not furnish greater varieties of animal food in different parts of India ?—I think not ; Lord Dalhousie was very anxious upon that point, and wished to substitute pork, but the medical men objected to that in Calcutta.

5047. Can you, yourself, suggest any other articles that might be advantageously supplied as substitutes for that kind of meat which you admit is not of first-rate quality ?—I do not think that there is anything to be got in India.

5048. Would you not recommend an attempt to be made to feed the cattle better than they are fed now ?—It is on the score of expense that they are not ; it depends upon the Government. We pay for our own gram-fed sheep 8 and 10 rupees ; the grass-fed sheep cost only about 1 rupee or 1 rupee and 4 annas.

5049. (*Col. Durand.*) And in some parts of India they would cost much more than that ?—Yes, in Lower Bengal, and on the Bombay and Madras side, far more.

5050. (*Dr. Farr.*) As I understand you, the responsibility of rejecting the food is thrown on the commanding officers ?—Yes, on the regimental authorities.

5051. Would not a commissariat officer be better able to determine the quality of the food than the commanding officer, if he had received a special education ?—I think that an officer who is on duty every day ought to know just as well as a commissariat officer.

5052. But to go into the market and purchase articles of food with discrimination and judgment is not a very easy task ?—No ; but there is a great difficulty in India, you cannot go into a bazaar and purchase a large supply of meat.

5053. Do you not think that the commissariat officer might take upon himself a larger responsibility than he seems to do now ?—Yes, if every article was supplied by agency ; but if a man takes up a contract which he cannot fulfil, the commissariat officer cannot cancel it unless he is aided by the regimental officers.

5054. Is he not responsible for the regiment getting good articles of food supplied to it ?—He ought not to be, so long as the articles of food are supplied by contract, and regulations are made by which those alone who receive them have the power to reject and condemn them.

5055. By the evidence it would appear that the commissariat officer neglected his duty in supplying bad articles of food ?—I think that that is a most decided mistake on the part of the officer who stated it.

5056. (*Sir R. Martin.*) The responsibility rests almost always on the contractor, does it not ?—Yes ; and he will supply a bad article if he can ; but the regimental authorities ought not to allow him to do so.

5057. (*Col. Greathed.*) Still there would be a great difference in the supplies furnished to a regiment from the circumstance of the commissariat officer being a sharp fellow or not ?—Yes, of course, when he can exercise control.

5058. There would be just that difference ?—Yes.

5059. (*Dr. Farr.*) The commissariat officer makes the bargain, does he not ?—Yes ; so far he calls for tenders, and forwards them, with his opinion, to the

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Commissary-General, who accepts the lowest tender, if recommended.

5060. Still, you admit that he has a considerable responsibility in furnishing supplies?—His desire is to supply good articles, but he is obliged, by the regulations of the service, to recommend for acceptance the lowest offer, unless he knows anything against the character of the contractor.

5061. (*Col. Durand.*) Is not that rather the weak point of the system, as the lowest tenderer may often be a man of straw?—I am no advocate myself for contracts.

5062. (*Chairman.*) I suppose the system of accepting the lowest tender was resorted to as a means of preventing favouritism and corruption?—Quite so. Perhaps it may make the matters in connexion with the supply of the soldier's ration more clear if I may be allowed shortly to recapitulate. The ration of the soldier in India consists of 1 lb. of bread, 1 lb. of meat, 1 lb. of vegetable, 1 oz. of rice, five-sevenths of an ounce of tea, or double that quantity of coffee, at the pleasure of the soldier, sugar, salt, and firewood. With the exception of tea, all the articles are usually provided by local contract. Tenders are called for annually for the supply, to be of the first quality. The lowest tender, as a general rule, is accepted, unless the commissariat officer can assign a sufficient reason for it being rejected. The acceptance or rejection of tenders rests solely with the Commissary-General. The party whose tender may be accepted by the Commissary-General is called upon by the commissariat officer to deposit, as security for the due fulfilment of his contract, one-fourth of the estimated expenditure for the year. Suppose for bread the expenditure to amount to 40,000 rs., he would be required to lodge 10,000 rs., he is then required to enter into a legally drawn-up bond to supply the article of first quality, subject to the approval of the regimental or medical authorities, and equal to what is used in the officers' mess; he binds himself to pay a fine of 50 rupees for every rejection by committee, and in the event of five rejections by committee occurring in thirty consecutive days, to forfeit his security deposit of 10,000 rupees and to have his contract annulled; he binds himself to abide by the opinion of the regimental committee, and to consider it final. The commissariat officer, who formerly could interfere and call for a station committee if he differed in opinion, has now no voice in the matter, all he can do if he thinks the regiment has improperly condemned the article, is to submit it for the inspection of the officer commanding the station, who, if he concurs with the commissariat officer, may report the matter to his Excellency the Commander-in-Chief, but he cannot compel the regiment to receive what has been rejected. Thus it is in the power of the regimental authorities to raise the rations of the soldiers to the proper standard, and to keep them at it. The order making the opinion of the regimental committee final was issued on the recommendation of my predecessor, General Ramsay, to give full power to commanding officers, and, by cancelling the former order, to do away with the prevalent opinion that commissariat officers take the part of contractors to the prejudice of the soldier. The commissariat officer, having no voice in the matter of receiving or rejecting rations, is not the person the contractor would select to bribe; there are, however, regimental subordinates, who he considers can sometimes afford him material aid in passing bad rations, at all events, they make him believe they can, and so extort money from him. To check such irregularities the regulations framed for the good of the soldier are ample, and ought to be strictly adhered to, and no subordinate interference with the rations should be allowed. As commanding officer, with such regulations before me, I should have no difficulty in obtaining for the soldier under my command the best article the country could produce, for I would rather put the soldier to temporary inconvenience for five days, and so get the contract

annulled, than receive an inferior or bad article, which the contractor will undoubtedly tender if he think that to prevent such inconvenience it will be received. The meat ration is the only one for which it is difficult to fix a standard; the other articles, being of first quality, can be tested by what the officers have on their own tables, but the beef and mutton being only grass fed will not bear comparison with that fed on gram and boossa (or chopped straw) at eight or ten times the cost. The medical officer, also, in receiving the articles of diet, should not permit interference on the part of the medical subordinate (or steward), but himself inspect and reject such as do not come up to the proper standard.

5063. (*Col. Greathed.*) Everybody who has been to Delhi knows perfectly well the success of the free market which you established there, and I wish to ask you whether, as a general rule, you think free markets might be substituted for the present regimental bazaars for the supply of the troops?—No. I am a great advocate for regimental bazaars.

5064. I asked you the question in consequence of the success of the free market which you established at Delhi?—Yes, it was got up for the occasion.

5065. Do you think, as a general rule, that it could not be carried out?—I think that the European regiments would feel the want of the regimental bazaars.

5066. Are not things more expensive?—I think not much.

5067. (*Sir R. Martin.*) It was under Lord Dalhousie, was it not, that the great reform in the commissariat department took place?—Yes, and my predecessor, General Ramsay.

5068. What is the nature of the probationary examination of which you spoke?—They have to attend at one of the principal offices, and under one of the senior commissariat officers they have to learn their office work; they are obliged to go every day to inspect the rations, and see that everything is done as it ought to be done, and they are then, at the end of 12 months, examined as to their knowledge of accounts and knowledge of the duties of a commissariat officer; if found qualified, they are appointed permanently to the corps.

5069. Part of the probationary course is also in the audit department of the commissariat, is it not?—Yes; an officer has to attend three months there, after he has been six or nine months in the executive office, to make himself acquainted with the system of auditing charges, and the requisite vouchers to pass them.

5070. Altogether should you say that the probationary course secures you a most efficient class of officers?—Certainly.

5071. More efficient than you ever had before?—Far more efficient.

5072. It secures you a good staff of officers for any purpose?—Yes.

5073. (*Col. Greathed.*) Is there an examination in languages?—They have to pass that examination first before they are admitted as probationers.

5074. (*Sir R. Martin.*) They must have passed an examination for interpreters before they are received as probationers?—Yes.

5075. (*Sir P. Cautley.*) You say that you are no advocate for contracts; if you had not contracts how would you manage?—By holding the commissariat officer solely responsible for the quality of the article supplied, which he would arrange for through his own agent.

5076. Practically, how do you think that would work?—Very well, though perhaps not so cheaply as by contract. I will give an instance. During our stay at Delhi there was one brigade supplied with bread by commissariat agency, and there was not a single rejection during the whole time, four months.

5077. (*Dr. Gibson.*) Are the hospital mattresses made of hair?—No. There was a committee which

sat in Calcutta some few years ago, and they recommended cocoa-nut fibre, but it could not be obtained, except in Lower Bengal.

5078. That would make them very much better, would it not?—Yes.

5079. And cheaper?—No, much more expensive.

5080. (*Col. Durand.*) With respect to the hospital arrangements, does anything occur to you in the way of an improvement that might be made?—No. Just before I left, the expenditure in the hospitals had been very great. The finance commission recommended certain changes should be made. An order was issued before I left, putting things on a better footing altogether, fixing responsibility.

5081. (*Dr. Gibson.*) With regard to the hospital servants and nurses, are they generally natives?—All of them.

5082. Are they provided by the commissariat?—Yes.

5083. Can the medical officers trust severe and dangerous cases to them?—They have a subordinate medical department.

5084. But I mean with regard to nursing the patients, do they not generally obtain the attendance

of the comrade of the soldier who is sick?—Sometimes, but not very often.

5085. (*Sir R. Martin.*) Are there native attendants in all the European hospitals?—Yes.

5086. They are practically good nurses, are they not?—Very fair.

5087. Better than Europeans?—I think they are more attentive.

5088. (*Dr. Gibson.*) Is it not the fact that the medical officers have not confidence in them, and that they generally obtain the services of a soldier's comrade in dangerous cases?—That I am not aware of. I have never heard any complaints made against the servants, and I think they are generally approved of as attendants and nurses in hospitals; you see them for years and years remaining in some of the hospitals, and I suppose therefore that the medical officers are content with them.

5089. The report is that they are not trustworthy, and that they cannot confide dangerous cases of disease to them?—I am not aware of that.

5090. Do you think that some remuneration should be given to the soldier who is so employed?—Those are points upon which I cannot give an opinion.

The witness withdrew.

Colonel HENRY MARION DURAND, C.B., Member of the Council of India, examined.

5091. (*Chairman.*) How many years have you served in India?—I have served from 1830, when I landed in India, until nearly the present time.

5092. In what stations chiefly?—I have been at a great many stations, but much of my service was first in the department of public works; afterwards in the canal department, and subsequently a great part of my career was political, excepting when I was on military duty with armies in the field, which occupied a considerable portion of the time.

5093. You have not had comparatively speaking much experience of ordinary regimental duty, except in the field?—No, I was with Lord Ellenborough as his private secretary when he was Governor General, and therefore I had an opportunity of witnessing from the time he arrived in the country the very great care and attention which he paid to the subject of the sanitary state of the European troops. It was one which occupied a great deal of his attention, and wherever he went he always inspected the barracks at the different stations, and made very considerable alterations in many; some of them which were bad he had pulled down, as at Kurnool; he also originated the improvement of having a troop boat to bring the Europeans, and in fact in every way he paid the greatest possible attention to those subjects, and originated many things which have been subsequently brought to great perfection. He also paid great attention to issuing directions with reference to landing the troops at the proper seasons, and sending them up by routes the best adapted to enable them to reach their regiments with the smallest amount of exposure, and the smallest loss; and from that time to this I think that the Governments in India have none of them failed in doing what was in their power, to put the condition of the European soldier in India upon as favourable footing as it was possible to do. It has necessarily been a somewhat difficult process, but it has been partly rendered so by events which, from the necessities of the service and the exposure of the troops, have caused great loss, also from circumstances rendering it necessary to pour into the country large numbers of troops, those troops having to be covered temporarily. These various circumstances of course have prevented that uniform perfection in barrack buildings, and attention to everything which would otherwise have gone on gradually increasing, but even where these temporary arrangements had to be made I can bear testimony to the very great care and attention which in 1857 and 1858, when very large bodies of troops had to be put under cover, was paid by the Government to their comfort.

5094. (*Sir P. Cautley.*) Lord Ellenborough, I believe, paid great attention to the hospitals, both European and Native?—Yes, very great. He was under the impression which must be even more felt at this day, that it was really a matter of national importance to the service in India to pay attention to the soldier, to his comfort, and to take the utmost care of his health in order that the service in India should not render the British army unpopular, and that necessity is an increasing one from the greater body of troops that there is now in India, and the greater frequency of the reliefs which will take place, and consequently the far greater proportion of service in India, which every man who enters the army will have to give; it renders it still more imperative, and still more of national and imperial importance that everything should be done to improve the health of the soldier in India.

5095. (*Sir R. Martin.*) And to make him contented when there?—Yes.

5096. (*Chairman.*) Upon the whole after your experience of the service can you say that the service in India was unpopular among the European troops?—I judge rather from the evidence that was given by those who were examined before the Commission, which had to make its report upon recruiting for the British service, and from all the reports made by men of large experience in recruiting in England; it certainly appeared that the service was not popular, but as far as I have had opportunities of judging I do not think that Indian service is unpopular among the men who are in India.

5097. (*Sir R. Martin.*) Is not the monotony of barrack life very much complained of by the men in many parts of India especially?—I cannot say that I have ever heard complaints of the monotony. I think that the men are always very much delighted to move, and that they are never so happy as when there is a chance of any active operations, as it causes a break in the regularity of their lives, but they appeared to me upon the whole to accept their position there as one which was not an unfavourable one.

5098. (*Sir P. Cautley.*) When a Queen's regiment is relieved by another regiment, is it not the fact that both the officers and the men of the relieved regiment seem always inclined to remain in India in preference to going home?—A great many of them, and particularly those who are married.

5099. That shows, does it not, that when they get there they have no feeling against it as they had before they started?—Yes.

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5100. (*Chairman.*) Do not the men make exchanges into regiments that remain in India?—Certainly.

5101. (*Sir R. Martin.*) Those are men, I believe, who are domesticated in India, generally old soldiers?—Yes.

5102. There is another branch of the service with which India has always been in high favour, that is the mountain regiments?—Yes, I think it has, and with reference to the question as to breaking the monotony of the soldier's life, and finding him employment and amusement, I think there is one point upon which something might be done, which is this; where there might be magazines it would be certainly advisable in future that no large magazine should be at a place where you have no European troops; you ought to have Europeans wherever you have large magazines, and in connexion with them I imagine that a system might be introduced under which an officer in charge of a magazine, wanting assistance, in the way of skilled labour, might employ a certain number of men, and employ them usefully and profitably to themselves, and profitably to the public service. The men besides would see that there was utility in the arrangement, and take an interest in it. I can understand that such a system might possibly be introduced, and I think that the system of gardens and minor arrangements of that kind, and workshops which have been attempted have a good deal failed, partly, I think, for this reason; it is not so much that the soldier dislikes work, but it is that he dislikes work which has no apparent utility in it, and if a man saw that he was employed usefully as well as profitably, I think it might make a difference, and also that it would have a very good effect upon the service, inasmuch as you would have, just in the same way as on board ship you give employment to the sailor at all times; where they have many modes of employing them there is no difficulty in it. Any man who has been on board a man-of-war knows perfectly well that they have never any difficulty in finding employment for the men; they are always giving them employment; and by that method they increase their intelligence very much, and increase their utility, as they work to a certain extent, but within moderate limits. I think, therefore, that by the co-operation of the commanding officer and the men in charge of magazines, you might at certain places in India find useful employment for the men in that way.

5103. (*Col. Greathed.*) Suppose a period of active service arrived when you would want every man in a regiment in the field, how would you supply their place in those magazines?—I only mean for occasional work in the magazines; it is not for permanent employment, and there is a great deal of work in the magazines, *quasi* laboratory work, in which you would certainly improve the private soldier in the present day, when it is a very great object that you should increase the intelligence of the private soldier; you are putting in his hands arms of precision, and a great deal depends upon the intelligence of a man upon his fineness of hand and fineness of touch, all depending upon the development of his intelligence, and I think that what I have suggested would work towards that end also, and therefore would be useful.

5104. Do you think that you could employ them upon public works more than they are in actual building?—I think so in healthy stations; it depends so much upon that. In several places even in the plains, at healthy periods of the year you might find employment for them for some time, and then in the hill stations you might do it of course to a greater degree; I mean with reference to its not being during a limited period of the year, but I doubt much whether, on the plains of India, as a general rule, you could employ them very much on account of the climate.

5105. But a plan has been suggested by several persons of putting up large sheds in barracks or by the side of barracks, could you not employ the carpenters of the regiment, for instance, in work which they could carry on at all times?—Yes, but I was

adverting more to what is called outdoor labour, such as bricklaying and building.

5106. (*Sir P. Cautley.*) I think that if you were to employ men in that way in the magazines or public works you would cause both the magazines and the public works, to a certain degree, to depend upon those men, and in case of war when they were called away I think it would lead to a very great inconvenience?—That is a disadvantage which would attend it, and you would *pro tanto* throw out a certain number of native hands who otherwise would be in continuous employment, and who would not leave you when a time of service arrived, whereas you must have the European soldier, but I think that the advantage of giving more employment to the European soldier and his improvement altogether would counterbalance that.

5107. (*Chairman.*) As I understand you there are two limitations upon the possibility of employing European soldiers in non-military duty; one is that you cannot put him to hard manual labour in the plains, nor perhaps anywhere, except during a very short period of the year, and the other is, that whatever work you give him it must be such work as admits of being discontinued when the soldier is required for military duty?—Yes, in fact his work can only be regarded as auxiliary and occasional.

5108. Therefore it must be a kind of work that may be interrupted?—Yes.

5109. And we may also assume that, considering the cost of native labour throughout India, there is scarcely any work that the European soldier can be put to which would not be more cheaply done, looking at the results of the work, if done by native labour?—Certainly.

5110. Therefore, in fact, it comes back to this, that whether you set the soldier to do work which is remunerative to himself, or whether you merely encourage him to employ or amuse himself, you would be paying him for employing himself, and not getting any reasonable return from the occupation that you gave him?—Yes; it comes really to that, that you would be paying him an amount for the work done greater than you would pay if you employed native labour, and therefore, in one sense, you would not be getting the same amount of work for your money; but in another sense you would be gaining, perhaps, in another way, namely, in the health, comfort, and contentment of the men.

5111. I think you threw out that the men do not like being set to any occupation which they see is clearly intended only to find occupation for them, and which is not remunerative, and the object of my question was to ascertain whether all non-military work to which you can put the soldier, does not more or less fall under that class?—To a certain extent they do all fall under that class; but there is a difference in degree, because when a soldier is employed in a magazine, and giving assistance in all the various employments to which he can be turned in a magazine, I do not think he would perceive that; it requires a greater far-sightedness than would exist in the soldier. He would see that everything was in connection with his profession; that it was in connection, for example, with the artillery, or in connection with whatever branch of work was going on in the magazine, and he would connect all his labour with his military occupation.

5112. (*Col. Greathed.*) You would give the soldier employment and pay him?—Yes; but only those men who volunteered.

5113. (*Sir P. Cautley.*) I understand that those persons who advocate the employment of the soldiers in workshops look to that employment as repaying the money that the necessary tools have cost, and that the men so employed in the workshops are to be told that the money produced by the sale of their productions is to be put into some fund, there to remain for a time, and to be ultimately paid to the soldier. If that is so he has to look to the reward of his employment, and therefore he cannot look at a workshop as an unsatisfactory thing?—No; and when I

spoke of his not looking with much pleasure to the work, as the mere work to which he was put, and his being so employed, I adverted rather to gardening, which I think he does not like.

5114. (*Col. Greathed.*) Might not the gardens be made remunerative?—In some places I dare say they might with regard to the growth of vegetables.

5115. And by keeping the men longer at a station?—Yes.

5116. (*Chairman.*) Evidence has been given as to the difficulty of obtaining European vegetables at a moderate price near a station; is there any difficulty in having a station garden, not appropriated to the particular regiment which might be at the station at the time, but to be maintained for the use of the station generally, and which might be carried on in connection with the station, the men who happened to be quartered there working in it, and what was grown in it being purchased on account of the troops?—It might be tried.

5117. It appears that the difficulty of carrying on these soldiers' gardens with any success is this, that they are appropriated to the men during the time they are there, and that the men do not take an interest in them, as they do not know how long they shall stay?—Yes; but the plan suggested might be tried.

5118. Might not the management of such gardens be made permanent, the labour being contributed by those who happened to be quartered at a station?—Yes; by those who volunteered.

5119. (*Col. Greathed.*) Do you think that vegetables produced in that manner could be furnished as cheaply to the troops?—That I doubt.

5120. (*Dr. Farr.*) But where vegetables cannot be procured in any other way, would it not be absolutely necessary to establish such gardens?—It is difficult to predicate, for circumstances vary so much in India, that a thing may be tried with success at one place, while it would not answer at another; it is very difficult to say; I see no reason why it should not be tried where circumstances were favourable.

5121. (*Col. Greathed.*) Can potatoes be grown everywhere?—No, they cannot.

5122. (*Chairman.*) You have heard all the evidence that has been given before this Commission; have you considered the question of the hill stations, and is it your opinion that any considerable portion of the European force can be removed from the plains to the hills without danger to the military defence of the country?—I do not think that any large portion of the troops can be permanently quartered in the hills without detriment to the military occupation and holding of the country; and I have always regarded that as the primary consideration. The object for which troops are sent to India is to hold the country, and to hold it as far as possible quietly; their utility is as great in preventing as in putting down any disturbance. If you throw up the key points of the country and withdraw the troops to the mountains, you practically evacuate the country; it is one thing to prevent a disturbance and to keep the country quiet, and it is another thing to lose provinces and to have to retake them; and the fact is that there is no one who can calculate the cost both in credit and in cash of a system of that kind if carried on to any extent in India. I quite agree with some of the evidence which has been given before this Commission that the hill stations are exceedingly useful, for instance, in the way that I think Mr. Grant spoke of; that they can be made exceedingly useful, and that is the proper way in which to use those stations. At the same time, within a moderate limit I think that troops can be advantageously placed on the hills, if you consider a portion of the troops in India as being really a reserve. I mean a portion of the European troops in India; there is a surplusage of European troops in India, which, when you come to sift and examine the thing, are a reserve; you employ them

if you have a war, for example, with China, with Persia, or anywhere to the east; India is a storehouse from whence you derive your European troops, and, therefore, so far as you have any surplusage of European troops, over and above that which is necessary for the quiet occupation of the country, that surplusage, or a portion of it, you might very well station in the hills, and the natural position for that reserve would be perhaps, some portion of it, in the Neilgherries, and some of it in the north of India in the hill stations, commanding an immediate communication with the Punjab, and with the Indus frontier, and in the south, to be ready to be moved anywhere in every direction. But I think that it is only with a very moderate portion of the European troops that you can deal in that way; and it is entirely dependent upon your having more troops in the country than are absolutely requisite to hold the country; at the present moment I think that we have rather more troops than are absolutely necessary for holding the country.

5123. You are alluding now to the present number, not what they will be when the reduction announced by Lord Canning has taken effect?—Yes, and when the railroads are completed, and there are rapid facilities of communication, that will somewhat alter your military status in the country; the object of a great number of these stations is the quiet occupation of the country, and, from the difficulties of communication, and the immense area of that empire, it was necessary to have a greater number of those stations than will be requisite when the railroads are thoroughly completed, and for this reason—under the former state of things at some times of the year it was very difficult to communicate between one place and another, there being tracts of country through which there was no regular road, and which were impassable during the rains—all those considerations rendered it essential for you to have a certain number of well-selected stations in order to keep all parts of the country under control; there was only a certain limited sphere within which the troops at a station could act at a certain time of the year; but you will greatly increase as it were the sphere of action of the troops at each station the moment your railroads are completed; that will increase it eight or even ten fold, for you will then be able to move with certainty a body of men within a few hours to a point, which you could not do before in a month or six weeks, and the result will be I think that you may effect a reduction in the number of the stations. You may, therefore, be able either to diminish the number of the troops, or to quarter a few more in the hills; but there is one thing upon which I am very clear, and that is, that it will never do in India to throw up what I should call the key points of the country, and to divest them of European troops. I think it would be exceedingly dangerous, and I will mention one or two points. The first happens to be an unhealthy place, but it would never do to leave it without troops—that is Allahabad—if you were to lose Allahabad temporarily, it is impossible to say what effect would be produced.

5124. (*Sir R. Martin.*) Do you consider the temper of the people, *quoad* the British Government, to be of such a nature as to require a repressive force generally throughout India?—You must always bear in mind that you are in India as a conquering race—that your whole system, your language, your habits, your religion, and everything is entirely distinct and different from theirs, and I do not think, although the Government is a very just one, and acts with the best intentions, that it will ever do for our Government to lose sight of the fact that it is their holding the country practically by the sword. If you lose sight of that fact, and divest your provinces of the troops, you will expose yourself to the risk of insurrection; any ill-conditioned man may start up for a short time and seize a point of some importance with the large masses of men who are always ready to join in any movement of the kind, particularly if he

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raises a fanatical cry—it will not do to expose yourself to that chance.

5125. Would not smaller garrisons in well constructed field works answer the purpose of the larger ones of the olden time, seeing that our implements of war are so much more perfect in the present day; for instance, the Armstrong gun and the Minié rifle?—I am not in favour of garrisons, except at a few points, the key points of the country, where you have magazines or field works. I think, when it comes to shutting yourself up in works, it is not at all a position in which we ought to be in that country. So far as may be necessary, merely for leaving the magazines in security, and putting whatever you leave behind, the women and the children, in safety, temporary works of any kind may be useful; but, as a general rule, I think that we ought to avoid dotting the country with little petty works, and that we ought to concentrate our European troops as much as possible in a few points, so that you may dispense with the necessity of having those petty works. There is one great advantage in having two European regiments at a station together, for, if you have to move out troops, you can move out a regiment along with the native troops that accompany it, and you still leave behind a body of men to hold the country, securing your magazines, and securing your position. I am not in favour of dotting the country over with small posts of that kind.

5126. The recent events in India have tended to show that very small forces, even in the most imperfectly constructed works, are sufficient to resist very large bodies of natives?—It depends upon what you may be alluding to.

5127. For instance, Lucknow?—Lucknow was an instance which I should have advanced, as an example of the danger of scattering your European troops. There is not a doubt upon my mind that if, when the insurrection broke out, General Wheeler at Cawnpore, and Sir Henry Lawrence at Lucknow, had been able, one or other of them, to effect a conjunction, things would have gone very differently with either, or with both; but the fact was, that you had too small a body, and in exactly the position which I think is objectionable, namely, having them scattered. The object is not that of mere resistance, because it becomes a matter of discredit, if you are shut up for months, fighting a very uncertain issue for months; it puts the whole country in a blaze, and you put yourself in a false military position, and one which I think you should carefully avoid.

5128. What do you think of the results of the disarming, which was carried out in the Punjab, with the view of repression?—I have no doubt that it was very useful.

5129. In your opinion should it be more extensively carried out?—That depends so much upon the part of the country in which it is done. There are parts of the country (native states) in which it cannot be done, on account of treaties and various other things. If you disarm your own populace, with native states in the midst of them, who have arms, and who can pour arms into those districts which you have disarmed, it becomes a very questionable matter whether you are doing anything that is useful.

5130. In the Punjab, I believe, it was quite successful?—Yes, I believe it was; but the Punjab is rather peculiarly circumstanced, geographically speaking.

5131. (*Chairman.*) Do you believe that in the long run it is possible to keep a population like that of India disarmed?—I do not. I have known an instance, in which it was thought that the people had been disarmed, and a man came to me, and asked permission to examine a Mahomedan burial ground; at first I demurred, for I did not like to have anything done that could be construed into a desecration of the burial ground; but he said that he was convinced that it had been made use of to conceal arms, and he stated that his information was so good, that I might rest assured that the issue would bear out what he

wished to do. So I authorized him to go and open the ground, and sure enough, he there found a large quantity of arms, and where a population has recourse to these contrivances it is a very difficult thing to disarm them.

5132. (*Col. Greathed.*) I believe the population in Scinde were not disarmed?—No.

5133. That is as quiet a country as any in India, is it not?—It is now, certainly.

5134. (*Sir R. Martin.*) But the very warlike people of the Punjab were readily disarmed, were they not?—I believe they were; they were disarmed just after the last campaign in the Punjab, when the impression of the sword was on the people; it was done at once, and I believe pretty effectually, although how far it may have been thoroughly done I do not think anybody knows, because they have various ways of concealing arms, and one of their ways of storing shot and ammunition was by burying; you found guns, shot, and ammunition, turning up in various places; and after the troops were beaten you suddenly found those troops turning up again provided with artillery and with ammunition.

5135. (*Chairman.*) Your opinion is, looking at the political condition of India, that there are many considerable posts, which are of too great military and political importance to be abandoned, whether they are healthy or unhealthy?—Yes. I think that it would be most dangerous not to occupy the great strategical points, on which the security of armies in the field, and on which the security of your hold of the country depends; you must hold them; that is the condition by which you hold the country, and you will peril the possession of that empire if you throw those points up.

5136. You think that a smaller number of men would be able to suppress a revolt in the beginning, when, if there was an interval of three or four days, a very large number might not suffice?—Yes, and it may cost you many lives, and a great deal of money.

5137. Have you considered the question of the marriage of soldiers, and do you think it is possible, without any very great increase of expenditure, or inconvenience of any other kind, to do that which Sir John Lawrence has recommended, namely, to increase the number of soldiers allowed to marry, from 12 to 25 per cent.?—Yes, I think that the question is now rather more complicated by the much larger number of European troops that are to be for the future in India, and by the more frequent reliefs that will become necessary, and consequently the much greater expense which it would entail. I think it very desirable if the thing can be done, that there should be a larger number of men allowed to marry in India, but how that can be done is partly an economical question. I am wholly in favour of it, if it can be done, because I think that a married man is a more contented, a happier, and a healthier man; he is necessarily exempt from many of those things to which single men are exposed.

5138. Is it possible, considering the frequent changes from country to country, and which are inevitable in a soldier's life, to make the condition of the soldier's wife, in the majority of cases, other than very unsatisfactory?—I do not think it is, and that is one of my reasons for doubting how far my wishes might go in favour of the soldiers being allowed to marry; the difficulties which attend it, with reference to general service, and with reference to the position and condition of the women altogether are very great, and make the question one of exceeding difficulty, and however much one's feelings might go in favour of extending the privilege in India, I must say that I am not at all clear that it would, taking it as a whole, be an advisable thing.

5139. (*Dr. Farr.*) It must be done, of course, by a general regulation that must apply to the whole army?—Yes, and with reference to our colonial service, and with reference to the home service, and

with reference to everything ; it is a very large and very difficult question.

5140. (*Chairman.*) It has been stated that the proportion of the married men who volunteer to stay in India is quite inconsiderable in comparison with the proportion of the single men who volunteer to stay ; is that within your knowledge or not ?—I am not cognizant of the exact proportion, but when I mentioned the married men volunteering I alluded chiefly to men with native or half native connexions, not to those with purely English wives.

5141. Is there anything with regard to the sanitary arrangements for troops in the field, on the march, or on a campaign, as to which you could give us the benefit of your very long experience ?—No, I think, every thing considered, that the arrangements on field service in India are as good as they can be ; I have seen them very hardly taxed on more than one occasion, and I am not aware that I ever saw them break down. I would instance the action at Chillianwallah, in which the losses were very heavy, and the wounded were numerous, and where, of course, the exertions of the medical staff were very severely tested ; but it appeared to me that the arrangements were adequate even to that emergency, and it was quite an exceptional one.

5142. Do you think, as a rule, that sufficient care is exercised that men shall not be moved about unnecessarily in the sun ; that they shall not be paraded at undue hours, and that they shall be guarded as much as possible from all unnecessary exposure to the climate ?—I think that a great deal depends upon the wisdom of the commanding officer ; the wisdom of a commanding officer is really a thing of very immense importance in India, for almost everything is in his hands ; he must maintain discipline ; he must maintain the state of efficiency of his corps, and in a climate of that kind, unless he does so, having paid great attention to the times at which it is best to carry on his drills, and to all those internal arrangements which rest entirely with him, unless, in fact, the commanding officer is a man of wisdom his regiment may very likely suffer severely.

5143. As it unfortunately is not a law of nature that all commanding officers shall be wise, do you think that any general arrangement or regulation can be made which shall prevent the inexperience or ignorance of some commanding officer, perhaps newly arrived in India, from exposing his men to unnecessary hardship and suffering ; would it be wise to lay down any rule forbidding the movement of men or calling them out for parade after a certain hour in the day, and at certain seasons of the year ; is not that a matter that might come fairly under the cognizance of the highest military authority, and be made a matter of general regulation ?—I look upon it as part of the duty of the commanders in chief at the different presidencies, and of the adjutant-general's department, to see that the commanding officers of regiments, when they enter into that country for duty, shall receive a careful warning as to the attention they are to pay to their men with reference to drill and with reference to every other part of their duty. It would be a very difficult thing to lay down precise rules, because the country varies so much and the climate varies so much ; and it is better to hold the commanders in chief and the adjutants-general responsible, that they do not neglect the supervision of the commanding officers, and not only that they make the commanding officers do their duty upon those points, but that if a commanding officer shows himself not fit for his place to remove him.

5144. (*Col. Greathed.*) Are you aware that the inspection by the general officer is a heavy marching order inspection ?—Yes.

5145. Invariably ?—Yes.

5146. And that necessarily the men are kept standing for a considerable time, and not moving ?—Yes.

5147. Is it your opinion that that parade is trying and dangerous to the men ?—I think that it is a very

trying parade ; I have known similar things even in this country, and therefore it must be in India ; it must depend entirely upon the season in India in which you put them through that sort of ordeal.

5148. You are no doubt aware that the inspections of Queen's troops in India take place in April and in October ?—Yes.

5149. (*Sir R. Martin.*) But in neither of those months should the soldiers be kept for any length of time in heavy marching order at or about sunrise, or at any time after ?—It is a point of detail upon which it is rather difficult to give an opinion, because that the regulations of the service enforce this inspection, and from a certain point of view it is a very necessary inspection, and it must be done so far as it is possible in a way and at a time the least trying to the men.

5150. (*Col. Greathed.*) Is it not your opinion that the object gained, it taking place only twice a year, would be attained equally well by having every man's kit displayed at his feet, he standing by his knapsack and his kit on that parade ?—I think it would be attained fully ; better.

5151. (*Dr. Gibson.*) Are there no general regulations for the guidance of commanding officers ?—Yes ; there are very full general regulations in all the three presidencies, and also medical regulations.

5152. (*Col. Greathed.*) Are you aware that the soldiers on parade at drill suffer infinitely more by standing still than by moving about ?—I am quite aware of that ; I have seen it not only in India, but before I went to India.

5153. Would you recommend that great discretion should be exercised as to keeping the men standing ? Very great.

5154. Are not the regulations on the subject of marching so clear and definite as to leave very little in the power of the commanding officer if he attends to them ?—I think they are admirable.

5155. (*Dr. Farr.*) You have referred to the importance of this subject, and its increased importance now, inasmuch as a greater proportion of European troops will serve in India than formerly ?—Yes.

5156. One of the circumstances to which you referred was the period of service in India ; do you know what the period was formerly ?—It varied very much, I believe ; I cannot state it accurately, but my impression is that it was frequently for a long period.

5157. Can you name the period of time to which it extended ?—No, I cannot.

5158. Was it 20 years ?—I cannot answer correctly ; I have no distinct recollection.

5159. What do you expect it will be under the new arrangements, or have you at all turned your attention to that ?—I think it is to be found in the Report of Lord Hotham's Commission ; I think it is stated there that the intention was to make it 10 years.

5160. During those 10 years, at the present rate of mortality in India, there would be a great loss sustained ?—Great loss.

5161. And great suffering ?—Yes.

5162. Do you think that the loss and the suffering which have been hitherto experienced in India can be reduced in any way ?—Of course it might be by attention to the period at which you land troops in India, by attention to the mode in which you convey troops from the points of debarkation to the stations where they have to join their regiments, and by attention to the countries from which you send troops to India.

5163. Do you consider the question of stations of vital importance ?—The question of stations is of very great importance.

5164. Do you consider it indispensable that a certain amount of force should occupy these strategical positions ?—Yes.

5165. But not the whole of the force now in India ?—The whole of the force in India is distributed with reference, of course, to the military occupation of the country ; those strategical points which it is

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essential to hold are not numerous, but they must be held.

5166. By a considerable force?—Yes.

5167. Do you consider that those stations admit of any improvement in a sanitary point of view?—I have no doubt of it. My opinion is that sanitary improvements may always go on. It is very difficult to say, but I think I have scarcely seen a station in India where improvements could not be carried on; it is just a question of expense.

5168. You are not satisfied with the present state of things when we find the mortality at the rate of 5 per cent. in India?—I think that with due care and attention it is, humanly speaking, within our power to reduce that ratio of mortality.

5169. From some returns before me it appears that at Fort William the mortality was 10 per cent., at Dumdum 8 per cent., at Dinapore 6 per cent., at Gazeepore 5 per cent., and at Allahabad, which you consider must be occupied under any conditions, 12 per cent.; that is the mortality in the infantry; in the cavalry it was inconsiderable; at Cawnpore 9 per cent., Agra 4 per cent., and at Meerut 2 per cent. Without going to the hill stations, there appears to be great difference in the mortality?—I think that a great improvement might be effected; of course it requires great care and attention. Some of the attempts which have been made are tentative, and may or may not succeed; but experience will show. Take, for example, Fort William, and Calcutta, and Allahabad; I have no doubt that with proper care and attention the mortality might be reduced, but it is always, of course, a question of expense, more or less.

5170. You would not hesitate to consider that that is a very important element that this Commission has to deal with, the consideration of the stations at which the main body of the troops should be placed?—It is a most important consideration.

5171. (*Sir R. Martin.*) The loss of the troops being the most costly circumstance of all?—Yes.

5172. Do you think that generally throughout India the military stations are occupied with reference to antecedent circumstances, or to the present requirements of the country?—That depends so much upon the part of the country referred to. Some of the older stations were taken up at an early period, and taken up with reference to the then condition of our power, then, as our frontier has moved on, we have been forced to change and change according to the emergencies of the moment, the forces have been pushed forward, and they have been dis-

tributed. So far as the selection of stations goes, I think there has been very great care taken. The system in Bengal and in the north-western provinces was to have a Committee appointed, and the Committee was always composed of scientific officers, either engineers or artillery, and sometimes both, and of officers of cavalry and infantry, and also of medical men; that was the regulation in fact. After their report, and after a careful examination of the site, if it was approved of it was taken possession of, if not, it was rejected, and some other was found; it did not always follow that after all the care that you might have taken a place proved very healthy, but you had done what you could, and experience alone showed whether you had done right or wrong.

5173. (*Dr. Farr.*) What is the general effect of the service in India on the condition of a soldier? when he returns is he more or less efficient?—That is a question that would require to be rather more defined as to his period of service, and whether you put the question with reference to his physical condition.

5174. I refer to that particularly?—I have always observed that a soldier, after a certain amount of service in India—I cannot exactly say whether it is service, for I think it depends rather upon the individual—but I have always observed a great falling in in the chest; a man seems to fall in in the chest, and has the appearance of being a less physically powerful man.

5175. (*Sir R. Martin.*) That arises, does it not, from a want of exercise in the upper extremities, and a want of games and amusements, and the listless habits of barrack life?—I am not able to say whether that is the cause, or whether it is the result of inaction; but I think that any one who has observed troops, would have observed that after a certain number of years there is a general falling in of the chest.

5176. (*Col. Greathed.*) Do you think that that would be remedied by the use of gymnastics?—I think that it would to a certain extent, and for this reason, that I think you will find among the men who have a good deal of exercise with their arms, for instance, the cavalry and artillery, who have, one way or other, a good deal more physical exertion to make, it is less so with them than with the infantry, therefore I think that gymnastics would prevent it.

5177. (*Sir R. Martin.*) Would inaction and the climate of the plains produce that condition?—It may be so.

The witness withdrew.

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Mr. EBENEZER WILLIAM HUGHES, C.E., examined.

5178. (*Chairman.*) I believe you appear here with reference to the model which is upon that table?—Yes.

5179. Which is of your construction?—Yes.

5180. Of what profession are you?—I am a civil engineer.

5181. Will you have the kindness to explain to the Commission the peculiarities and advantages of that model?—The whole of the framing and supports are wrought iron, coated with mineral paint, and arranged so as to dispense with brick or stone foundations. The outsides and roofs are corrugated iron, with an inner casing of the same material, with spaces throughout the sides and roof, for the circulation of air; thus making the inside of the tents perfectly cool, even when exposed to a great solar heat. The tents may be erected without the aid of scaffolding or skilled workmen in about two hours, and taken down in less time, so that should diseases which are infectious break out in any part of a camp, one or more of the tents can be completely isolated, and used as hospitals. They can be easily removed, one man being capable of carrying the heaviest piece used in the construction. As duplication of work consists throughout, no confusion can

take place in erection; and for removal to a distance, the whole can be packed in a small space. The strongest gales cannot affect the stability. The framework being of wrought iron, the tents are of a permanent character, and cannot be easily injured. The tent is fireproof. The cost of lodging the men, at five per cent. upon the outlay, is $1\frac{1}{2}d.$ per man per week.

5182. What are the dimensions, and what number of men is it intended to accommodate?—It is 35 feet in diameter. Each tent accommodates 25 men with single beds.

5183. What is the height?—About 17 feet 6 at the centre.

5184. Is it supported entirely from the sides, or also from the centre?—It is supported entirely from the sides.

5185. Are the supporting pillars of iron or of wood?—Of wrought iron exclusively.

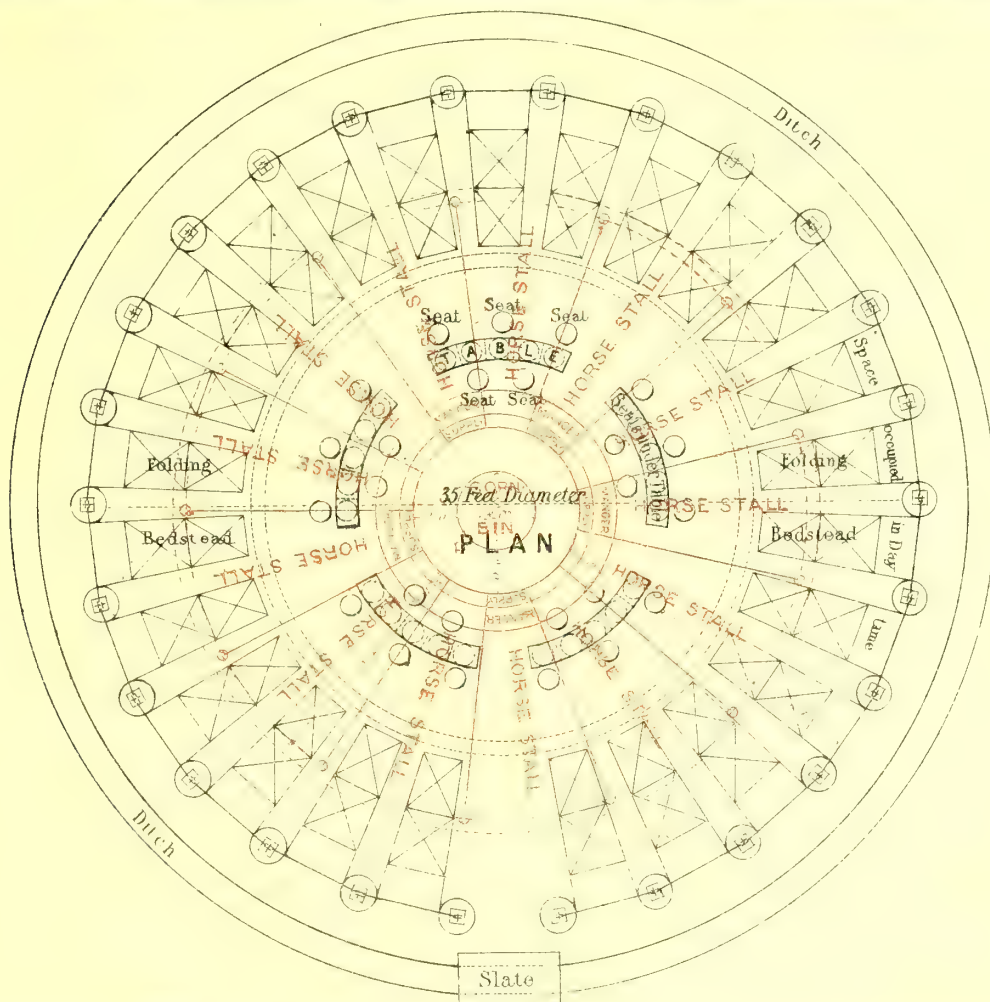
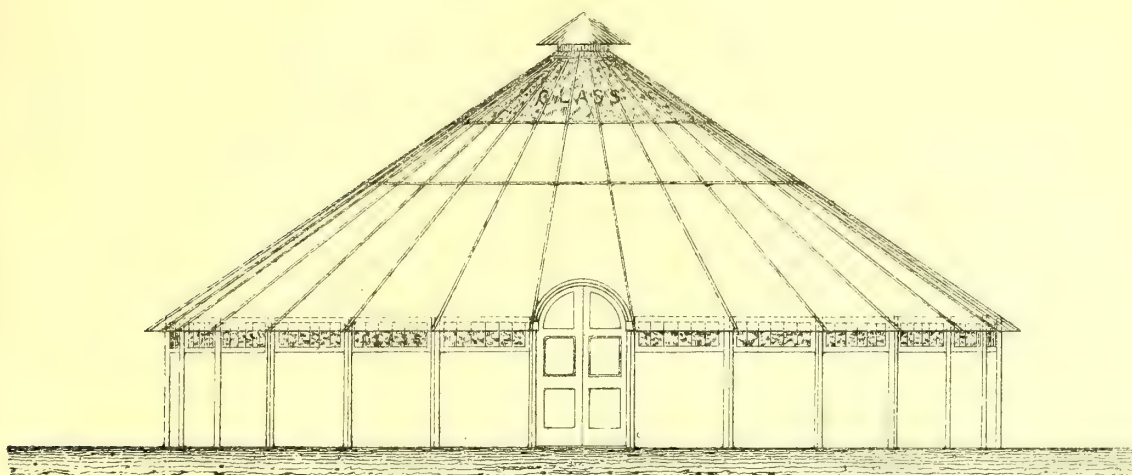
5186. Are they connected with one another at the top?—Yes.

5187. How many of them are there?—26.

5188. At the top there is an iron roof?—Yes.

5189. I presume that the principals and fastenings

ELEVATION.



SCALE

12 6 0 1 2 3 4 5 6 7 8 9 10

10 JULY

DESCRIPTION.

The whole of the framing and supports are covered by a non-ferrous metal with external paint and a wrap-around is to disengage with brick masonry foundations.

The underside not to be examined is a rich yellow, tinged with a leucous or dusky crosser throughout the sides and not for the striae or dots, thus making the incision like *Tritia perisphincta* but with a exposed to a greater from the sun.

The simplicity of construction, advantage of the Joints being effected without the aid of scaffolding or shillies workmen in about two hours, and taken down in less time. They can be easily removed from place to place, one man being capable of carrying with ease the heaviest frame used in the construction.

As degeneration proceeds throughout a nation, and the price of clothes and the whole consequently are kept at the smallest possible rate.

The strongest given constraint on the variables T and θ was taken to be the one brought in by making the T and θ extremes character and amount of each individual. The T and θ extremes were used.

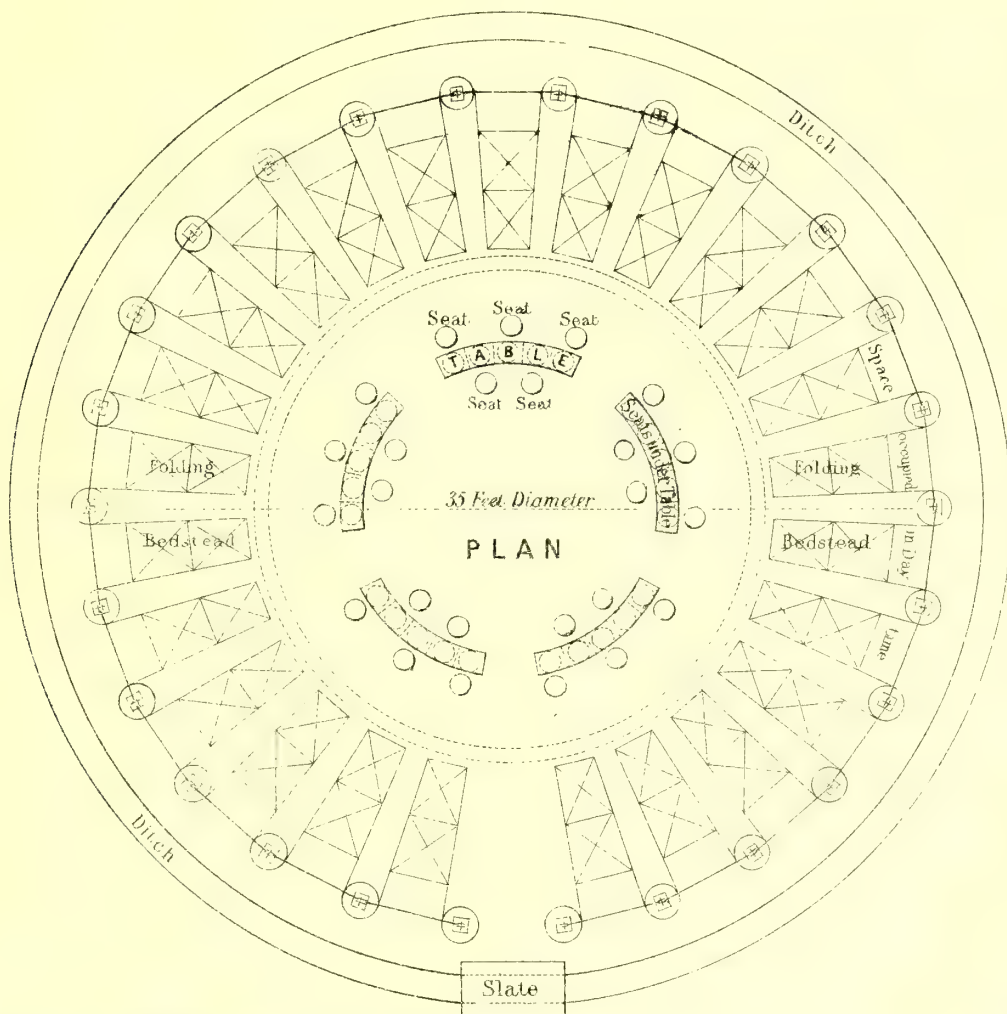
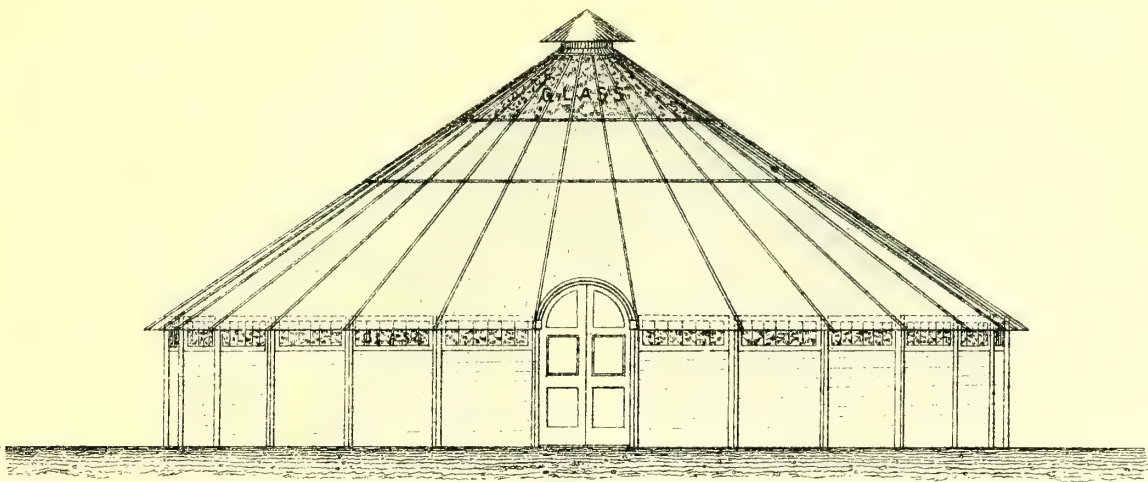
The cost of feeding these 2000 at 1 lb per day on the average is about 1 1/2 per man per week.

The whole is arranged upon the following principles

Each Tent accommodates 25 men with 500 lbs. of stores

SOLDIER'S TENT.

ELEVATION.



DESCRIPTION.

The whole of the framing and supports to be of wrought iron well coated with mineral Paint and so arranged as to dispense with brick or stone foundations.

The outsides and roofs to be of corrugated iron with an inner casing also of corrugated iron leaving cavities or spaces throughout the sides and roof, for the circulation of air, thus making the inside of the Tents perfectly cool even when exposed to a great heat from the sun.

The simplicity of construction admits of the Tents being erected without the aid of scaffolding or skilled workmen in about two hours and taken down in less time. They can be easily removed from place to place one man being capable of carrying with ease the heaviest piece used in the construction.

As duplication of work consists throughout no confusion can take place in erection and the whole consequently can be packed in the smallest possible space.

The strongest gales cannot affect the stability. The frame-work being of wrought iron makes the Tents of a permanent character and cannot be easily injured. The Tent is perfectly fireproof.

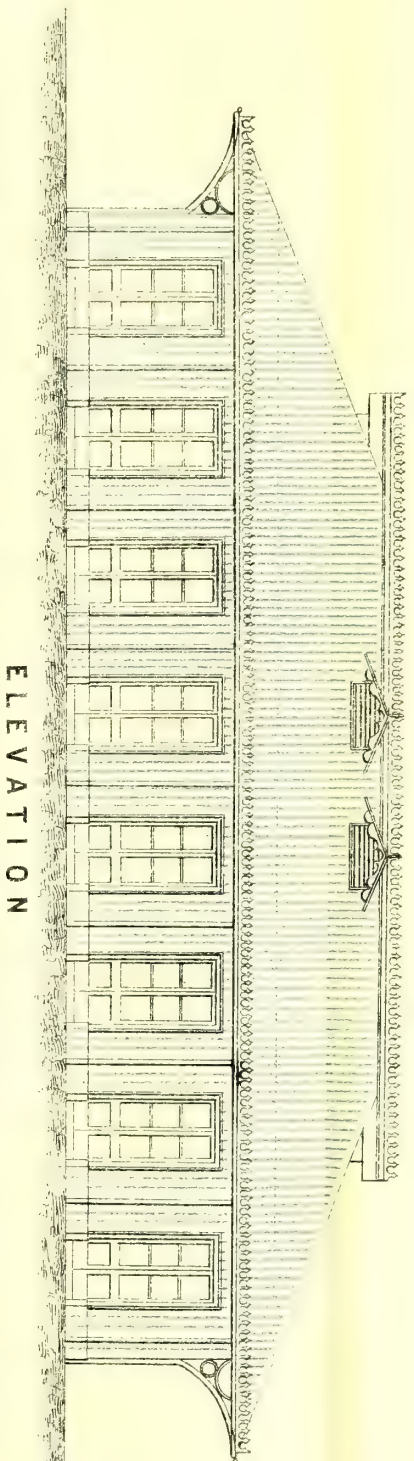
The cost of lodging the men, at 5 For tent upon the outlay is about 1st per man per week.

The whole is arranged upon the most sanitary principles.

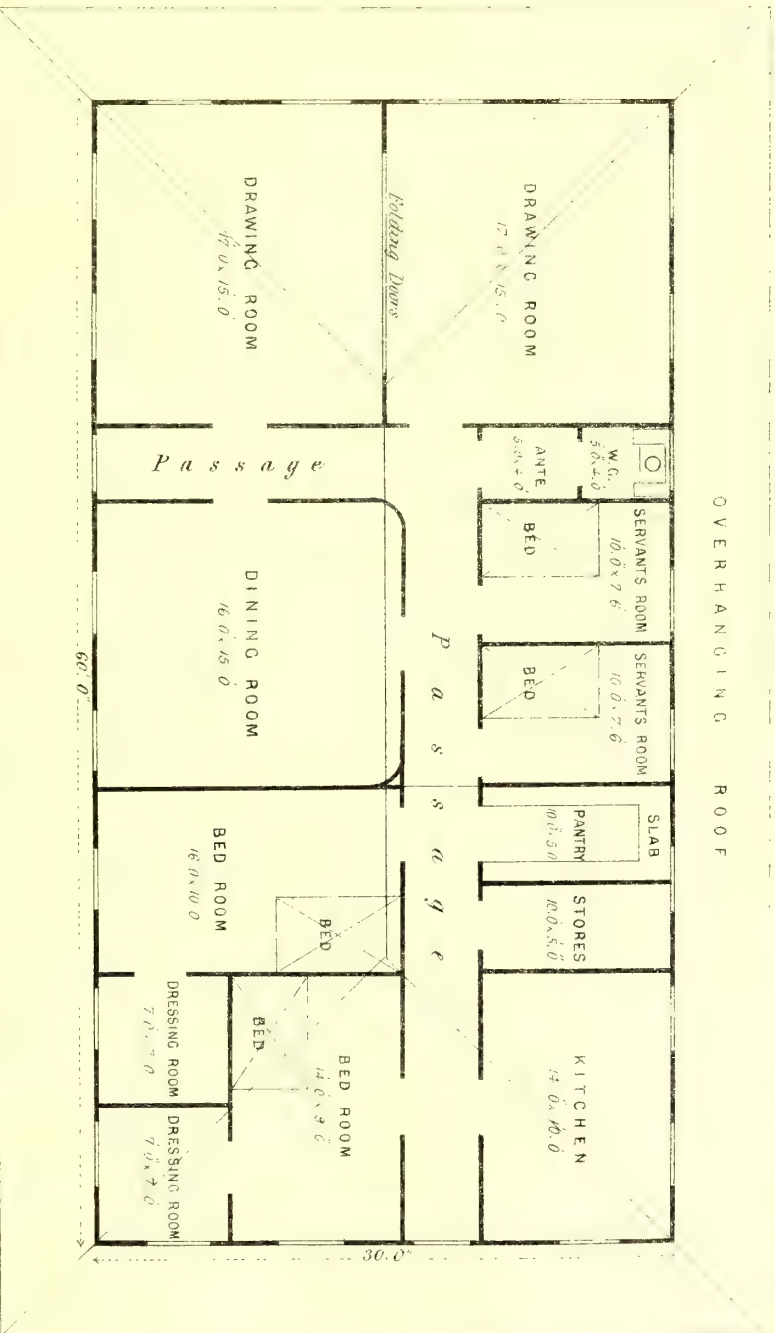
Each Tent accommodates 25 men with single Beds.



FIREPROOF PORTABLE HOUSES.



ELEVATION



PLAN

DESCRIPTION.

The outside and roof to be of iron-plate iron, and on the inside iron-plate iron. The construction of the roof will be made in such a manner that the building will be able to stand in any position, and it will be able to keep the inside perfect in all.

The inside to be of iron-plate iron, and on the inside iron-plate iron. The construction of the roof will be made in such a manner that the building will be able to stand in any position, and it will be able to keep the inside perfect in all.

The simplicity of construction admits of the building being erected in a very short time.

The rest of the building will be of a strong design, delivered in a ready-made state, and it will be able to stand in any position, and it will be able to keep the inside perfect in all.

FIREPROOF.

E. W. HUGHES,
22, Parliament Street,
Westminster,
London, S. W.

Mr. E. W.
Hughes, C.E.

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of the roof are of iron; the rest would be of canvas?—No, it is exclusively iron.

5190. Is that iron roof double or single?—Double.

5191. What space is there between the two?—On an average three inches.

5192. Have you made any experiments to show what difference of temperature would be caused by that double roof?—Yes, I have.

5193. Will you be good enough to state the result?—Before I attempted to go into this matter I had a rough model made of a very uncouth character, but for the purpose of satisfying myself about it at first. On the top I applied a heat of 147° , and in the inside I suspended a thermometer, and another one at the far end of a large room, larger than this; the one that was in close proximity with the under casing of this roof was not in the slightest degree affected by the heat, showing that the conduction of the heat was entirely cut off, and that however hot the outside may become the inside casing is in no-wise affected. Again, to facilitate the putting together of all the principals with the apex ring, they are similar to an umbrella, acting on a swivel joint, so that these connexions are made before the tent is attempted to be erected; the dotted line on the diagram will show that there is only a pulley required to hoist them; they are connected on the ground by the men before they are attempted to be drawn up, a pulley attached to a windlass draws them up into their requisite position, then the ends are raised and connected by bolts with the outer rings simultaneously.

5194. What is the weight of the tent?—Altogether about seven tons.

5195. Is it easily taken to pieces, and transferred from place to place?—Portability was one of the principal things I had in view when designing it; there is no part that could not be carried by a boy; there is no length exceeding 10 feet 6, and they are all duplicates throughout, so that there can be no confusion in putting it up by men having no skill; one connection being made that applies to the rest; whether put on the north, south, east, or west, it would make no difference.

5196. How is it to be carried; on carts?—It might be carried on vehicles of some sort, but there is no part that could not be taken up by a boy.

5197. You say that the weight of each part is inconsiderable; will you state what the size is of each particular part?—The longest piece is about 10 feet 6, and the hollow sliding rolls, which slide from the bottom upwards, exclude the possibility of water getting access to the tent, and also of heat being conducted to any part of the tent, as these are quite hollow, so as to protect the tops of the rafters. In point of economy I have calculated that it is the cheapest thing that could possibly be made, taking into account the durability of it.

5198. You contemplate I presume that it would be used as a sort of shed intended to be stationary; you do not contemplate that it will be used habitually as a tent for troops in the field?—Not for marching purposes; but suppose it were necessary to remove from one place to another in the course of a month, or two or three, it would then be very well suited for that purpose.

5199. What is the weight of an ordinary canvas tent which would afford the same accommodation?—I have not gone into that.

5200. Have you calculated what would be the cost of making, I do not mean an experimental tent of that kind, but assuming any considerable number of them to be ordered, have you calculated what the cost of constructing each would be?—I should prefer that one of these should be made, and I think that that might afford a basis for further negotiation, and something then could be ascertained as to its real commercial value, as it is entirely new, and I have never seen anything bearing the slightest resemblance to it, I should not like to state positively the exact amount, but I think that one might be made for a

sum something like about 200*l.*, and after that they would be considerably less.

5201. Have you any idea of the length of time that such a tent would last exposed to a tropical sun?—That would depend upon the frequency of its being moved about from place to place, and also the care that was taken in coating it with paint; oxidation might be almost entirely prevented by care, because the plates that are double with purlins between are connected with screws, and one piece of double roofing can be withdrawn entire, and painted inside and outside, and oxidation prevented.

5202. Is not iron, such as you would use, liable to be bent by rough usage?—Not by fair usage, because the corrugations afford such a very great increase of strength, and from their having bearings from point to point, it is almost impossible to be injured.

5203. If I understand the principle of construction rightly it is intended that these iron plates should slide into the grooves for which they are destined?—Yes, precisely.

5204. Would not a very slight amount of deflection, or any injury that might be sustained from a fall or collision make it difficult to fit them into the grooves?—Not at all; they are composed exclusively of wrought iron. I did away entirely with cast iron, because, if a man should throw one part carelessly on the ground, cast iron might break; but if this was to become injured it would be a mere matter of beating it out again; it would not produce any fracture at all.

5205. But I rather spoke of bending?—Yes, it could be easily bent.

5206. You admit that it could be easily put out of shape, but that it might easily be bent in shape again?—If it were submitted to unfair usage, it might be easily put into shape again.

5207. (*Sir P. Cautley.*) Do you think that sort of tent could be raised by the soldiers themselves?—Certainly; it is intended for the soldiers themselves to raise it; that was my object.

5208. How many men would be required to raise such a tent?—If the complement of men who inhabited the tent applied themselves to it, certainly it could be raised in two hours, or less, but not more.

5209. You are aware that in India, the tents now used which cover about 16 men are raised in about 20 minutes—canvass tents?—Yes.

5210. Do you consider this kind of tent very much superior to the canvass tent?—Infinitely.

5211. (*Chairman.*) If I understand you rightly, this construction is rather more a portable building than a tent?—I rather think that tent was a misapplication of the term; but my idea in making use of it was to convey the idea of portability.

5212. (*Sir P. Cautley.*) You would consider it more like a permanent barrack than a moveable tent?—For such purposes as camps, or where men take up their abode in a place for a month or two, permanent camps, or camps to be moved about, with intervals of a month, or two, or three; but certainly for marching purposes it is not at all applicable.

5213. (*Dr. Farr.*) Such a tent would have to be carried by 26 men?—Yes.

5214. It is heavy, is it not?—Yes.

5215. Could you not lighten it in any way?—I think it is desirable that it should have seven tons weight on account of its durability.

5216. (*Chairman.*) You would propose that a construction of this kind should be used in places where it is now the practice to put up a temporary building, as in a new station, the healthiness of which was being tried?—Yes.

5217. (*Sir P. Cautley.*) With reference to hurricanes and heavy rains, what is your arrangement for closing the large apertures at the sides under the eaves?—The windows are closed and opened by means of fastenings, but the glass is placed underneath the projecting eaves to prevent the sun getting access to the glass and so communicate heat to

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the tent ; but the principle of the sides I will explain. The corrugated ends are open on the outside, having a double corrugation ; but they are closed on the inside, so that when the sun engenders heat within that cavity it must necessarily be discharged outwardly, and cannot obtain access inside, as there it is permanently closed ; but the air makes its ingress and its exit through the ends, keeping up a constant circulation there.

5218. (*Dr. Farr.*) That is the object of the double plates, to keep up a constant circulation of the air ?—Yes, and to keep out the heated air that would be engendered in the cavity from getting access within the tent.

5219. In that way the temperature of the interior will always be cooler, as compared with the external temperature ?—Always cool. I say cooler than the external air ; but there is sure to be some heat which would be reflected from the sun acting on the outside. But it would be cooler in the inside than the outside.

5220. You would get rid of the radiated heat of the sun ?—Yes.

5221. And the people would be under shade ?—Yes.

5222. So that they will not suffer from the direct rays of the sun ?—They cannot.

5223. (*Dr. Sutherland.*) What amount of cubical space per man shall you give ?—400 cubical feet.

5224. According to the present regulation in India it is, I believe, 1,000 ; you would then, I presume, have to increase the dimensions to give such a cubical space as that per man ?—Certainly.

5225. The cubical space in England is 600 feet ?—Yes.

5226. So that your proportion would not answer for the number of men that you propose to put into the tent, which is, I think, 25 ?—Only there would

be an admission, and a regulation of the air that is introduced all round, having its means of escape by a ventilative top, and which can be regulated.

5227. Have you made any experiments to show how much the heat of the sun is thrown off by that kind of surface ?—No.

5228. (*Sir P. Cautley.*) You do not propose the outside to be a polished surface, do you ?—No, a painted surface.

5229. (*Dr. Farr.*) Is your apparatus in use anywhere ?—No.

5230. (*Chairman.*) I presume the principle you have adopted for that portable barrack is that which gives the largest amount of tent to the smallest amount of circumference ?—Yes.

5231. It is circular ?—Yes, I consider it to have the strictest economy of space.

5232. (*Sir P. Cautley.*) And it exposes less surface to the action of hurricanes and winds ?—Yes, I think it would be almost impossible for the strongest tornado to affect its stability.

5233. It would, at any time, be possible, would it not, to add to the ventilation by taking out any of the plates which form the surrounding walls ?—Yes, the windows all move, so that the admission of air could be regulated to any desirable extent.

5234. (*Chairman.*) Is there anything else you wish to point out ?—There is a diagram of another building entirely on the same principle.

5235. (*Col. Greathed.*) Do you depend upon the walls for the support of the roof, or are the staunchions sufficient ?—I depend upon these.

5236. Those are sufficient ?—Quite sufficient ; they are made of wrought iron, so that they cannot be injured.

5237. Are they all interchangeable ?—Yes, and their base plates you can pack them like a lot of saucers for shipment.

The witness withdrew.

Saturday, 29th June 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.
Sir RANALD MARTIN, C.B., F.R.S.
J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
JOHN SUTHERLAND, Esq., M.D.

Sir CHARLES TREVELYAN, K.C.B., late Governor of Madras, examined.

5238. (*Chairman.*) How many years have you served in India ?—I served 12 years in Northern India in the Civil Service, and I was for 14 months Governor of Madras.

5239. Has your attention been turned to sanitary questions ?—Several important points connected with that subject were brought under my attention while I administered the Government of Madras.

5240. Will you be good enough to describe what those were ?—Immediately upon my arrival I was called upon for a decision in regard to the European barracks in Fort St. George ; those barracks had been condemned as incurably unhealthy by a large committee of military and medical officers, and an expensive plan was proposed for their reconstruction. It, therefore, became my duty to inspect them personally in a very careful manner, and the conclusion at which I arrived was that there was no fault in the barracks themselves ; they were substantial, commodious, and costly buildings, but the subsidiary arrangements were of a most defective kind ; the ventilation, the drainage, and the protection from the sun were all extremely imperfect, and quite sufficient to account for their previous unhealthy state. I immediately applied my mind to the means of remedying these defects, and the improvement of the

ventilation was much assisted by the reconstruction of the sea wall of Fort St. George, which had become necessary in a military point of view ; the wall had become dilapidated ; and it was a question whether it should be rebuilt according to the old plan, or whether it should be lowered, and have only one tier of heavy ordnance upon it instead of two tiers of lighter ordnance, and it was determined, after full consultation with the commander-in-chief and Sir Arthur Cotton, the commandant of engineers, to lower the wall six feet. This was done on military grounds ; but an additional recommendation was, that it was very desirable on sanitary grounds.

5241. That wall, I believe, had been long considered unfit to bear heavy ordnance ?—Yes. The Commissioners are probably aware that the great sanitary agent at Madras is the sea breeze, and by reducing the sea wall of the fort six feet, the sea breeze was admitted into every part of the fort to an extraordinary degree, quite beyond our expectations. We had no idea that a reduction of the wall to the extent of six feet would have been followed by such an important effect throughout the fort, and, among other places, in the European barracks. We assisted the action of the sea breeze in the barracks by opening some doors which had been blocked up, and

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by enlarging the windows on the sea-side; we also made two large openings into the patcherry, or the married men's quarters. These arrangements sufficed to remedy the ventilation. Then, with regard to drainage, we caused a large cistern to be constructed on the top of an old powder magazine, and had a steam pump annexed to it, for the purpose of filling it with water from the sea, and by these means a free flow of water was secured through every part of the barrack, including the upper story, so that the privies and urinals could be kept constantly flushed; the cistern was on a higher level than the upper story of the barrack.

5242. That was sea water?—Yes; it had not been completed when I came away, but the ventilation had been perfected.

5243. (*Sir R. Martin.*) With immediate good results?—Yes, the effect was instantaneous; it was remarked, not only in the barrack, but in other parts of the fort. All the residents were much struck by the change, and pleased with it. Then, with regard to shade, we proceeded to the construction of a double verandah, that is, a verandah for each story. The verandah was in an advanced state before I left, and is now, I understand, completed, and answers the purpose perfectly well. We also proposed to the Secretary of State to construct what, for want of a better name, was called a "recreation house;" it was to be on the plan of a large railway station, with a lofty metallic roof supported on iron pillars, furnishing perfect shade without interfering with the free circulation of the air. Underneath this roof, we proposed to have the school rooms, library, gymnasium, tennis court, the place for skittles and bowls and single stick, the reading room, and all the institutions connected with a European soldiers' barrack, intended for instruction and amusement. We conceived that this was an expedient specially adapted to the climate of India, and the position of Madras in particular, on account of the sea breeze. In the hottest weather, provided you have a good roof over your head, and a large house open to the sea breeze, you can get on very well at Madras. We thought it was calculated to diminish the depression of spirits arising from the monotony of barrack life, and that it would save the soldier from the hazardous alternative of either moping in barracks, or going out into the sun to the injury of his health. I have not heard what has since been determined upon that subject.

5244. What is about the number of European troops in Fort St. George?—A single regiment.

5245. Have you made any estimate of the cost of this place of recreation?—No, not of the railway roof, because that could only be procured with advantage from England; but I imagine that it would not be expensive. It would be something on the scale of a second-class railway station. The same improvements were applied to the general hospital, which includes the European military hospital, so far as they were required; the sea breeze had been excluded from the hospital by an old useless town wall, and also by a range of sheds; they were both of them taken down, and the sea breeze was freely admitted to the general hospital with precisely the same happy effect. The moment those obstructions were removed, the occupants of the hospital of all classes felt the benefit of the fresh breeze. A new wing and a second story were also added to the hospital, including some rooms for officers, on the plan which has long been so beneficially adopted in the French service. Any officer of the French army who wishes to have the advantage of the best surgical treatment is able to go into hospital, and finds a room well suited to his habits and his station in life.

5246. (*Dr. Farr.*) Did the barracks in the presidency come under your notice, and did they appear to require improvement, although not of the same kind, so as to make them as healthy as they could be made?—I inspected the European barracks at Trichinopoly and on the Neilgherries. The barracks on the Neilgherries are admirable, of the most modern im-

proved construction, and no suggestion, I think, can be made for their improvement in any important respect. At Trichinopoly, no doubt, the barracks are on a different footing, and many improvements might be there made.

5247. (*Sir R. Martin.*) Most of the barracks on the plains are of an old date and old construction, are they not?—Generally speaking, they are; but the art of building barracks is now so well understood that the only suggestion I have to make is, the great importance, besides providing sleeping rooms and ordinary sitting rooms, of providing for the soldiers some shady place, where they may enjoy themselves in the daytime, in the nature of a recreation house.

5248. (*Sir P. Cautley.*) Do you mean an open covered building, like a railway station?—Yes; there are places on a limited scale, and of a rather expensive construction, of that nature at Aldershot. The barracks on each side of the street are joined by an open iron and glass roof. I would have an arrangement on that principle, but on a much larger scale, connected with the European barracks in India. It is a practical expedient of a simple but of a very effective kind. Where the number of men living together is so large, it would be difficult and expensive to provide rooms of an ordinary construction sufficiently airy and capacious for them to spend the whole day in; for you must remember that they cannot walk out and amuse themselves as they do in this country; they are confined to the barrack all day, so that it is very desirable not only to provide in-door accommodation for them, but also to arrange for their having something like a change, to give them the means of carrying on their amusements and occupations in the daytime according to their inclinations.

5249. (*Sir R. Martin.*) The effect of a high wall, so common to all the old forts throughout India, must, for a very long period of the year, have a very depressing effect upon the health and spirits of the European soldiers?—No question about it; and the admirable effect that was produced by lowering the wall to which I have referred only six feet, proved how much many generations of soldiers and others living in the fort had suffered from the absence of that precaution. I carried the same improvement into effect in the town of Madras, as far as I was able. There was one wall especially bounding the Government House grounds; a wall that looked as if it had been built on purpose to exclude the sea breeze, the blessed sanitary agent provided by Providence for the whole of that immense population. I took down two-thirds of it, but for the remaining third I was obliged to wait until some rails and gates could be procured from England. I am afraid that the remainder of the wall is still standing; but I am convinced that the removal of it would not only have the effect of making the Government House and grounds much more healthy, but that it would also lead to a rapid improvement of the adjoining parts of the town, because houses of a better description would then be built fronting Government House.

5250. The improvement that you effected in the barracks at Fort St. George was only required because those barracks were situated within the old fort. I presume it is not commonly the case that Indian barracks are found enclosed by high walls which exclude the breeze?—No, certainly not. At the same time, they are sometimes so constructed as to exclude the breeze; in barrack squares, for instance, which is the case at Trichinopoly.

5251. But no modern barracks are built in that way?—I believe not.

5252. (*Dr. Farr.*) Such a construction as you have mentioned is not generally found in the barracks in India?—No.

5253. Would it involve much expenditure?—Very moderate expenditure. Probably the cost of a large railway roof might be known to some of the members of the Commission; but, as compared with the great

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object of providing health and recreation to so large a number of men, the expense would be quite insignificant.

5254. A sort of artificial shed would be provided there, underneath which the men could sit and amuse themselves?—Yes; it is one of the happy results of modern science, for 20 years ago this kind of roof had not been invented.

5255. There is a force at Bangalore, which is in the presidency of Madras?—Yes; but I have not visited it.

5256. Are you acquainted with the station at Secunderabad; do you know anything of the barracks there?—I was not able to visit Secunderabad, although a correspondence passed.

5257. There is a new barrack there, is there not?—Yes, an improved barrack; but I am not sufficiently able to speak to it.

5258. Generally, should you say that the barracks in that presidency might serve the purpose for which they were intended if they were improved, as they might be, at a moderate cost, or should you recommend any new constructions?—The question is not a general one, but an individual one. The observation you have made strictly applies to the barracks in Fort St. George; the barracks themselves were almost as good as they could be; but they were rendered unhealthy by the want of proper means and appliances, which have now been supplied.

5259. (*Sir P. Cauley.*) They have been more careful during the last ten years in selecting sites for barracks, have they not?—Yes; great care is now taken, and the attention of all the authorities is directed to the subject. Nothing could be better, in my opinion, than the selection of the site of the Jackatalla or Wellington barracks, as they are now called, in the Neilgherries, or the construction of them. I have nothing to suggest on those points; but there, also, I am of opinion that an improved application of the barracks might be made, which I will refer to hereafter.

5260. With an improved site, good ventilation and drainage, you get everything that you want, almost, in a barrack, do you not?—Yes, provided they are water-tight, and there is plenty of air-room, or of cubical space, for each individual. The Wellington barrack in the Neilgherries is a most ample one; in fact, the married soldiers complained that it was too large. I visited the married quarters, and I found there an Irish couple, who said that it was not at all comfortable; it was much too airy.

5261. (*Sir R. Martin.*) The climate there is quite European, is it not?—Yes; like that of the south of France.

5262. (*Dr. Gibson.*) The general hospital in Madras is a civil hospital, is it not?—Yes, a civil hospital, including an European military ward.

5263. Its site and its sanitary state are very bad, are they not, and also the vicinity?—The site was much objected to. I found a prevailing impression against it; but I came to the same opinion with regard to the general hospital as I had with respect to the barracks in the fort. The general hospital at Madras was a solid capacious building, of one story, which was said to have been an old Dutch warehouse. It is situated on the banks of the Cooram river, in which the water is influenced by the tide and by the rains, and the situation is quite open to the sea breeze; nothing intervenes between the outer walls of the hospital and the sea. But the banks of the river and the drainage had been neglected. I found an open drain leading from the centre of the hospital to the river filled with the most offensive matter; so much so, that it was a very disagreeable thing to pass near it. The river also, instead of being dredged, embanked, and the water made sufficiently deep to cover the sewage from the hospital and town, was, in many places, very shallow, so that the sewage was exposed to the air. But the main cause of the unhealthiness of the hospital was the intervening walls, which shut out the sea breeze. No hospital

could be healthy under such conditions of drainage and ventilation, however salubrious the situation in other respects might be. Having remedied these defects of drainage and ventilation, and having provided ample accommodation by erecting an additional wing and an upper story the hospital will be all that can be desired.

5264. (*Dr. Gibson.*) But that has not been done yet, has it?—The building was in progress when I left Madras, and the ventilation and drainage had been set right. The intervening walls and sheds which intercepted the sea breeze had been taken down.

5265. On the other side of it is there not a bad neighbourhood?—Yes, there is a bad neighbourhood on the other side; but I do not think that that affects the health of the hospital. There is a wide street between the hospital and the town, and the hospital is on the windward side.

5266. The hospital contains also a school of anatomy and a medical school, does it not?—Yes; they adjoin it at a distance of about 50 yards.

5267. The portion occupied by the European regiment is not satisfactory, and it is supposed that a separate hospital on another site would be preferable?—That objection was not brought to my notice by the committee that was appointed to consider the subject of the construction of the hospital. A committee was appointed, consisting of military and medical officers, acting in concert with the commander-in-chief and the chief engineer, to make all the arrangements necessary for the reconstruction of the hospital; but no suggestion was made, either by that committee or, as far as I am aware, to that committee, to eliminate the European military hospital; provision was made for it in the new buildings; a new wing was allotted to it.

5268. (*Sir R. Martin.*) The military admitted into the general hospital at Madras, I presume, are of the same class with those who are admitted into the hospital at Calcutta, viz., men belonging to detachments coming from the upper stations or arriving from England, there being a garrison hospital within Fort St. George?—The military admitted into the general hospital belong to both the classes mentioned; the garrison hospital is within the same building as the general hospital.

5269. It is not so in Calcutta?—No; but there is some advantage in having it in the same buildings; this arrangement is best calculated to provide the strongest and best medical force, because it admits of the concentration of that force. Every necessary separation is made; the building is sufficiently large for the purpose.

5270. (*Dr. Gibson.*) Until you recommended the additional wing, the accommodation for the European hospital was not considered good, was it?—It was deficient rather in point of healthiness than of space, for long lines of sheds had been added to the central building. There may have been some deficiency of room; but the objections to the hospital were mainly on other grounds, that it was close and unwholesome; its unhealthiness was attributed to the situation, but I came to the conclusion that it was not owing to the situation, but to the external circumstances to which I have alluded. It is a very interesting hospital. The Dutch building was in the form of the letter H, and the new reconstruction is to add another H to it, and to put another complete story on the top, and to have no outworks at all, nothing to intercept the free circulation of air; and houses were to be built for the hospital surgeon and his assistant, at a place where they would not intercept the sea breeze. This noble institution will answer all the purposes of a general hospital; that is, there is to be one ward for natives, and another ward for European civilians, and East Indians, Portuguese, and other persons of European extraction, and another large portion, which will be at the side nearest the fort and the sea breeze, for the military, and a ward for officers.

5271. Do you think the new wing, and its entire appropriation to the European hospital, quite essential?—Yes; after the curtailment of the accommodation

which was made by taking down all those exterior sheds, it was absolutely necessary. The plan of reconstruction was to take down the long lines of sheds, for they deserved no better name, with tiled roofs, which obstructed the sea breeze, and were used as hospital wards, and formed a great part of the accommodation. The removal of these made it absolutely necessary to add to the substantial part of the building, and in order to accommodate the patients during the transition, a large temporary hospital was erected adjoining the central building.

5272. Is the general front of the building exposed to the sea breeze?—Yes.

5273. There is no part of the building behind another, so that the sea breeze is intercepted?—No; not as it has been permanently reconstructed.

5274. (*Dr. Farr.*) Do you attach much importance to the second story, do you think that that is more likely to be salubrious in India than a story on the ground?—It is generally so considered, but where the other conditions are satisfactory, the ground floor will be very healthy; it is always the coolest.

5275. (*Sir R. Martin.*) Where the soil is pure and dry?—Yes; where the soil is pure and dry, and where there is a free ventilation.

5276. (*Dr. Farr.*) In a malarious country it is found by medical experience that the ground floor is unhealthy?—Unquestionably, when the other conditions are defective, the evil may be mitigated or avoided by a good upper story.

5277. (*Chairman.*) Where there is malaria, you avoid it by going to an upper story to some extent; but where there is no malaria, and the drainage is good, it is not proved that any unhealthiness arises from living on a ground floor?—No; certainly not. The soil of Madras is very healthy; it is a pure fine sand without any vegetable matter whatever; the only possible cause of malaria arises from neglect of drainage, which was very bad indeed; the river Cooram got an extremely bad name, and was considered to be essentially pestiferous, but I thought that the river had been hardly used. The first thing that struck me was, that it swarmed with excellent fish, and that those who objected to it for its unhealthiness, every morning and evening ate delicate fish taken from its waters; the cause of the unhealthiness was apparent; the banks were entirely neglected; it is a shallow river, which varies according to the season and the rain-fall, and as soon as the water begins to subside, wide banks of sand are exposed. The river is the general main sewer of the town, every sewer drains into it, and as the water fell, the efflux of sewage from the sewers became exposed, and the noxiousness and unhealthiness of it was obvious; that alone was sufficient to account for all the objections.

5278. (*Sir P. Cautley.*) There is a great want of slope, is there not, about Madras for drainage?—Yes, there is a general want of slope, but my remarks are now confined specially to the Cooram river. I found that there were cross drains, which entered the main drain of the river. It is a sort of estuary, what they call in the west of England a pill.

5279. (*Dr. Farr.*) Is it a tidal river?—No; it would be if the mouth was left open. It is, in fact, a nullah on a large scale, and in the rainy season the water comes down in great force, and fills the river to overflowing. The esplanade and the Government House grounds are all overflowed, and when the water has risen to a certain point the bund or dam is cut that separates it from the sea, and the river for a time is converted into a running stream, with an embouchure in the sea, and then it silts up again.

5280. (*Sir P. Cautley.*) It is, in point of fact, periodically scoured by those freshes?—Yes; but to return to the drains, which, although a very simple, is obviously an extremely important point; those town and hospital drains discharge their sewage into the river; as long as the river is in flood it is all covered with water, but when the water falls the sand is exposed, and then the sewage is exposed also.

The remedy that I applied was a very simple one, that of having deep cuts made through the sand, at comparatively no expense, the expense only of half-a-dozen labourers for a week or ten days, to secure a constant supply of water up to the mouths of the sewers, nothing more; that was all that was wanted; so that the sewage, instead of spreading over the dry sand, should fall at once into deep water and be covered; that I had done throughout the town.

5281. Is there sufficient stream to carry it away?—Yes, once a year; but until then it remains innocuous, being covered with water.

5282. (*Chairman.*) This river, as I understand you, is the common sewer of the town?—Yes.

5283. Then in a time of flood, once a year, are we to understand that all the filth that is there deposited, or the greater part of it, is swept out to sea?—Yes.

5284. After that the river is in a perfectly clean state?—Yes; I should say that in that state the water is quite pure, and the deposits are swept away.

5285. Is there anything more with regard to the sanitary state of the town of Madras, or the barracks and hospitals within it, which you wish to lay before the Commission?—I had long been aware that the advantages which the upper and middle classes of society in this country enjoy, arising from the advanced state of dental surgery, had not extended to the European non-commissioned officers and privates in India; the assistance which they had received had been of the most antiquated and barbarous kind. When they were troubled with tooth-ache, or their teeth were decayed, the only help given them,—of course I am speaking generally,—was to extract their teeth, the objections to which I need not mention; nothing effectual was done to preserve their teeth by the modes now in use, such as stopping them and so forth, the consequence of which has been that even men in early and middle life, in the ranks of the army, are found to have lost a number of teeth, and I believe that they suffer individually, and that the public suffers from that circumstance; for if there is any class of men who ought to have sound and serviceable teeth it is the privates in the British army. They require a great deal of solid food for their sustenance, to keep them in health, biscuit and meat, and so forth, and in order to masticate and digest that food properly, it is necessary that their teeth should be sound; it is necessary for their health, and for their comfort, and indirectly it is necessary for the public service, for the public will gain by the increased efficiency, cheerfulness, and healthiness of the troops, and by the delay *pro tanto* in the invaliding.

5286. You mean that a man who cannot masticate his food is likely to suffer from indigestion?—Yes; I believe it is one of the most important conditions of health that the food should be well masticated.

5287. (*Sir R. Martin.*) A defect in the teeth is, in fact, a disqualification for being received as a recruit?—Yes. Happily in the higher ranks of life it matters less, owing to the variety and more careful preparation of their food. I found, on my arrival at Madras, that Dr. Porteus, the acting garrison surgeon, and also my own surgeon, was an accomplished dentist, and in concert with the commander-in-chief, —for I beg leave to say that all these advantages to the military were obtained in close concert and co-operation with Sir Patrick Grant, from whom I always received the most kind and cordial assistance; I had a special responsibility as to Fort St. George, for I was officially commander-in-chief myself there, and not merely governor, but still I took no step whatever without consulting and having the acquiescence of Sir Patrick Grant,—with his approval, I arranged that Dr. Porteus was to have a room assigned to him in the fort, where he might be attended by any non-commissioned officers and privates or others who wanted assistance to their teeth, and a circular was issued to the different European regiments, and throughout the medical service, calling for volunteers among the

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assistant surgeons to add to their other qualifications a knowledge of dental surgery under Dr. Porteus's tuition. Several responded to the call, and in this manner a school of dental surgery was established at Madras, which was extremely successful, and the soldiers almost immediately appreciated the new advantage that was held out to them; the applicants were more numerous than could be attended to, for applications were received from the people in the town, who thought it hard that they should be excluded from similar advantages. The plan has answered so well that it has been extended to Bengal, and I presume it may now be considered as a permanent institution. Although the object is limited, I conceive it to be an important point, both for the comfort and health of individuals, and also for the efficiency of the service. There will be at least one surgeon or assistant surgeon in each European regiment acquainted with this art, and a number of medical officers throughout the presidency will be able to give assistance of this kind to Europeans and natives of all classes, greatly to the benefit of the community.

5288. (*Dr. Gibson.*) As the teeth are so very important, and you have paid so much attention to the subject, do you not think that the addition of a tooth brush to the soldier's knapsack would be useful, and tend to prevent his teeth decaying?—Yes, certainly; I think it is very desirable to impress him with the importance of looking after his teeth. I may mention that the improvements in the barracks in Fort St. George are all explained in a summary manner in a report by Captain Rawlins, the assistant engineer, which may be obtained if it is thought desirable.

5289. (*Dr. Farr.*) What is the population of Madras?—Very large; the common opinion is, that it is nearly a million; but the town is one of a peculiar character, and it gives, I think, a better idea of what Babylon and Nineveh of old are said to have been, than anything that I know of in modern times. It spreads over an immense area, but sparsely, the greater part of the area being occupied by houses each situated in its own garden, so that looking over the town, the greater part of it appears more like a wood than a town. It is about seven miles long by two broad.

5290. What is the area that you include in Madras within which that population is lodged; does the town extend along the coast?—Yes, it has a long face to the sea, which is of course a great advantage; it is about seven miles long by two broad.

5291. Does the wall that is reserved for the special benefit of the fort run along the sea face?—Yes, that is the sea wall of the fort; there is also an ancient wall round three sides of what is called Black Town, which is the most densely inhabited part of Madras, part of which I took down to open the general hospital, and a larger portion to provide funds for the formation of a people's park between Black Town and Vepery. I intended to have taken the whole of that wall down, because, although situated on the side of Black Town furthest from the sea, the effect in preventing a free circulation of the sea breeze was almost as bad as if it had been situated towards the sea.

5292. Has the population of Madras ever been enumerated?—I think it has been in a rough way.

5293. (*Chairman.*) But there has been made no attempt to take a census from house to house?—A census was taken some years ago through the police, not a detailed census, nor one that can be depended upon. A census of the whole of the presidency was taken, but in a very rough way. The popular opinion is that Madras is the second city in point of population in Her Majesty's dominions; it has undoubtedly a larger population than Calcutta. Calcutta is packed into a very close space; there is a large population that passes daily in and out of the town, up and down the river; but Calcutta itself is compressed into a much smaller space than Madras; and when all the towns, and villages, and garden houses, and barracks com-

prised within the area of what is called Madras are included, I think that the population must be nearly that which it is supposed to be.

5294. (*Dr. Farr.*) Is it possible, do you think, to enumerate the population by any existing machinery?—Yes, I think that a fair approximation might be obtained. The census might be taken as it is in Ireland, through the new police.

5295. Do the numbers fluctuate much at different times of the year?—Not much.

5296. How is this great population chiefly employed?—One large portion of the population is employed, first of all, as servants of the Government, both civil and military; then all the departments of the Government, such as the Ordnance and others; and then a large portion of the population is employed in ministering to the wants of those large official bodies, civil and military.

5297. Are there any manufactures going on?—Yes. Then there is a large Mahomedan establishment connected with the family of the Nawab of the Carnatic; the members of that family and their immediate dependants are numbered by hundreds, thousands I may say; their servants again are extremely numerous; and then Madras is a place of considerable trade. Black Town is a mart of commerce of great importance.

5298. And always has been?—Yes. Then there must be a large floating population, chiefly employed in the conveyance of goods; you may see the native carts collected by hundreds in the places provided for them to put up.

5299. The river, I believe, is not navigable to any great extent?—No. I had it dredged, and placed a small steamer there.

5300. Are there any returns of the deaths among this population in Madras?—I believe the police keep a return of the deaths, but I cannot speak to its accuracy.

5301. Upon the whole, the means of determining whether the population is healthy or otherwise, or what are the causes of death, in one of the largest cities in India, are very defective?—Very defective indeed.

5302. Is it not desirable that some means should be adopted for ascertaining what the actual population is, as well as the number of births and deaths, and the causes of death?—Certainly, I think it is.

5303. The general sanitary arrangements in Madras are deficient, both as to drainage and sewers?—Yes; the sewers are extremely defective. A great work has to be executed for the drainage of Madras, for the drains are of the most offensive and scandalous description. I do not speak of surface drainage. The sewage is discharged for the most part into open street drains. In Black Town there are some covered drains, and arrangements were made by me, in concert with the municipal commissioners, for flushing them with sea water; but, generally speaking, they are open street drains, which are extremely offensive to everybody passing by.

5304. (*Sir R. Martin.*) Owing, I presume, to a deficiency of water?—Yes, that is the main cause; the great object is to obtain an ample supply of fresh water, primarily for the personal use of the inhabitants, for the wells are very limited, and many of them are becoming very objectionable.

5305. You say that there is no system of sewerage or adequate drainage in Madras?—There are no means of flushing the sewers. The town, no doubt, is situated on a level, but if the means existed for providing Madras with an ample supply of water, a great improvement would be effected. A great deal of discussion had taken place on the subject for many years, and there had been a great deal of professional and other investigation carried on, and I had to determine whether it would be advisable for the Government itself to proceed to reform the drainage and sewerage, and provide an ample supply of fresh water in connexion with that, or whether I should first create a municipality of a sufficiently popular character to interest the inhabitants in the subject,

and to bring the strength of popular opinion and popular action, I may say the intelligent action of, in many respects, an advanced community to bear upon it, and the opinion at which I arrived was, that it would be advisable first of all to form a municipality, and to work through that municipality. I prepared a scheme for the reconstruction of the municipality at present there, which consists of two or three paid commissioners. I prepared an outline of a scheme, founded on our English arrangements, dividing the town into wards, and the nature of the town is such that it divides very naturally into wards, and proposing that the Government should begin by appointing a commissioner, a sort of representative, for each ward, and that the council so formed should have the power of borrowing and taxing for purposes of local improvement, and should proceed, as its first act, to take into consideration the sewerage and the supply of fresh water. It appeared to me that a double object would be attained in this way, that we should be at once adopting the most effectual means of securing for this large population the public benefits of proper drainage and of a proper supply of fresh water and should also institute a municipal system, under circumstances the most favourable to success, because we know by experience that the way to get up a public body, and put it into effective action, is to give it some important work to do, in which it is deeply interested, just as in London, it may be expected that if the new London municipality succeeds in draining this great town in a satisfactory manner, it will attain new strength and life. My idea was that that proposed new municipality for Madras would obtain strength, from success, to proceed to further action by first accomplishing this great popular object of providing a supply of fresh water and flushing the drains. I submitted the matter to the Chamber of Commerce, and they appointed a practical committee, who proposed what appeared to be a very practicable plan, but it was submitted to the Government after I left Madras. I hope it will be one of the first subjects taken up by the new Madras Legislative Council.

5306. (*Sir P. Cautley.*) The object being to get one comprehensive system of drainage and a good supply of water; one great defect in drainage, in all parts of India, especially in cantonments, being that it is never done in a comprehensive way, but always bit by bit, which always ends in failure, whereas if the drainage were at once taken up by the Government or by a municipality, and it were carried out in an extensive manner, success would attend it?—The defect in Madras is not so much the want of drainage, as the want of means of flushing the drains; the town is on a level, and there are plenty of drains, in one sense too many, for they are offensive in the extreme, because there are no means of propelling the offensive matter, and getting rid of it; the only possible means is that of flushing the drains.

5307. (*Dr. Farr.*) You still think that is a matter of the utmost importance?—I think it is a matter of the highest importance. I consider that not only the preservation of life and health is concerned, but the strength and comfort and general efficiency of the population are involved; they would be better and abler men, women, and children for all the purposes of life, if the average standard of mental and bodily vigour were improved by the removal of these local causes of a low state of health.

5308. The people in the East would appreciate the value of a supply of pure water, would they not?—Yes; it is an extremely popular subject, and extremely desired by them, and it was my knowledge that it would be at once taken up with the perfect good-will of the community, that induced me to delay action upon it until I had first formed a popular municipal body.

5309. In reference to its connexion with the health of the army, do you think it is at all important to consider, whether the health of the populations living around the stations where different portions of the

army may be placed is likely to influence the troops themselves?—No doubt about it; European troops must partake of the general conditions of healthiness or otherwise of the surrounding population; no doubt, the European troops are placed in the best position at Madras, in Fort St. George, on the margin of the sea, but the men are continually wandering about the town, the native troops are cantoned in the town, and half of the civil European population. I may illustrate what I am saying by the fact, which I alluded to before, that a high wall is maintained between the Government House grounds and the body of the town, in one of the most thickly populated portions of the town, expressly for the purpose of excluding the noxious smell that may issue from the drains, thereby excluding the sea breeze, and preventing the improvement of the adjoining part of the town, and thus greatly aggravating the evil.

5310. Do you think that we can ever expect to maintain our troops in health in the neighbourhood of Madras, unless Madras itself enjoys those sanitary advantages which you have suggested?—The health of the troops must be more or less affected by those circumstances; other arrangements may mitigate them, and the troops may have some advantages over the rest of the population, but still they must follow, more or less, the conditions of the health of the bulk of the population.

5311. You are aware that cholera and other diseases generated among the native population must necessarily spread?—Yes; that is a case in which the general conditions of health sensibly affect all classes of the civil and military servants of the State.

5312. So that the sanitary state of our army, or the civil population, is more or less mixed up with the sanitary condition of the people of India?—Certainly; and in a capital city like Madras, the matter derives increased importance, owing to the large number of public functionaries who reside there, besides the regular European force; and the deaths at Madras from cholera and other causes, among Europeans, of late, unfortunately, have been very serious and painful; the seeds of the disease originating as, I believe, from the native population; that is the prevailing opinion, and I believe the true one.

5313. Cholera which visited this country is supposed to have originated among the natives of India?—Yes.

5314. (*Sir R. Martin.*) I may mention to the Commission, that when I was surgeon of the native hospital in Calcutta I always became aware of the advent of cholera 15 or 20 days before it seized the European population, by its being prevalent among the natives, and their being brought into the hospital, so that amongst them it began first, and that was one of the reasons that led me to suggest extended measures for sanitary improvements in Calcutta, which have been carried out since I left?—I proposed that the health of the European population in Madras should be improved, not by building a wall of separation between them and the natives, but by powerfully acting upon the conditions of health of the native population itself.

5315. (*Dr. Farr.*) In England it has been shown by evidence that the mortality caused by cholera was very much owing to the impure supply of water derived from wells?—Yes, and it is believed that that cause powerfully operates at Madras; the water supply is extremely deficient, being chiefly derived from a group of wells immediately to the north of Madras, which intercepts the flow of water through the sandy stratum of which I was speaking; but the supply of water derived from those wells is quite insufficient for the greatly increased population, and it has become partially deteriorated by offensive matter from the drains.

5316. At what depth does the water lie?—It is near the surface.

5317. In all such cases the filth of the surface invariably gets into the water?—Yes; there is an urgent necessity, on the commonest principles of duty

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to that large population which is intrusted to our care, to provide for them a sufficient and ample supply of that prime necessary of life, fresh water, which, if necessary in other climates, is emphatically so in a climate like that of Madras.

5318. You would apply the same remark generally to India?—Yes; but the strongest case that has ever been brought under my observation is that at Madras.

5319. (*Chairman.*) Is there any other sanitary question to which your attention has been specially turned?—During the early part of my residence at Madras my attention was much called to the barracks in the Neilgherries, then called the Jackatalla barracks, and I reserved all the papers upon the subject until I arrived on the spot; I then inspected them very carefully, and the site of the barracks seemed to me to be as good as it could be; the climate of the higher plateau of the Neilgherries has a degree of harshness in it. I experienced it myself; a steady east wind blew for eight or ten days, and I found it disagreeable; but the European barracks are situated on a lower plateau, where the climate approximates more to that of the south of France. I think it is a happy medium between the heat of the plains and the cold of the more elevated regions. The barracks are situated on the summits of an undulating space, perfectly exposed to the currents of air, and I think there is no objection to be made to the site, nor, as far as I was able to judge, is there a word to be said against the barracks themselves; they are noble barracks, constructed according to the latest improvements in the art of constructing European barracks, and the only question which appeared to me to be deserving of serious consideration was as to the appropriation of those barracks, and the use to be made of them. The use which had been made of them up to that time had been to locate a single European regiment there; but it seemed to me that that was not the most beneficial application that could be made of them for many reasons. I can only give a slight summary of my reasons, and perhaps the Committee will allow me to put in the remarks which I made at the time in the Minutes (see Addendum, page 301) which I recorded, showing the results of my tour; but speaking in a summary way, I should say that the objections to using those barracks as the barrack of a single regiment are as follows: first of all, the advantages, whatever they might be, would be confined to a single infantry regiment, all the other infantry regiments on the establishment of the Madras presidency, and the whole of the cavalry and artillery, deriving no benefit whatever from them; next, it would be extremely expensive, having in view a general system, to apply a hill station barrack in that way, because a sufficient European force must be maintained at all the principal points in the plains; there must be a European regiment at Madras, there must be a European force at Bangalore and at Secunderabad, and probably at Trichinopoly, and for the present at Malabar and elsewhere; we must hold all the necessary points in the plains by a sufficient European force, so that any force we may maintain in the hills will be surplus to the others; in fact we must have two establishments,—one establishment for the plains, and another for the hills. Taking the most favourable view, and supposing it was arranged that one-third of the force should be constantly in the hills, and should be relieved, so as to give all the force a turn in the hills, still we should have to keep our European force about a third larger than would otherwise be necessary.

5320. (*Sir P. Cautley.*) You would have to keep a large reserve?—Yes; a reserve, not to strengthen the other, but to give a relief, that they might all have their turn in the hill stations.

5321. (*Sir R. Martin.*) Would it not be desirable to have the more expensive buildings for the plains, and the common huts of the country for the mountain ranges, as being so much cheaper, and being equally, if not more, healthy?—Perhaps the Wellington barracks may have been constructed in some respects on

a more expensive scale than was necessary, although I do not think that they are upon the whole open to that objection. As to the plains, there is no doubt that we should build barracks the best adapted to preserve the health of the troops, and on a comparison of the two, the superior class are more necessary in the plains than they are on the hills; still I think that we should have the best barracks that are required for the purpose on the hills also; we have them on the Neilgherries; nothing can be better than those barracks.

5322. (*Sir P. Cautley.*) In the Himalayan hill stations, where the monsoon rains are so heavy, you would require as good barracks as on the plains, would you not?—Yes; you may remember that relying upon the excellence of the climate in the Himalayas, the troops were not allowed the usual cubical space, and great unhealthiness arose therefrom; there should be a satisfactory cover to secure the troops from the action of the elements, and a sufficient allowance of cubical space; they are quite as necessary in the hills as on the plains; still, no doubt, it is more certain destruction in the plains than in the hills not to have proper barracks. I was saying just now that a double force would be required, and that would increase the expense; the expense of provisioning a force stationed in the hills is also very great, much greater than in the plains, and the expense of moving the troops is much greater. When an entire regiment is removed the expense is very serious. The troops stationed in the hills cannot be brigaded and exercised there with other troops, and especially with native troops, for it is very essential to our Indian army that the European troops should be constantly in the habit of being exercised with the native troops. Although there is a great deal of fallacy in the prevailing doctrine about acclimatization, still there is something in it; all Europeans, civil as well as military, require to be seasoned before they come to the state of health best suited for a tropical climate, and if troops are at once stationed in the hills they do not become seasoned.

5323. (*Chairman.*) Do you mean, when you speak of their becoming seasoned in the climate, that there is a physical change, or do you mean merely that they become more accustomed to the peculiarities of the climate, and therefore take more care of themselves, and avoid the dangers into which they would otherwise run?—I mean both. I think that the rude habit and the full warm generous state of the body which belong to a temperate climate are not suited to a tropical climate, and that Europeans arriving in that state are always brought down, often through some serious illness; but whether they have an illness or not they always alter, and it is necessary that they should alter, in order to give them a chance of preserving their health in that climate. Then there is the consideration which your Lordship has mentioned, and which is very important; whatever doubt there may be about acclimatizing the troops, there is no doubt it is important that they should be trained to all those habits of life which are necessary for preserving health in that climate, and under those peculiar conditions of society; if they are stationed in a barrack on the plains they acquire those habits, but in the hills they do not. There are also many constitutions which are not suited to India; we see it among the civilians, and no doubt it is so also among the military. If, when regiments are stationed in the plains, the unsuitableness of the soldier's constitution to the climate becomes apparent, he is eliminated, he is invalided or transferred to a regiment in some other quarter of the globe, whereas upon the hills those defects of constitution would not become apparent until the regiment was brought into action. If, therefore, a regiment were habitually stationed in the hills, and were brought down into the plains only when required for active service, we should find breaks-down and deficiencies which we were not prepared for; the conditions would be new.

5324. (*Sir R. Martin.*) But their service in India

must necessarily imply a residence in both places, seeing that a corps generally serves there from 10 to 15 years?—Yes; but it would often happen that a regiment had been only stationed in the hills, and it would be brought down at once to the plains. I believe that the view taken is that a regiment should be first stationed in the hills and be afterwards removed down to the plains. Then the men disliked the hills; that was entirely new to me, and it was only when I had been for some time on the spot, and had conversed with the commanding officers and others concerned, that I became aware of it; the men consider it dull; there is a want of the excitement of the full tide of human existence, which they have in the large stations in the plains.

5325. (*Chairman.*) Did they not also complain of a want of certain indulgences which it is better they should be without, and which they can only find in the great towns?—No doubt that enters into their consideration.

5326. (*Sir R. Martin.*) That is chiefly where the mountain stations are on spurs and ridges, and where there is not sufficient table-land?—No, I speak generally; there is ample room for all purposes of recreation on the Neilgherries. Then the married men complain that they cannot practise trades there, and their wives get no washing there, and there is a want of society there; in the stations down upon the plains they have the society of the men of other regiments, and of other departments, civil society, and so forth, but in the hills they are entirely isolated; they feel secluded and out of bounds; they are found to be restless and difficult to manage, so that it was necessary to prescribe bounds for them, beyond which they were not to pass.

5327. Did not those circumstances chiefly arise from want of occupations and amusements for the men?—It is more difficult to find amusements for them in the hills than in the plains. The mere strolling about Madras is an amusement, shopping is an amusement, paying a visit is an amusement; but at Wellington, all they can do is to take a sort of Sunday walk, going over the mountains or the jungle, and they walk great distances and get into scrapes.

5328. Was it during your government of Madras that the 74th regiment was employed on the public works in the Neilgherries, with remarkable benefit to their health and contentment?—That was before my time.

5329. (*Sir P. Cautley.*) Your evidence seems to imply that if workshops were established for regiments, they would be very effective in the hill stations?—Yes; but it is more difficult to manage them there; the situation is so isolated, and the distance so great from the centres of Indian society, that it is very difficult to employ the men in trades there. At Madras, or at any station in the plains, a man may more or less follow his trade, whatever it may be, and obtain some demand for his work.

5330. Do you approve of workshops being attached to barracks for the amusement of men, generally speaking?—I think that it is a very desirable object. I have often heard that question discussed, but I have never been able to satisfy myself as to the precise conditions under which they should be adopted; but without Government workshops being established, the men of their own will, for their own benefit individually, follow trades, and it is very desirable that they should be encouraged in doing so,—tailors, shoemakers, saddlers, and there are various other occupations which they follow. The same results have appeared at Wellington in the Neilgherries as at Aldershott. I well remember that one of the main reasons for the establishment of Aldershott was the vicious lives which the men led and the scrapes into which they got in the suburbs of great towns, and it was supposed that by putting them by themselves in the middle of a great Surrey heath that state of things would be remedied; but a new state of things developed a new class of evils, and, as I understand, the men were found to be restless, and not to have any

sufficient occupation for their time and interests, and they were more difficult to manage than they were even in the suburbs of large towns. I believe that the mere effect of being in the presence of a large population has an engrossing, perhaps a sedative effect; it occupies the mind.

5331. (*Dr. Farr.*) The placing of troops in the hills in India is analogous to the placing of troops in Aldershott in many respects, is it not?—Yes, in its social and moral aspects; but it wants the advantages of Aldershott as a place combining military exercise; it is entirely deficient in that.

5332. At the present time?—Yes; it is very difficult to obtain it. I mean to have a sufficient number of troops together in the hills, or to find proper ground upon which to exercise them.

5333. (*Sir R. Martin.*) But the intercourse of the European soldier with the native populations on the plains has generally been considered very destructive to him, as the natives with whom he can have any communication are of the very worst class, and minister to his worst propensities?—Yes; there is no doubt great room for improvement there, but it is not always so, and in order to have the advantage of our troops being located at the great stations in the plains, we must take the corresponding evils with it. Still, upon the whole, I am of opinion that the troops are better, for their own sakes and for the sake of the public service, on the plains than on the hills.

5334. (*Dr. Farr.*) Suppose you found that the mortality on the plains is three times as great as on the hills, and the sickness also?—No doubt the sickness and the mortality are somewhat greater on the plains, but not to the extent that one would suppose. But my answer to that is, that you must have men on the plains, and that you must submit to whatever may be the unavoidable mortality and sickness, and all your efforts should be directed to make the stations on the plains as healthy as possible; all your efforts should be brought to bear on the conditions of health on the plains.

5335. (*Sir R. Martin.*) Would it not be desirable also to reduce the number of the troops serving on the plains as much as it was consistent with the service of the State, the sickness and mortality there being so great?—Yes. I am advocating merely a general system. Every general rule has its exceptions; and I by no means mean to say that there may not be circumstances which would allow of a combination of both objects, and that you might locate troops at a hill station sufficiently near for the purpose of over-awing the population on the plains.

5336. As has occurred in Jamaica?—Yes, that is an instance in point.

5337. Where the troops are healthy and contented?—Yes. The barracks at Newcastle in Jamaica have answered every purpose, and preserved the health of the troops; they have also maintained a garrison in the island in a very satisfactory manner; but Jamaica is a very limited field compared with the immense continent of India. A portion of the European force in Upper India has been held in reserve in the hill stations, as the European force at Bangalore is in the south.

5338. (*Chairman.*) If you consider that it is not advisable to place a regiment permanently on the hills, which I understand to be your idea, what use do you think ought to be made of those hill stations, the value of which you acknowledge?—I will confine my observations to the Wellington barracks in the Neilgherries, the conditions of which I understand, and the Commission will be able to judge how far the observations I make as to the Wellington barracks are applicable to other hill stations in other parts of India. I would make the Wellington barracks a sanitarium on a liberal scale for the whole of the European army of the south of India and Burmah; and I would not only send thither the broken down men, who require to be restored, but I would make it part of our military sanitary system to watch the cases in which a change of air would be advisable; and I

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would make arrangements to enable the non-commissioned officers and privates to resort as freely to the sanitarium as the commissioned officers and civil servants do now. I would extend to the non-commissioned officers and the privates of the European portion of the army the great and acknowledged benefits which the higher portion of the services now derive from a resort to the hill stations. I believe that the practice, speaking generally, at present is, to allow disease to go on until it is necessary entirely to remove men from India, and a great deal of unnecessary invaliding takes place in consequence. I would prevent that and benefit the soldier, and promote the efficiency of the service, and also the economy of the public service, by saving the unnecessary invaliding, and by giving the ranks of the army the benefit of a change of climate in India.

5339. (*Sir R. Martin.*) You have heard, no doubt, the general professional opinion expressed throughout India, that for the cure of disease the mountain climates have not been found very advantageous, but that for the prevention of disease they are efficacious?—Yes, I have heard that, and that consideration was present to my mind. I meant to say that a great deal more might be done in the way of prevention in connexion with the hill stations than in the way of cure; and that it would in every point of view be better not to use those stations as ordinary barracks for the whole of the troops, whether they specially require it or not, but to appropriate them as sanitarium for the particular men who require a change.

5340. (*Dr. Gibson.*) That is weakly men, who have not yet fallen into a state of disease?—Yes; men who have begun to suffer from the continued action of the climate.

5341. (*Chairman.*) Would there be any difficulty in keeping up so close a medical supervision over the men's health as is implied in that proposition?—I think not. No difficulty is experienced in keeping up that supervision in regard to the civil servants and the military officers.

5342. Is there not this difference, that the civil servants and the military officers probably take the initiative themselves in the matter, and do not wait to be told that they are getting out of health; they know it themselves, and consult their medical men; but do you think that the same care of the health of the private soldiers would be taken?—I conceive that the constant supervision which the army surgeons exercise over the health of the men would enable them to judge. The mere length of a man's service, his general state of health and appearance, would be a guide to them. Although a man may not be suffering from any disease, or may not even appear to have the seeds of disease about him, he may be so relaxed that it may be desirable to brace him up by transferring him to a hill climate. I conceive that, by applying this great benefit to all, we should be doing great good; for it is undoubtedly one that has been fully tested in its application to the higher ranks of the two services. We know what we are dealing with, and the only question is, whether it should be extended to the lower ranks, to the many as well as to the few. I conceive that by appropriating the Wellington barracks to this object, this great advantage may be liberally extended to the whole of the Madras European force, of all arms, cavalry and artillery, as well as to the men belonging to the military departments, conductors and others, and that it would be a frugal and economical as well as an effective application of this sanitary power. At present there is a great waste of that sanitary power; the great majority of the men of the regiment now stationed at Wellington really do not in any sense want to be there. If it were put to the vote I believe, as far as their inclinations are concerned, they would much rather be in the plains. Directions have been sent out to convert the Wellington barracks, on the first occasion of the relief of the regiment there, from an ordinary barrack to a

general sanitarium for the whole army. The railroads of course will be ancillary to the object.

5343. (*Sir R. Martin.*) Has the question of the relative value of the extreme and medium elevations in the mountain ranges been considered under your government?—I found a great amount of tradition and mature opinion upon the subject. It was a subject that had been extensively discussed, and the conclusion which everybody had come to was, that for persons in a very relaxed state and far gone, who had suffered very much from the enervating climate of the plains, a lower elevation was preferable. Kunoor was generally recommended, which is somewhat lower than Wellington, the climate being like that of the north of Italy. The climate which was considered to be of the most medium temperature in the hills was at Kotegherry; but it is rather an out-of-the-way place, and is very little resorted to now.

5344. A station of medium elevation?—Yes, that is considered to be the golden mean of all the different climates of the hills. The climate of the highest range of the Neilgherries is a *quasi*-Alpine climate; there is a great deal more rain there, and the climate is harsher and severer.

5345. But there has been no detailed investigation, scientific or practical, instituted by the Government in respect to the mountain climates throughout India?—There have been local investigations by medical officers, many of whom are highly intelligent and scientific persons. They have investigated it, and discussed it; but I am not aware of any general inquiry which has been made.

5346. It has not been done under orders from the Government at home?—The results which I have given are those which the common sense, and observation, and experience of European society have arrived at.

5347. (*Sir P. Cautley.*) The Golconda range was tried as a sanitarium?—Yes; but the railroads will greatly increase the usefulness of the central sanitarium at Wellington.

5348. (*Dr. Farr.*) Do you think that the sanitarium should be central, and that the troops should not be dispersed over the country?—We are limited in our choice. I do not believe that there is any situation in the south of India so well adapted for a sanitarium as the one that has been actually adopted, and when the railways are completed it will be sufficiently central; it will be in easy communication with the Malabar coast on the west, with Trichinopoly to the south, and with Madras to the south-east, and would be connected by railway with Bangalore, which is the nearest station of all. Secunderabad is no doubt at a considerable distance. When the railway has been opened to Madras, the troops in Burmah, and even those stationed at Calcutta and other places in Lower Bengal, will be brought within the range of the sanitarium in the Neilgherries.

5349. (*Sir R. Martin.*) The railways will, in point of fact, meet many of the strategical questions connected with this subject?—I was speaking rather of medical questions. I was viewing it as a sanitarium, and considering how far it would be easily accessible from the different stations in Madras.

5350. (*Dr. Farr.*) Considering the immense extent of the population of Southern India, do you consider that the employment of so large a number of European soldiers as there is now will be always necessary in the stations where they are now quartered; for instance, according to the latest returns, there were 1,070 men at Kamptee, 2,550 at Secunderabad, 970 at Berar, 970 at Madras, 1,550 at Bangalore, 600 at Cannanore, and 800 at Trichinopoly?—Speaking generally, the existing stations of the European troops must be maintained; but no doubt, as we reduce our native army, and as we give the general population an increased direction towards peaceful and industrial pursuits, we may diminish the number of our European troops.

5351. And abandon some of the stations?—I will

not go that length, for that requires a separate consideration.

5352. Do you think it is not possible to concentrate any large body of the troops at any healthy point in India as we concentrate troops at Aldershot?—I rather demur to that statement, for it can hardly be said that we concentrate troops at Aldershot; Aldershot is rather a reserve, with a special view to military exercises; but we have also garrisons in London, and in large towns like Manchester, and there are certain points in the south of India at which an European military force must always be maintained.

5353. That is contemplated by every one; but do you think that no considerable portion of the existing troops could be concentrated at healthier stations than those which are now occupied, and where the sickness would be one-third of what it is, and the mortality be reduced to the same extent?—Not at present, to any great extent. Something may be done hereafter in that way, especially as the railroads are extended. I doubt the necessity of having an European regiment at Bellary; and when a good road shall be made from Mysore to Malabar, the European force in the last-mentioned district may be reconsidered.

5354. (*Chairman.*) Do you not think that in the various stations where there are now large garrisons, small ones would suffice, if it were known that within two or three or four hours' journey, by railway, the garrisons could be powerfully reinforced?—Yes, I think so; I think that the principle advocated might be carried out more in that way than in any other. It is a very important general principle to concentrate the main body of our European force, and to concentrate it in a healthy situation; the place in reference to which that principle may be best applied in Southern India is Bangalore, which is in a comparatively cool climate and healthy situation. It commands the southern portion of the peninsula in a remarkable manner; and, speaking generally, I consider that the European force for the south may be concentrated at Bangalore, keeping only the necessary detachments for maintaining our position at other places, such as Trichinopoly.

5355. (*Sir P. Cautley.*) Do you not think that the facility with which a railway may be broken up, so as to interrupt the passage of troops, rather militates against the notion of keeping the troops in the hills?—Not practically. This question must be considered with reference to all the circumstances,—the nature of the country, as to whether it is an open country, the nature of the population, and the hold that we have over their interests and goodwill. Looking at all these circumstances in the south of India, I should say that the principle of concentration might be carried out there to a great extent. The population of Southern India is, generally speaking, of a very unwarlike and docile kind, and they have become much more so of late; they have lived under our Government for several generations, and a race has grown up who are unacquainted with the use of arms. The people are very quiet, docile, and industrious, and not at all disposed to create disturbances, and I consider therefore that a moderate force, fully equipped for immediate action, in a central situation like Bangalore, would command the whole of the south of India. I do not mean that there should not be proper detachments with their magazines secured in fortified posts, but that our main force should be confined to the central station of Bangalore, ready to move in any direction. The health of the troops would be greatly promoted by that arrangement, and our financial position would be greatly improved. We should have a great deal more money to spend in improving our administration, which again would react upon the peaceful disposition of the people. I think that we might spend a great deal less upon military matters, and more upon good administration. I advocated upon that principle the dismantlement of the fort of Vellore; that is a case in point which illustrates the principle very satis-

factorily. The Commission are acquainted with the ancient history of Vellore, and the tragical circumstances which occurred there in modern times. After a full inspection of the place and consideration of the subject, I came to the clear opinion that the only reason for maintaining a military force at Vellore was because there was a fort there. The existence of that stronghold renders it necessary for our safety that it should be properly garrisoned; but, in truth, we should be much safer if the fort were dismantled, and there were no native force there. If we garrison it strongly, it is a great waste of force, for troops are shut up there which may be wanted elsewhere. On the other hand, if we garrison it weakly, it is a temptation to disaffected persons to attack us; and therefore it is a source of weakness, and not of strength, a military weakness, and a financial loss.

5356. (*Sir R. Martin.*) Does not that statement apply to many of the old forts throughout India?—Yes, no doubt it does, and upon that principle I removed detachments from many places, including the fort of Dindigul, where there were some bomb-proof barracks. One side of the fort was taken down, and it was converted with the adjoining esplanade into a place of public recreation.

5357. Those bomb-proof barracks, such as existed in all the old forts, are excellently contrived, are they not, for smothering the garrison?—Yes. The bomb-proof barracks which I speak of were constructed at a time when sanitary science was at a very low ebb, and had not begun to be cultivated as it is now. I also removed the so-called garrison from the old fort at Masulipatam; I found an entire company there, keeping guard at the principal gate of the fort, whereas, about 50 yards off, a wall had fallen down, and there was a breach up which a whole regiment might have marched at once. But to return for a moment to the hill stations, by making them a point of union for the whole Madras European army, to which men in a weakly state of health would be sent, the progress of European colonization in the hills would be much promoted; the men would thus become acquainted with the hill districts of the Madras presidency, which are very important and interesting, and many of them would be induced to settle in the neighbourhood. That is the only part of the south of India where Europeans can colonize at all in the Australian or Canadian sense. There is, however, a point which, I think, surpasses in importance all other considerations. I may have a difficulty in fully explaining myself, but the vital consequence of it must be admitted: it is not sufficient, in my opinion, to provide for the health of the troops, or to provide for their recreation, or to provide the means of instruction for them. All those things are excellent as means, but we have to do with moral agents, and it is necessary for our success in the great object we have in view that we should act upon their wills, and supply adequate motives; for men do not choose hard study, or the abnegation of ease and enjoyment for their own sake, and they soon get tired of skittles and bowls; when exertions are made, and self-denial is practised, it is with a view to some ulterior object, such as the improvement in their condition in life, and the main point is to bring that object to bear upon our European soldiers. At present they are in a very unfortunate state in that respect; they are isolated from the rest of the community; they know little and care less about all the country interests which occupy the minds of the higher classes of Europeans in India; they have no objects of ambition, and no motives bearing upon the improvement of their condition in life are offered to them. By the native population they are regarded with aversion and fear. Our Mahommedan predecessors managed better in this respect. The Mahommedan power was founded on a system of military colonization. The Mahommedans first appeared purely as a military people, a military leader with his army; and in various ways, partly by official employments, civil and military, and partly by actual settlement and colonization, these military bands were converted into

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component parts of the population, and were transfused into the body of the people, and the remarkable influence and duration of the Mahommedan power are chiefly attributable to this. Now I would propose, that in a manner suited to the altered circumstances of our system, we should pursue a similar policy. I propose that we should offer to non-commissioned officers and privates sufficiently powerful motives to influence their conduct, and to induce them to exert themselves for their own improvement. We must look at the matter not only as a military question, but also as a social question. The greatly increased European garrison we shall have to maintain in India will form a very important element of Indian society, and in order to improve our relations with the natives, and to confirm our hold upon the country, we ought to endeavour to leaven the mass as far as possible from this source. The way I would propose to do it is by holding out inducements to the non-commissioned officers and privates of the army of the same kind as those which are held out to military officers and civilians, but suited to their position in the scale of society; that we should encourage them to conduct themselves to the satisfaction of their commanding officers, to cultivate and improve themselves in the regimental schools, and to learn the vernacular languages by offering them the prospect of employment in the police and public works, the commissariat, ordnance, and various other departments where trustworthy European agency would be of the highest value. By so doing we should improve our administrative system, for European agency of a good and suitable kind is hardly less wanted in subordinate than in the higher positions. We should improve the body of the population by leavening the mass, and transfusing into it the best portion of our European lower class. We should improve the troops themselves by giving them a worthy object in life and an adequate motive, and we should so raise the character and prospects of the European military service as to encourage recruiting, and make it an object to a better class of persons throughout the United Kingdom to take service in the army, with a view to improve their condition in India. No doubt, in a strictly military sense, we should lose many valuable men and non-commissioned officers, but I conceive that our gains in other ways would far preponderate; the balance of advantage would be infinitely in our favour. Besides the benefits to the administrative system and to the population at large, the improvement in the army would be very considerable. Having so large an European force now in India, our native troops being reduced to a few auxiliaries, it is of great consequence to keep them in heart, and give a satisfactory direction to their minds and feelings, instead of leaving them to idle in barracks without having the ordinary objects of life offered to them. What I propose for the non-commissioned officers and privates is only what we are doing, with success, with reference to military officers and civilians; they all have worthy objects offered to them, and rules have lately been established by which military officers are encouraged to exertion by holding out to them the various civil and military employments, for which they are rendered eligible by admission to the staff corps; whereas these bodies of European troops are left without any active employment, and there is a great waste of European energy and intellect which might be applied to the highest purposes. If we could thoroughly rely upon the contentment and good humour of our European troops, and they were encouraged to occupy their time as intelligent agents, we should be in a safer position, and might dispense with a portion of the force, for a smaller force would in that case do the work of a larger. What I propose is already done in an imperfect desultory manner; men are taken from the ranks who may be deserving men, and put into the different public departments; but it is done without any system, and the selection is made by what is called interest, that is, taking a personal interest in a particular man.

5358. The employments, I believe, are chiefly military?—Yes; but my view extends (and on a much larger scale) more to the civil departments than to the military, the police, for instance. A liberal transfusion of European honesty and trustworthiness, and the habit of obeying and commanding such as our good non-commissioned officers have, throughout the subordinate situations in the police, would do more for the efficiency of that department, and for raising the tone of morality throughout India, than anything else that I know of. But whatever is done must be done according to a system. We must place before us an object, and work systematically towards it; and regulated official prizes should be established, by which the European force should be brought into the relations I have described with the administration and the native population, so that any non-commissioned officer or soldier who is prepared to make the sacrifice, may know that, provided he conducts himself properly and qualifies himself, he will sooner or later be placed in a better position of life. A great deal has been said about colonization in India, and it is now fully understood that colonization in the Canadian and Australian sense of the word is not applicable to India; but it has been truly said that as organizers of labour India is very suitable to European settlers. I submit to the Commission that this is another kind of European colonization, which is eminently applicable to India; and if a system of the kind I have sketched were adopted, our European garrisons would send forth every year a large number of well-conducted qualified English Christians, who, in all the various walks of life, in all sorts of situations, military, civil, and mercantile, such as assistants to coffee and tea planters, employés on railways, and in 500 other lines of life, would carry English energy and English civilization through all the arteries and veins of the continent of India. We made a small beginning at Madras. Being possessed with these views, I wished to give such practical application to them as was in my power. I found the civil engineering college in an incipient and doubtful state, and the first question that was brought before me relating to it was, whether it was to be continued or not. I at once decided upon continuing it; however defective it was, I thought it might be made of great use if properly organized and regulated. It was very suitable to the present circumstances of the country, in which public works of various kinds are of so much importance, and I engrafted upon it an organization directed on a small scale to the object I have mentioned. Twenty stipendiary studentships were established in connexion with it for European soldiers, and a programme of the necessary qualifications was circulated to the commanding officers of all the European regiments on the Madras establishment, including those in Burmah. Soldiers who could be recommended by their commanding officers for their good conduct,—we considered that as an indispensable condition, whatever their attainments might be,—provided there was *prima facie* evidence of certain elementary, scientific, and literary attainments, were considered eligible to compete for those 20 stipendiary studentships. The arrangement was highly popular and successful from the first, and in some regiments quite beyond expectation. In regiments where pains had been taken with the regimental schools, the number of qualified persons who applied was so great that it became necessary to have recourse to a preliminary regimental competing examination, in order to determine who were to be the candidates for the central examination. In that way we collected at Madras 20 men, who were the pick of the whole army, for the administrative service of the Government in the civil and military departments. The plan was approved by the Secretary of State and his Royal Highness the Commander-in-Chief, and so far as my experience went it was highly successful. I would propose that an extended system should be established on that principle, and that a scale of qualifications should be laid down, the first of which should be good

moral conduct, perfect trustworthiness, a power of self-control and obedience, and then the necessary knowledge of English composition and arithmetic, and an elementary knowledge of the native language which they are now teaching in the regimental schools. The persons so recommended from the regiments should be subjected to some appropriate test, I will not say necessarily a competing examination, but they should be selected by some central authority, and should undergo such further instruction and probation as might be considered proper, either in central institutions or otherwise, as might be determined, and they should in that way be worked into the different administrative departments.

5359. (*Sir P. Cautley.*) Do you mean after purchasing their discharge, or that they should remain in the army?—The arrangement, so far as practical effect had been given to it at Madras, was quite in an elementary state, but, as a provisional arrangement, they were to retain their position in the army for a certain time. This rule worked in a way that was very painful to me, for while I was absent on an official tour an order came to send the 44th regiment away to China, and with that regiment were sent two of our best military students.

5360. (*Chairman.*) Is there not an objection to such a scheme as you suggest, that you must withdraw the men who have qualified themselves in the way you have described from the army altogether, because if they stay in it they will be always liable to be called away from those special pursuits to which they have been laboriously trained?—Unquestionably they must be separated from the army if the system is adopted as a comprehensive arrangement; they must undergo such a probation as may be considered proper, and then their connexion with the army must cease.

5361. We are here only to consider the position of the army in India in regard to sanitary affairs, and therefore we should not be able, in any report that we may make, to go further into the matter than this, that we consider that the health of the men would be greatly improved by giving them a greater stimulus to exertion than they have at present, and that I take it is the tendency of the view you have explained to us?—That is the point of view in which I have submitted the subject to the Committee. The disease from which European troops in India suffer is neither fever, nor dysentery, nor any of the ordinary com-

plaints, but it is vacancy of mind, want of occupation, *ennui*. I believe that that is the origin of most of the physical and mental evils with which they are afflicted; and if an effectual remedy could be provided against it, if the most ordinary interest and activity of mind could be created among the European troops, their health would be greatly improved. It would act in both ways, negative and positive; it would keep them out of mischief, and instead of going to the grog shop, or to worse places, for excitement, they would go to the regimental school for improvement, promoting their future prospects by an interesting occupation, and improving their health by the elevating effect that would have upon their spirits. There is another slight suggestion I have to make. I think it is very desirable, when this subject of the sanitary state of the army in India has been fully considered and worked out, that a manual should be prepared of the conclusions arrived at, so that the most advanced experience of the present day may be placed in an available form at the disposal of every medical and military officer. At present it is very difficult for an officer to get to the front of the existing state of knowledge on the subject; he has to search through a great variety of documents, some no doubt of great merit, but still so scattered up and down through treatises and volumes of reports that it is very difficult for one person to master them.

5362. (*Sir R. Martin.*) The want of such a manual has been long felt by the medical department of the British army and it was one of the questions that was mooted before the Royal Commission on the sanitary condition of the army in 1857?—Yes; but I think that the conditions of military health in India are so peculiar, that one treatise should be appropriated wholly to India, as specially applicable to that climate; not to tropical countries in general, but to India in particular. I do not see how military and medical officers are otherwise easily to acquire the necessary knowledge, or how they are to be held responsible. I have known the most deserving men, who have had the object thoroughly at heart, but who have made painful mistakes, merely from the want of such guidance. Every military and medical officer who serves in India should be expected to master this treatise, and the young men should be examined in it as they are in other branches of military science and in the native languages.

The witness withdrew.

ADDENDUM.

EXTRACT from MINUTES by the GOVERNOR of MADRAS relating to his TOUR in the SOUTH of INDIA, between 5th of January and 6th of March 1860.

THE barracks at Jackatalla are, in my opinion, a successful work. The mild climate of this lower shelf is well suited to the object; the site has been judiciously laid out, and the height and capaciousness of the barrack rooms would delight the heart of Florence Nightingale. The married quarters are much in advance of the habits of the majority of the persons intended to be accommodated in them. The only failure was the Waterloo Bridge, which fell down owing to bad work and neglect. Instead of rebuilding it, the debris should be converted into a dam (over which the road might go) for the formation of the lake which formed part of the original plan for laying out the ground. This would add to the beauty and enjoyment of the place, and as a great deal of low rough ground, which could not easily be kept in order, would be covered by it, and the steepness of the banks would prevent malaria, the health of the place would be improved by it. It was intended to give the name of "Wellington" to this remarkable military station; and the "Waterloo stream" actually flows through it to Kunoor. I recommend that the intention be now carried into effect. According to returns furnished to me by Captain Farewell, the special executive engineer, the sum which has been expended upon the barracks up to the present date amounts to 1,515,000, and the sum remaining to be spent to 1,464,000 rupees, of which 893,000

rupees is for a convalescent dépôt, and rupees 129,000 for Protestant and Roman Catholic churches. The use to be made of this noble station deserves the gravest consideration.

There is a certain work to be done in the plains by European troops. They must be cantoned and exercised with the native troops. They must be ready in central positions, such as Bangalore, Trichinopoly, Hyderabad, &c., to hold in check both our native army and the population at large. This work cannot be dispensed with, and if it is costly in European life, every means should be adopted to give relief by suitable food and clothing, suitable physical and intellectual occupation, and suitable change of climate for the sick; all this is done for the upper classes, and the great diminution both of loss of life and loss of health of late years is a well known fact. Extend this to the soldiery, and it is certain to produce the same good results. If the reasoning be sound for placing European troops in the hills, the Government itself, the superintending civil and military officers, and a certain proportion of civil officers of all classes, in addition to those who are actively employed in the plains, should be so placed. This plan, therefore, renders a double establishment of European troops necessary. The full number must be maintained on the plains in addition to those on the hills. European

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troops in India are so costly that it is an indispensable condition of Anglo-Indian administration to have as few as possible. This condition is violated in more than the ordinary sense by stationing European troops on the hills. If European troops in India are expensive, they are so in a much greater degree in the mountain regions of India. The cost of rationing a thousand men at Jackatalla, and at the two nearest stations on the plains, was last year as follows:—

Jackatalla	- - -	153,300 rupees.
Trichinopoly	- - -	113,000 „
Cannanore	- - -	87,000 „

If to this were added the expense of conveying the large quantity of beer consumed by 1,200 Europeans in the prime of life, and the increased cost of transit for invalids, recruits, soldiers' wives, together with other items incidental to the troops being placed in this position, the difference against the hill station would be much greater. The cost of placing the European regiment on its perch with all its impedimenta and taking it off again is also very heavy, and a European regiment cannot be moved from such a situation without much previous preparation, which might not be convenient or easy at a time of emergency. If it be so great an advantage to one European regiment to be stationed on the hills, it is equally so to all. To extend the advantage to all, however, would be impossible, because a large European force must always be cantoned with our native troops at the stations on the plains. To provide for an effective relief, even so that one-half or one-third of our European force should always be in the enjoyment of the superior climate of the hills, would require that the entire force should be augmented in the same proportion. Till that is done, one or two favoured regiments may have this benefit, but the rest must be subjected to the ordinary conditions of service on the plains. The advantage of a residence on the hills is as great for the cavalry and artillery as for the infantry, but it has never been proposed to extend it to the two first named arms.

It remains to be seen what will be the effect upon the health of European troops when they are suddenly called upon for active service in the plains after having been stationed in the hills. Of this there can be no doubt, that the efficiency of Anglo-Indian troops depends in a great degree upon the European and native portions of the force having been accustomed to act together, and that this advantage will be lost by the isolation of Europeans in the hills, where they are not even able to take part in the ordinary brigade exercises. European troops transferred to the plains from the hills are almost as ignorant of the ordinary conditions of life in India, and of the proper modes of preserving health, as troops fresh from England. Nothing but a residence on the plains can give them this knowledge. Independently, therefore, of the old doctrine of the "seasoning," which in my opinion is substantially true, the sanitary result of placing European regiments in the hills, on a general view of all the circumstances of Indian service, is very problematical. The men themselves do not like the secluded life they lead on the hills; and a tendency to misconduct on the part of some of the younger officers, and of some of the men, has developed itself, which has rendered precautions necessary not usually adopted in the plains. The temptations to which our soldiers were subjected in the suburbs of the great towns in England used to be the theme of popular declamation, but it has been found by experience that the seclusion of Aldershot is still more objectionable. At Jackatalla there is not even a second regiment to furnish a change of society, or an independent check of public opinion. Everything tends to produce an impression that they are "out of bounds." The spectacle of the full tide of human existence in our great towns is, in itself, an occupation; but at Jackatalla the men have not even the resources which large cantonments provide, the want of which is especially com-

plained of by the married men. They are also unable, owing to the state of isolation in which they live, to exercise such trades or handicrafts as they may be acquainted with, and for which there is always more or less demand in a cantonment. The disease from which European soldiers in India chiefly suffer is not fever or dysentery, but "vacancy of mind," which induces habits of intoxication, and every other physical and moral evil; and this disease is aggravated by their being stationed on the hills. We have lately made arrangements for encouraging European soldiers to qualify themselves by a knowledge of the native languages for the various employments which are open to them in the commissariat, ordnance, police, and other branches of the public service; but all interest in the natives and their languages is at a discount at Jackatalla, where native society is seen only in its most limited and meanest aspect.

The true use of Jackatalla is as a military sanitarium, to relieve the sick, to restore the convalescents, and to give a change of air and scene to all who have begun to suffer from the climate of the plains. All the buildings which have been erected, and, not the least, the ample ranges of married quarters, are admirably adapted for this purpose. All branches of the European military service—infantry, cavalry, and artillery—may participate in the advantage. Jackatalla, or, as I hope it will in future be called, Wellington, would thus become an institution of the greatest value to the whole Madras army, by promoting the health and efficiency of the force which is the backbone of that army. The sole condition of success, so far as I can see, is that well considered rules should be laid down for the sanitarium, and that military and medical officers and a chaplain should be carefully selected for the charge of it. An incidental, but very important advantage is, that our European soldiers would be induced to settle in greater numbers in the hill regions. Supposing this course to be adopted, the entire cost of building a separate convalescent dépôt, amounting to 893,000 rupees, will be saved, and suitable places of Protestant and Roman Catholic worship may be constructed in the unfinished sixth range of barracks, whereby a further saving of 129,000 rupees will be effected. The citadel, the foundations of which have not yet been laid, and the still more expensive stores of tents and other military equipments which it is intended to contain, would also be unnecessary. Indeed, considering that this entire hill region is an English garrison, which is annually augmented by fresh settlers, these fortifications might, I think, be dispensed, even if the other buildings continued to be used as barracks. Whether a military prison would be required in the event of the barracks being turned into a convalescent dépôt, is a question for the commander-in-chief. This would be another saving of 51,000 rupees.

I inquired into the cause why so few labourers and artisans from the European regiment had been employed upon the works, and I found that the soldiers would not come forward unless they were entirely excused from military duty on the days on which they were so employed. This appears to me to be a solid objection. Men cannot apply themselves steadily, so as to give a good day's work, if they are liable to be interrupted by roll-calls and parades. It is so desirable to provide occupation for the European troops, and to husband the insufficient stock of labour on the hills, that I hope the matter may be arranged consistently with the requirements of military discipline, as it has been in other armies. The same reason is alleged for the neglected state of the soldiers' gardens. This difficulty would not occur in the case of convalescents; and the general occupation of attending to a garden in a temperate climate would promote their recovery. The maintenance of the trees, walks, and fences might be intrusted to two or three pensioners (many of whom have been gardeners in their youth); and the convalescents might be remunerated by a share of the vegetables and fruit.

J. Bishop,
Esq., F.R.S.,
F.R.C.S.

JOHN BISHOP, Esq., F.R.S., F.R.C.S., examined.

5363. (Chairman.) I believe you have given much time and attention to the subject of the mechanism of the human frame, and you have published a work upon that subject?—Yes.

5364. Have you considered, in reference to that general subject, the best way in which burdens can be borne, so as not unnecessarily to fatigue the bearer?—Yes. The question was submitted to me to determine how a weight could be carried with the least mechanical labour, particularly relating to the knapsack of the soldier and the belt; those were the questions submitted to me for a particular purpose.

5365. By whom were those questions submitted to you, and at what time?—They were submitted to me by a person who at that time had obtained a patent for a knapsack; I was at that time examined before the Privy Council as to the propriety of extending his patent.

5366. (Sir R. Martin.) Did you on the occasion referred to report in detail upon the advantages of the knapsack which you speak of?—Yes; I was requested by the inventor of the knapsack to investigate the anatomical and mechanical difference that would result from using his invention compared with the ordinary regulation knapsack, and at that time I pub-

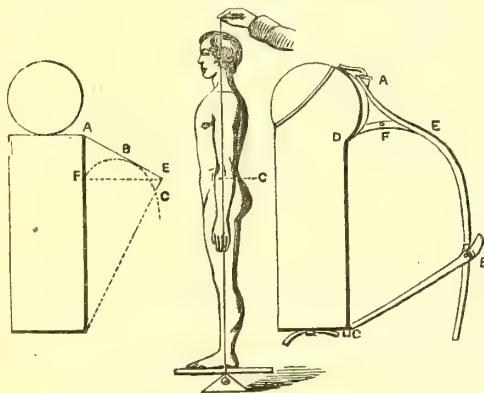
lished, at least he published, an account of the opinion that I delivered to him on that occasion, as follows :—

“When a man stands erect, all parts of his body are in a state of equilibrium, and the centre of gravity lies in a vertical plane, passing through the shoulder, hip, and ankle joints (Fig. 1); whilst standing in this position, the amount of muscular force exerted in supporting him is the least possible. It also follows, from the laws of mechanics as well as from experience, that when any heavy body is supported and carried on the back of a man, the head and trunk must be thrown so far forwards as that the centre of gravity common to the man and the load may lie in a vertical line, passing through the feet or base of support. Hence, the greater the distance of the centre of gravity of a given weight is behind the transverse vertical plane in which the centre of gravity of the body lies, the greater must be the inclination forwards of the trunk, and the greater the expenditure of muscular force necessary to preserve the equilibrium, and consequently the less will be the distance to which the man can carry the load; and *vice versa*, the nearer any load is placed to the above-mentioned plane, the less will be the muscular force required to maintain the equilibrium, and the greater will be the power of the man to sustain the load. On this account, country milkmaids carry the pail, filled with milk, on the head, porters carry heavy loads on the shoulders, &c., in each case the burden being immediately over the centre of gravity. The ordinary method of slinging the knapsack to the back of the soldier is by means of two straps; these passing from the upper part of the knapsack above the shoulder joints, back under the arms, are attached to the under part of the knapsack. It is thus kept in a state of equilibrium by the reaction of the shoulders and back, but at a great mechanical disadvantage. In order to relieve the front of the shoulders from a portion of the pressure, a strap crossing the chest is connected with the shoulder straps. Thus scarcely any of the load presses upon the top of the shoulder, where the whole ought, if possible, to rest. This mode of attachment clearly tends to restrict the full motions of the shoulder and arms, which restriction must be detrimental in military exercises. It likewise tends to compel the soldier to lean forward, and to contract the chest. It impedes respiration, gives a stooping gait in walking, and makes the man round shouldered; moreover, it compels him to expend more muscular force, in proportion to the weight, than is requisite, and unnecessarily exhausts him in long marches.

Fig. 2.

Fig. 1.

Fig. 3.



“In Berington’s knapsack the upper leathern strap, A, E, B, (Fig. 3) which comes down in front of the chest, acts somewhat in the manner of a rigid rod; for, being kept in its place by the other strap C, B, the whole weight is suspended on the top of the shoulder by means of a web, F, fastened to the strap and to the knapsack at the two points D and E, both of which are below the top of the shoulder. By this means the whole catalogue of the evils resulting from the defective attachment of the common knapsack to the back of the wearer is avoided; and this may be satisfactorily proved by hanging a very heavy weight

to each knapsack;—in the one case, the strain upon the lower part of the back is enormous, and the man can hardly help falling backwards;—in the other, no further inconvenience is felt beyond the additional pressure upon the shoulders.

“In order to illustrate these views, let Fig. 2 represent the common knapsack, suspended at the back by the strap A, B, C, D, touching the shoulder at B and C. The forces which keep the knapsack in its place are a force in the direction A B, another in the direction C D, and the reaction of the back. Let A, B, D, C, produced, meet in E, and E F be perpendicular to the vertical line A D. Now, the force in the direction of B is equivalent to a force in the direction A F, and another in the direction F E, of which the latter presses against, and is counteracted by the back, and the former tends to pull the knapsack downwards; therefore both of them are detrimental. Similarly, the force in the direction D C, is equivalent to a force in the direction D F, and another in the direction of F E, of which the latter presses against the back, and is therefore detrimental; but the former both supports the weight of the knapsack and counteracts the downward force of the strap A B, in the direction A F. It is thus evident that there is a large amount of injurious pressure against the back; and since the strap D C, sustains the whole of the downward pressure, the bearing upon the shoulder must be greatest at some point between B and C, but much nearer to C than to B, as is found to be the case.

“Fig. 3 is the new knapsack, which is slung from the shoulder by a piece of web D E, attached to the knapsack, and a rigid strap A E B, at points D E, both of which are below the top of the shoulder; a strap C B also connects the bottom of the knapsack C with a rigid strap at the point B, below E: the web is so placed that the two points, where it becomes a tangent to each side of the shoulder, are very nearly in the same horizontal line, and consequently nearly the whole load rests on the top of the shoulder, as it ought to do, in order to lie within the transverse vertical plane of the man, and therefore to bear upon his centre of gravity. The only pressure against the back arises from the tendency of the knapsack to rotate around its point of suspension E, and is inconsiderable, for the strap B C has very little tension.

“These demonstrations so clearly prove the superiority of the new over the ordinary knapsack as fully to justify the opinion already pronounced upon their respective qualities; and considering how much the health, comfort, and efficiency of the large body of men who compose the infantry of the British army are concerned, I have no hesitation in saying that at least the principles, if not all the details, of your invention should in justice to the men be adopted.

“The belt which you propose for adoption has several advantages over the one now in use. It is so shaped as to form a portion of a conical surface, cut off by circles parallel to the base of the cone, and fits nicely upon the brim of the pelvis, so that the pressure of whatever is attached to the belt is immediately over the hip joints, where it ought to be, since the framework of the pelvis is one of the strongest structures of the human mechanism. By the removal of the weight of the pouch and bayonet from the upper part of the body, a greater freedom of motion is obtained. The power of rotating the pouch to the side of the body must greatly relieve the soldier in long marches, and when he is not immediately engaged in military evolutions. The straps, which go over the shoulder, are also rendered unnecessary, and the pouch and bayonet kept ready in their places.”

5367. The inventor was Mr. Berington?—Yes.

5368. Do you consider his invention one of great superiority to any other knapsack you have seen?—I consider his knapsack to be one which has this advantage: independently of its immediate construction, the principle upon which it is slung to the body is that by which a man can carry the weight with the least mechanical labour, that is, it is hung upon what

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we call the transverse plane of the body; if you let fall a plumb-line from the head to the foot, it intersects all the joints of the body from the head to the ankle-joint, and if you cut a plane through at right angles to that, and cut the body upon a third plane at the intersection of those three planes, you cut the body at the point where it rests upon the pelvis, that being the centre of gravity of the body; consequently, if any weight, such as a knapsack, is put on that body behind this centre of gravity, it necessarily disturbs the equilibrium of the body, and the trunk must incline forwards to compensate for the weight of this body, whatever it may be, which is placed behind that equilibrium, and the body cannot be maintained in an erect position; when a weight is hung behind it, it must go forward with the same weight that happens to be lodged behind it. Supposing, according to the regulation, that 17 lbs. are placed in the knapsack, and which I find is the weight placed in the knapsack, so much of the body must be inclined forwards to compensate for that weight which is impressed upon it, if lodged behind this transverse plane. The advantage of Mr. Berington's knapsack is this, that being hung, and its weight resting on the shoulder directly, and therefore having its axis resting upon the transverse plane of the body, and not behind it, like the ordinary knapsack, there is no necessity for the body being thrown forward to compensate for any weight behind. That is one of the great advantages that Berington's knapsack has, independently of lessening the mechanical labour which the other knapsack entails. A greater weight can be borne in that position; a much greater weight absolutely can be borne if the body is in an erect position.

5369. It has also the great advantage that it leaves the arms free for movement?—That is another point.

5370. The arms are left quite free and unrestrained?—Exactly so. Of course this was considered irrespectively of its military application; but taking that into account, it can easily be imagined that if you strap up the arms and hang a weight behind, the arms cannot be so free as if they are left unimpeded, which is the case with the knapsack I am referring to.

5371. (*Chairman.*) The principle of this improved knapsack, if I understand it rightly, is to throw the weight as much as possible on to the centre of gravity?—Yes, directly on to the shoulders over the centre of gravity, so that no muscular exertion is required.

5372. (*Dr. Gibson.*) But part of the weight is thrown upon the chest, is it not?—No; there is no muscular labour, except keeping the body erect.

5373. But there are two pieces of iron which extend down the centre of the chest?—Yes.

5374. The supports of the knapsack, which practically cause considerable pressure on the front of the chest?—No, they ought not to do so.

5375. The soldier's duties require exertion from him, such as running, and in that act of exertion the movements of the chest are considerably accelerated?—Yes.

5376. And the practical effect of the pressure on the chest, according to the report of the soldiers themselves, is that it prevents the tilting up of the ring and the expansion of the chest, and causes great distress in breathing?—We have worn it and tried it upon ourselves, and we have not found that it has any such effect. When you speak of pressure on the chest, the specimens of Berington's invention which I have seen are quite free from that, and I cannot conceive how it could press upon the chest when the whole pressure of it, the axis of its weight, was upon the shoulder and the transverse plane of the body.

5377. (*Sir R. Martin.*) You are acquainted with the results of the practical trials of Berington's knapsack as compared with the others in use?—Yes; and I understand that those who have tried it were very much pleased with it indeed. I have never heard

disapprobation of it after the trials which have been made.

5378. (*Sir P. Cautley.*) Has it been tried by a company of men or a regiment, or by individuals?—By both.

5379. (*Sir R. Martin.*) One of its points of excellence was found to be the comparative freedom of the movements of the chest under Berington's knapsack?—The chest and arms. The official reports I have not seen, and I cannot answer as to experiments of which I have no knowledge. The only thing that I can do is to explain from my own experiments, and from my own analysis, what I have undertaken to do, and that is, that I have shown from the laws of mechanics, and from its construction, that it is better adapted to the purpose for which it is intended than the knapsack now in use; that it does not restrict the movements of the chest nor confine the arms, and that it can be carried with less fatigue than the other; that is a mechanical point. What the men have found, or what trials have been made, or what reports, I have nothing to do with; but I am quite sure of this, that the analysis I have made cannot be contradicted by any one, because it is based on those anatomical and geometrical considerations which I defy anybody to dispute. As to its effect upon the chest, I really do not understand it, because there seems to be nothing to confine the chest in its mechanism.

5380. You have also had occasion to examine the waist belt and pouch of Berington?—Yes; and I believe it has this advantage, that being placed round the body just over the pelvis, where, from its construction, and having also the advantage of disengaging the body from the strap by which the pouch hangs, the body is best able to support it. I look upon it that it has a great advantage over the other, as the soldier can carry the same load with less fatigue; and not only with less fatigue, but he can shift the load; the pouch can be shifted; and we all know that if we carry a gun on our arm, we are very glad to put it on our shoulder sometimes, to shift the pressure of it, or if we carry a carpet bag to a railway station, we are glad to shift it from one to the other hand, and sometimes to shift the load from one place to another; and it is very natural if a soldier finds, when he is not actually engaged, that the weight presses upon him at a particular part, if he has the means of shifting it, that he should do so, and it is a great advantage and a great comfort to him; and not only has it that advantage, but I look upon it that the great consideration is, that it disencumbers the trunk, and leaves it free for action, and not only that, but it is placed on that part of the body where he can support it with the least mechanical labour. Every medical man knows that a much greater weight can be supported at that part than by any other part of the body, and the more you load the upper part of the trunk, the weaker is the man for effective labour. When I reported the results of my investigation to the Privy Council, the remark was, that they wondered the invention had not engaged the attention of the Government before. I explained to them the mechanism, and the principle upon which it was based.

5381. (*Dr. Gibson.*) Do you think that the effects produced upon the chest of the men who tried it arose from any effect in the construction of the knapsack itself, or from the manner in which it was put upon them?—Principally the last. There is no doubt in question about the mechanism itself, nor of the principles on which it is based. I think that every one who is acquainted with mechanics will admit this conclusion. Whether the knapsack fitted the man who made the report, or whether it was so adjusted to him that he could wear it with the greatest advantage, is a point I cannot know.

5382. (*Sir P. Cautley.*) The adjustment must necessarily be a matter of importance?—Yes; we leave the body as free as possible. I look upon it, without

being a military man, that the soldier would like to have his arms and body as free as possible.

5383. (*Dr. Farr.*) Men who have been accustomed to the old knapsack might, perhaps, not see the advantages of the new one immediately?—Of course they would be able to ascertain whether they could carry the one or the other with the least labour; that they could easily test for themselves; but whatever their opinions might be, they cannot dispute the mechanical laws upon which this is founded.

5384. What do you consider to be the mechanical advantage of the new knapsack over that in actual use, can it be expressed numerically?—Yes; I look upon it that a force of 17 lbs., taking its distance from the transverse plane of the body, is the exact quantity that a man would have to compensate by certain portions of his body being thrown forward, and it has been remarked by those who have witnessed soldiers near the termination of a march, carrying the old knapsack, how remarkably they stooped.

5385. (*Sir P. Cautley.*) That might perhaps be not from the knapsack, but from tightly fitting shoes or a badly fitting hat?—It might be so.

The witness withdrew.

Saturday, 6th July 1861

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.

Sir RANALD MARTIN, C.B., F.R.S.

J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.

JOHN SUTHERLAND, Esq., M.D.

Dr. HUGH FALCONER, M.D., examined.

5390. (*Chairman.*) Will you be good enough to state how long you have resided in India?—I was upwards of 25 years in the service, furlough in England inclusive.

5391. You were lately, I believe, in charge of the botanical gardens at Calcutta?—Yes, I was superintendent; and in the previous part of my service I was superintendent of the botanical gardens at Saharunpore, in the north-west provinces.

5392. You have paid some attention, I think, to the geology as well as to the botany of India?—I have.

5393. Have you ever considered the question of how far the geological formation of the country affects the health of the persons living in it?—It strikes me that it is not so much a question of geology as one of the physical configuration of the country; and that the mere nature of the rocks, or the abstract geological conditions, have but little to do with it. I am not aware that any attention has been paid to the rock formations in reference to the sanitary condition of the country.

5394. When you say that the configuration of the country is important in a sanitary point of view, you include in that, I presume, the nature of the soil?—The nature of the soil, and the slope of the great lines of drainage. Suppose that in a tropical country, there is a great river valley with different measures of inclination along different portions of its course, you will have different sanitary conditions at different points; near the delta, where the water flows slowly, and where there are large alluvial deposits, you will have a very different sanitary condition from what you will find near the head of the valley, where the inclination is considerable and the drainage good.

5395. Taking first the question of drainage, I suppose that, as a rule, the drainage is worst near the mouths of great rivers?—Yes, as a general rule. In the delta of a great river like the Ganges, or Brahmapootra, it is with difficulty that you can have good

5386. (*Dr. Farr.*) With Berington's knapsack do you conceive that 17 lbs. could be carried with much greater ease than 17 lbs. in the present knapsack?—Yes, I have carried much greater weights myself and also friends of mine, who have put it to experimental proof independently of theory, and that left no doubt upon our minds as to the great advantage of Berington's knapsack.

5387. Do you think that 20 lbs. could be as easily carried in Berington's knapsack as 17 lbs. in the old knapsack?—I have made no calculation on the subject, but I think it might perhaps produce less fatigue at the end of the march.

5388. (*Dr. Gibson.*) Do you think that in the trials that were made of it, it made any difference if the elastic steel strap was not fitted to the chest of the individual man who wore it?—I think it is very possible that it was from the way in which it was put on that it produced the effect you have mentioned.

5389. An instructor would be necessary to explain to the men how it should be properly adjusted?—Yes.

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drainage, from this simple circumstance, that the mean level of the country and of the delta is hardly elevated above the level of the highest tides. I have known the superintendent's house in the botanical gardens at Calcutta completely surrounded by water. The way in which that is remedied, for the sites of houses in the delta of the Ganges, is by digging tanks and throwing the earth taken out upon the surface; for instance, about Calcutta the general depth of the tanks is about 17 feet, and if you dig a tank of the extent of an acre, you can raise the same area either 17 feet high above the level of the flooding, or you can elevate 17 acres a foot high. That is the way in which a considerable portion of the surface of Calcutta has been raised above the level of inundation.

5396. (*Sir R. Martin.*) Except the river banks, which are raised by gradually silting up?—Yes; that is the case in all river valleys. You have invariably on the margin a little higher elevation than you have inland.

5397. (*Chairman.*) The tendency is towards the mouths of great rivers, as in Holland and in Louisiana, for the water to be slightly elevated above the level of the land?—Yes, and good drainage for houses becomes difficult. The only way then is by raising the land in order to get an inclination upon which drainage can be established. That is, in a great measure, the condition of the inhabited parts of the delta of the Ganges near Calcutta. Among the natives, whenever a man acquires a little money, the first thing that he does is to dig a tank in front of his house, in order to raise the ground and make himself comfortable.

5398. (*Sir R. Martin.*) In the area of Calcutta there exists a sufficient fall eastward into the salt water lake for drainage, does there not?—I am not sufficiently acquainted with the precise hypsometrical details of the case at the present moment to give an opinion. I am addressing myself more to the general question than to special topographical conditions; but it does not in the least interfere with the general law. For the "Salt Water Lake" is merely an inland

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portion of the network of lagoons and creeks that form the water system of the Sunderbunds of the delta. It is subject to the ebb and flow of the tide, and forms no exception to the general rule. It can be shown that the soil around Calcutta is only a comparatively modern acquisition from the delta, and that there is no natural cause by which it could have been raised much on one side more than on another, except the circumstance to which you refer, that is to say, the elevation which takes place near the margin of the river from the outpouring of the silt more than in the interior. This will account for a slight amount of inclination towards the Salt Water Lake.

5399. (*Chairman.*) I presume that the same causes which affect drainage also affect the water supply?—They do; but I am not of the opinion that water should necessarily be bad by reason of its being stagnant; for when you get a proper balance of vegetable and animal life, in still water, there is no other natural condition required to keep that water sound and fit for consumption. So much is this the case in Bengal, that the natives prefer the water of ponds or tanks the surface of which is covered by a crust of *lemna* (species of duckweed). There are strong prejudices on these points in England, but the opinion among the natives in India is very different; practically, it is chiefly water of this kind that is used by the inhabitants of the delta of the Ganges; that water filtered will be found to be of a pure quality in every important respect, clear, and with a fair proportion of oxygen, in fact with the principal conditions which go to constitute good and wholesome water.

5400. (*Sir R. Martin.*) On the contrary, the presence of the animal and vegetable matter go to purify the water?—Yes, and to prevent that kind of unsoundness which would arise from the simple fact of stagnation.

5401. (*Chairman.*) Then do you think that the water consumed in the neighbourhood of Calcutta is generally good?—I do. There are, of course, differences in that respect; but I consider that it is generally good, and that it is difficult to believe that the mere water, as an article of consumption for drink, is the cause of an unhealthy condition, judging from observed facts and from the experience of ages.

5402. (*Sir R. Martin.*) Where the tanks are filled with rain water, the water is sure to be of good quality, is it not?—I do not know that; it will depend upon the washing in of the surface, and upon the nature of that surface. If decayed vegetable matter, or animal *excreta*, were thrown out on the surface, and the rain drainage took that direction, the water of the tank would be tainted and unwholesome. The tanks which the Europeans generally have access to are very seldom of that kind; but my remarks have more reference to the habits of the natives in the villages of Bengal, who commonly drink water, not out of what we call a tank, but out of ponds covered with a crust of vegetation.

5403. (*Sir P. Cautley.*) Your evidence conveys the notion that these tanks must be perfectly free from the drainage of the country near them?—Quite so; they are free from anything in the shape of obvious decayed vegetable or decomposed animal matter running into them. If any condition of that kind were to take place, the equilibrium would be immediately upset.

5404. Therefore, where you have running water in the upper regions of the valley, you are more likely to have good water, and with less care?—Clearly so, for you have then got a general good condition, from the fact of its being running water; the act of running brings it so much in contact with the atmosphere, that you have there good water provided without any other natural provision.

5405. (*Dr. Gibson.*) Do the troops generally obtain their supply of water from tanks?—They do generally; but the conditions vary very considerably, according to position. In the north-western provinces good well water is procurable in abundance

at many stations, in addition to the supply from tanks. Looking at the large map on the wall, the great valley of the Ganges, with its vast population, differs materially in this respect at different points. You might divide it into sections, and each would constitute a belt, with conditions more or less distinct. Where the rivers near the head of the alluvial portion of the valley begin to turn eastward, after escaping from the Himalaya, the elevation is 1,000 or 1,100 feet above the level of the sea, the soil is arenaceous, the inclination considerable, and the current strong until you get to Allahabad, thence it gradually diminishes till you approach the delta and the belt of inundation, where the inclination is almost nil, and the soil a fine alluvial silt.

5406. (*Dr. Farr.*) You say that you might divide the valley into five or six sections?—I am not prepared, on the spur of the moment, to define the precise number of sections into which the great valley of the Ganges might be divided, along a stretch of 1,000 miles, in reference to the subject of the question; but you might mark off four or five, say four belts. The first or lowest would include the immediate delta of the Ganges, or about 240 miles from the apex of the triangle to its base.

5407. Up to what point would you carry the next division?—I am not prepared to give an answer off-hand; but upwards from Allahabad, where the two rivers join, the physical conditions, as regards climate, soil, and drainage, differ very materially from those of the delta and lower provinces. The difference is as great in many respects as if they belonged to two distinct geographical regions; the physical characters of the inhabitants differ, and the food they eat differs. In the one case there is a puny or comparatively feeble race who subsist chiefly on rice; while in the north-western provinces the population consumes but comparatively little rice, and they are a more muscular and powerful race. The contrast increases as you proceed northwards through the Punjab towards the Indus.

5408. All these circumstances, you think, are likely to affect the health of troops?—Clearly; and there are some remarkable facts which might be cited in illustration; for instance, during the early operations in Clive's time—Major Kilpatrick came round to Calcutta from Madras in 1756 with a reinforcement of 230 Europeans; the following year, after a lapse of 13 months, Major Kilpatrick died, and it was found that there were then only five men left alive out of the whole force which came round with him, their service having been on the delta and adjoining provinces, (*vide* Broome's History of the Bengal Army, vol. i. p. 185).

5409. It was as fatal as the west coast of Africa now is?—Yes; the deaths were nearly 98 per cent. in 13 months, and I am not aware that any mortality on that scale has ever been observed in the north-western provinces; but it must be at the same time remembered that the intemperate habits of the soldiers, exposure, bad housing, sleeping close to the ground on mud floors, and deficient medical comforts, &c., greatly assisted the effects of climate and service-casualties in effecting such a mortality.

5410. Does your observation lead you generally to say that the unhealthiest parts of any country are the delta of large rivers?—Yes, in a level country; but in tropical and sub-tropical regions, contracted deep transverse valleys, covered with forest within the mountain ranges, and shallow longitudinal valleys outside them, are also most unhealthy.

5411. The organic matter is first washed down by the rivers, and upon the delta undergoes decay?—Yes, it is there spread out on the surface by inundation, it undergoes decomposition, and that decomposition is always concurrent with a malarious condition of the country.

5412. Are you aware whether any estimate has been formed of the amount of matter that is washed down the valley of the Ganges?—An estimate, founded on carefully observed data, has been made by

the Reverend Robert Everest, which appeared in the *Journal of the Asiatic Society of Bengal* (vol. i., June 1832, p. 238). During a year he made a continued calculation of the quantity of sediment brought down by the Ganges opposite Ghazee-pore in the different seasons of the year,—rains four months, winter five months, and summer three months. He ascertained that from June to September the average discharge of water was about 500,000 cubic feet per second, and for the remaining eight months somewhat less than 60,000; that, during the former period, the average quantity of solid matter was by weight $\frac{1}{428}$ or $\frac{1}{556}$ in bulk. The sediment during the other months was comparatively insignificant. This is the best calculation that has yet appeared in the records of science of the amount of sediment transported by a great river.

5413. (*Sir P. Cauley.*) He has refuted Reynell, has he not?—He has corrected Reynell, who gave a very extravagant calculation, showing that the quantity of sediment carried down by the Ganges during the rains was so great that if you took up a tumbler of that water, about one quarter of the bulk consisted of mud. This was universally accepted by men of science on the strength of Major Reynell's great reputation, but Mr. Everest applied himself to the investigation of the subject afterwards with great severity, and he arrived at results which have been considered extremely valuable.

5414. (*Dr. Farr.*) The cholera originated about the lower part of the delta, did it not?—I cannot at the moment quote the very place; but the great epidemic, I think, broke out at Jessore, to the east of Calcutta.

5415. (*Chairman.*) With what parts of the country are you the most familiar?—I know more or less of the valley of the Ganges, from the delta up to the foot of the mountains. I have crossed the Punjab to the salt range; I have been in Lower Afghanistan; I have crossed the Himalayas to the sources of the Ganges; I have been in Cashmere and Western Thibet; I have been a good deal in the Himalayan mountains, between the Indus and the Ganges, and along the outer ridges from the Ganges to the Kalee; I have been through the forests of the Tenasserim provinces.

5416. (*Sir R. Martin.*) Are you acquainted with the valley of the Brahmapootra?—Not from personal observation.

5417. (*Dr. Farr.*) The different parts of this immense country differ very much in temperature, meteorology, and food, do they not?—Yes, they differ very much in their climatic conditions.

5418. Will you have the goodness to state broadly what the circumstances are which you think would be likely to influence the health of troops in the lower part of the Ganges and in the upper part, and whether you think the latter is more likely to be healthy than the lower part of the Ganges?—The physical condition that seems to me to tell most, after mere temperature, upon the health of European troops, is the annual fall of rain, and the hygrometrical condition of the atmosphere; that is, putting the subject in a very broad form of expression, temperature first, and then humidity; and where you can reduce the temperature, and at the same time get a concurrent condition of dry atmosphere in India, in that direct ratio, will you, as a general rule, increase the healthiness of the climate for Europeans.

5419. (*Chairman.*) The drier the climate is the more healthy it is?—The drier it is, concurrently with a diminution of temperature, and that has been shown, in some cases, in a very marked manner.

5420. (*Sir R. Martin.*) To what instances do you refer, with regard to locality?—Wherever you cross the Himalaya mountains, and get upon the northern side of the chain. There is a remarkable physical condition which prevails over India during the south-west monsoon, namely, an atmospherical current which is charged for four months to saturation with moisture, conjointly with a high temperature. This current is

intercepted by the Himalaya mountains, and forced to ascend, when it necessarily cools down, and heavy continued rains fall all along the southern side. But when you cross the chain to the northern face this condition ceases, the moist current is arrested, and periodical rains cease to fall. I have stood on a high ridge of the Himalayas between Cashmere and the plains, and seen it raining a deluge upon the Punjab, while not a drop of rain had fallen on the northern side for months. In the upper part of the valley of the Sutlej, in Kunawur, and more especially in the valley of the Spitee, where very little rain falls, and where you have a cool and dry atmosphere conjoined, a European maintains as good health as in any part of Europe. On the other hand, when you cross to the southern side you may have the condition of a low temperature, but concurrent with a protracted fall of heavy rains, and charged humidity of the atmosphere, when the climate ceases to have the same salutary effect.

5421. (*Dr. Farr.*) Is there a considerable extent of country so favourably placed as you have described?—A large extent of country; in fact all the great valley of Thibet; but you would not find it suitable in other respects, nor advantageous for maintaining a body of European troops.

5422. Is the country fertile?—No; it is not fertile, but the reverse.

5423. Then you could not feed troops there?—You might feed a certain number, but I should consider it highly impolitic; it would be like having troops to garrison a town, and locating them 100 miles off from the garrison.

5424. (*Chairman.*) They would be within the limits of India, but at an enormous distance from the points at which they could be made available?—Precisely; they would be far away from the specific spots where they were intended to serve.

5425. (*Dr. Farr.*) That is, if they were placed in the particular localities to which you have referred?—Yes, where the conditions are most favourable, and where you have a low temperature, and a dry condition of the atmosphere. But when you come to the southern side of the Himalayas you will find many spots which are recognized to be favourable, but not to the same degree, which have got a low temperature, but concurrently with long periodical rains and great humidity.

5426. (*Sir R. Martin.*) Owing to their forming the front ranges of the mountains?—Not merely that, but the *low* ranges; they are within the belt of elevation which is affected by the monsoon. The south-west monsoon is a stratum of atmosphere having a definite altitude, less than 15,000 feet; for if you ascend in the Himalaya to 12,000 feet you have heavy periodical rains; but go up to 15,000 feet, and you are entirely beyond them; indeed, in some parts of Thibet a shower of rain has seldom fallen within the memory of man during the south-west monsoon.

5427. (*Chairman.*) But I presume that snow falls there?—Yes; on the high ridges and elevated steppes, as occasional falls of snow, or, in the valleys, as rain, during the winter season, but not synchronously with the south-west monsoon. In the valleys cultivation is mostly restricted to the patches that can be irrigated by rills of melted snow. These remarks refer to the Thibetan regions on the northern side of the Himalayas.

5428. (*Sir R. Martin.*) The objection to the front ranges of mountains has been, that they bear the brunt of the south-west monsoon, as in Assam?—Yes, as in the Khasia hills; but the conditions become more favourable as you go towards the north-west. Taking Chirra Poonjee and Sylhet, the conditions there are most unfavourable as regards moisture. They are less so at Darjeeling, and as you go westward they continue to improve, the fall of rain diminishing.

5429. But even in Assam, where the rains are so heavy as to be counted by fathoms, there are behind the front ranges, others in which the rainfall is very

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moderate?—Yes; it is a mere question of elevation above the sea and position. When the stratum of monsoon atmosphere is driven against mountain ridges it gets squeezed out, so to speak, like a sponge, and protracted rains fall. More inland there is still great humidity, with less rain, and when you cross the chain and get to the other side, there is a perfectly different condition of things.

5430. (*Dr. Farr.*) The being squeezed like a sponge is a figure of speech; you mean that the cold forces down the vapours?—Yes; the cold precipitates the vapour in rain.

5431. There is a range of hills, at a very low temperature, and that precipitates all the vapours?—Yes, a range of lofty mountains, which arrest the current, force it to rise, and thus cool it down. The atmosphere is no longer capable of holding the same measure of water in suspension, and the moisture is precipitated. But for the Himalaya mountains the physical condition of India would be very different; the mean temperature of the whole continent would be lower, and that of China higher. It is the interference of this enormous lofty axis, arresting the monsoon, and intercepting the interchange of atmospheric currents, that is the great cause of the physical difference between China and India.

5432. It cuts off the monsoon, and brings down rain?—Yes; it prevents the current from getting across and spreading over that part of Asia which lies on the other side of the Himalayas. The effect is very remarkable. There are some Himalaya stations, such as Mussourie and Landour, at an elevation of from 6,000 to 7,000 feet above the sea, which have a mean temperature of from 8° to 12° in excess of what they ought to have, calculated theoretically, for the latitude and elevation; while Saharunpore, in about 30° north, and 1,000 feet above the sea, has a mean temperature as high as that of Canton, which is 8° further south, and at the level of the sea.

5433. (*Dr. Farr.*) Is a good account of the rainfall in the different parts of India to be found?—Not in a separate form; but good data for a general account exist in observations made at different stations, which are to be found distributed over the Indian scientific journals and in other works.

5434. Showing the rainfall in different months of the year, and for a succession of years?—Both for the months, and in many cases for a succession of years.

5435. Could you supply a table of that sort?—I have no detailed table of the kind prepared; it is simply a matter of compilation, and could be prepared in the statistical department of the India office.

5436. Is Berghauz's map tolerably accurate?—It is not sufficiently detailed on that point. The fall of rain is so enormous in some places as to be hardly credible.

5437. Can you give an instance or two of these very extreme rainfalls?—At Chirra Poonjee, in the Khasia hills, the annual fall of rain has amounted to from 500 to 600 inches, or fifty feet. In the month of August 1841 it is recorded to have amounted to 264 inches, and that during five successive days 30 inches fell every 24 hours. At Mahableshwur, on the Western Ghauts, the fall is 248 inches. There are reports on the rainfall at different places to be found in the Journal of the Asiatic Society of Bengal.

5438. And of the temperature and other meteorological elements?—Yes.

5439. Then, as you have mentioned, there are places where there is no rain at all?—There is little or no rain at the moderate elevations in Western Thibet, and in the arid parts of Sind and adjoining deserts of the Punjab. The average annual rainfall in Sind does not exceed 5 inches; at Agra it is about 20 inches; at Khandalla, on the Western Ghauts, 200 inches fall, while at the foot of the eastern slope only 14 inches are said to fall, and at Poona, a little more inland, 24 inches. The local differences are very great, but they are generally explicable by the relation which the localities bear to the mountain ranges, which arrest or intercept the monsoons.

5440. In going up the valley of the Ganges does the rainfall generally diminish?—Yes; it diminishes gradually as you advance north-westward towards the Indus, where it is very light.

5441. Until you approach the Himalayas?—Close under the Himalayas it is greatest, and diminishes as you recede from them.

5442. Have you any information to give the Commission with regard to the Terrai?—I have paid some attention to the physical conditions and vegetation of the Terrai.

5443. Is there anything in the vegetation or the physical conditions which you think accounts for its fatality?—Not in its specific vegetation, but there is in its physical condition and conformation. The Terrai is a stretch of shallow depression, or succession of wide flat-bottomed valleys, extending parallel to the Himalayas from the Brahmapootra river to the Indus, or, as more strictly limited, to the Ganges. It is of variable width, attaining in some parts, as between Oude and Nepal, a width of many miles. It is bounded by the outer ranges of the Himalaya on one side, and towards the plains by a slightly elevated steppe, called the Bangur land. This wide depression is either sheeted with forest, or grass jungle, and patched over with extensive swamps. It becomes deadly during the rainy monsoon, and immediately before and after it. The unhealthy condition is not limited to the human species, who are fearfully liable to bad remittent fevers and their sequelæ, but it also affects the domestic cattle. One winter I passed through the Rohilcund Terrai when safe, and at the village of Rooderpore, where I examined great herds of cattle, I found that a very large proportion of them, young and old, had been fired with a hot iron on the flanks, this being a remedy practised by the Hindoos for enlarged spleen. They had also, in addition to enlarged spleen, the flabby look and pallid colour of the mucous membranes which is characteristic of spleen disease as a sequela of fever. I remember an instance also in the valley of Dehra Doon, where the settlers were carried off by a violent outbreak of deadly fever, which also affected their cattle.

5444. That, you think, is not connected with any particular form of vegetation or geological formation?—Certainly not.

5445. And only has reference to the physical condition of the country?—Yes; there is a wide shallow depression, with an intense development of tropical vegetation, and abounding in swamps.

5446. Supplied constantly by water from the mountains?—Excessively humid and deluged with rain, in consequence of its proximity to the mountains; being the conditions that are conjointly most favourable to the production of malaria.

5447. Is the water stagnant, or does it flow freely from this Terrai?—All the principal affluents of the Ganges pass freely through the Terrai; but there are numerous and extensive swamps, or jheels, and bad natural drainage.

5448. What is the soil; is it decayed vegetation?—It is a very rich soil of decayed vegetable matter, resting on a substratum of coarse sand or gravel.

5449. Do you think that disease is communicated through the air or through the water?—I believe that disease is there communicated by malaria arising from vegetable decomposition.

5450. That is, that it originates in it?—Yes.

5451. But does it affect the organization of man or the animals through the water or through the air?—My own conviction is that it is through the air.

5452. Is not that a general sort of popular belief, which is not very well founded?—I think otherwise—as regards fever. But the prevalent opinion among the natives of India is different; they look upon the water as being the source of the disease.

5453. Are there any very solid reasons for believing that disease reaches man through the air rather than through the water?—It is a large, complex, and

very difficult question, to which I cannot at the moment give you a satisfactory reply; it is one which has attracted the notice of the best chemists, during half a century, without arriving at any decisive results. Professor Daniell thought that he had detected it in the presence of sulphureted hydrogen, and that that was the cause why pestilential fevers were so rife on the coast of Africa, on board of cruising vessels at a distance even of 50 or 60 miles from the land; the quantity of sulphureted hydrogen in the sea water having been sufficient to affect the copper sheathing on their bottoms. But that opinion has not been confirmed or accepted, and all the subtlety of analytical chemistry has not been able to detect the peculiar state of the atmosphere which causes malarious fevers. In the Terrai the physical conditions which affect the water are constant during successive years, while periodically, after the lapse of years, intensely virulent outbreaks of pestilence occur, which are specifically marked by the natives under the name of Aol, to distinguish them from ordinary years.

5454. (*Sir R. Martin.*) Are not the people seized with Terrai fever in various parts of India, who gallop through in the shortest possible time, without tasting either food or drink?—They are seized with Terrai fever, after passing through it in the most expeditious manner, without tasting food or drink that they have not carried with them. I have known cases where it was inconceivable to me how the disease could have been communicated through water.

5455. (*Sir P. Cautley.*) You call that the Terrai which runs at the foot of the hills from the Brahmapootra to the Indus?—Yes, as a general designation for the stretch of low land at the foot of the Himalayas.

5456. A great portion of that, I believe, is not wet, is not that so?—On the contrary, all that part of it, which lies between the Indus and the Sutlej, which is now under cultivation, is dry, and generally speaking as healthy as the adjoining plains; while east of the Ganges it is humid and deadly unhealthy.

5457. Where the forest has been removed the country has become healthy?—Perfectly healthy; and there are facts on record which prove the previous existence of the forest; for instance, the Emperor Baber, in his autobiography, mentions that in his descents upon India he hunted and killed many rhinoceros in the forests near Peshawur; that animal has been driven back several hundred miles to the eastward, and is not found now west of the Ram-Gunga. It is rare even there and until you reach the Gogra.

5458. (*Sir R. Martin.*) That goes to confirm the general observation, that the best improvers of climate are a succession of crops and good cultivation?—Yes.

5459. (*Dr. Farr.*) You have spoken of the water, have many analyses of the water of India been made?—But few.

5460. Impurities, or organic matter, for instance, *excreta* from the inhabitants, getting into the tanks, would be always injurious?—Clearly so.

5461. You have spoken of the presence of vegetable and animal life in the water as tending to purify the water?—Yes, as destroying the organic matter, and maintaining that wholesome proportion of oxygen and carbonic acid that are considered to be essential to good water, particularly the oxygen.

5462. You do not think purely rain water less likely to be healthy, I presume, than water drawn from the alluvial soil in a valley such as that of the Ganges?—Perhaps not less healthy, but mawkish and insipid from the want of the hardening earthy salts which make good spring or well water palatable. The well water, tapped from the alluvial soil, in the north-western districts of the valley of the Ganges is generally good in quality, and preferable to rain water; and in the case of tanks, my impressions are so strong that I would rather take filtered water out of a good tank than drink rain water.

5463. If you wished to make a provision for a large body of troops, would you not think that it would be best to collect the rain water and store it up, and if kept from the light would it not be then of the best quality?—I do not think I should. I am not aware that rain water is ever used on the great scale you contemplate, except for isolated garrisons, or under similar straits, where good water from ordinary sources of supply is not procurable, and as a general measure it would be impracticable in India; for suppose a large body of troops thus supplied in cantonments to be moved on service, it would be chimerical to think of a commissariat organization for supplying them daily on the march with rain water. They must be thrown on the ordinary resources of the country. But taking the case you assume, if left to my own judgment, I would not consider a store of rain water preferable.

5464. It is found that water is either frequently in an unwholesome state before vegetation takes place in it, or that vegetation cannot destroy the whole of the organic matter in it?—You there introduce a condition which is fatal to the equipoise of which I have spoken. It is essential to have in it that amount of animal and vegetable life which shall maintain a fair balance; if you either put too much animal life into it, or let more organic matter be in it than can be decomposed by the vegetation, you upset the equilibrium, and get bad water; but I will assume the condition which you have proposed, and referring to the tanks, in which, by long experience, it is ascertained that the water is good, I would rather give the troops that water than rain water, although I should feel perfectly satisfied that I had provided good water if I gave them rain water.

5465. (*Sir P. Cautley.*) Practically it would be out of the question, would it not, to think of providing the troops with water of that sort out of tanks?—Yes, out of the question in every case. In the neighbourhood of Calcutta, many prefer drinking the water I have described. There are well-known tanks in particular spots which have a reputation for good water, and it is preferred to rain water.

5466. (*Sir R. Martin.*) You speak of the natives?—And of Europeans also.

5467. (*Dr. Gibson.*) I think you said that the tanks from which the European troops are supplied with water do not contain either animal or vegetable matter?—They do not; that is to say, decayed animal or vegetable matters in the shape in which I have spoken of them (5402). They are generally tanks of considerable depth, say, 15 to 17 feet, occupying a large area. They all contain more or less of vegetable and animal life, but are generally too deep for water plants (*naiadeæ*, &c.) rising from the bottom.

5468. And, therefore, do you say that the water is not wholesome?—The water in those cases where there is the least amount of vegetation ought not to be so wholesome; but really it becomes a matter of specific investigation for each case. I am dealing with it in a broad and general way.

5469. (*Sir R. Martin.*) You attach more importance, with regard to health, to the characters of the surface soils than to those which are more deeply seated?—Yes; in fact I am not aware, except you get into a volcanic country, where there is an evolution of gases, like carbonic acid, sulphureous or boracic acid vapours, or any other gaseous materials, that the more deep seated strata would introduce a disturbing element, nor am I aware that there are any good or reliable observations which point to rocks in the abstract as having to do with sanitary conditions. When they are ground down into fine silt or mud in the course of rivers, and that is converted into soil, that is the condition when they come into play.

5470. Are you personally acquainted with or have you heard of the influences of ferruginous soils throughout India upon health?—My personal observation on the subject has been but limited; but there is a peculiar and highly ferruginous deposit, composed

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of silicate of alumina and oxide of iron, called *laterite*, which is very extensively developed in certain parts of Southern India, more especially on the Malabar coast and the Deccan. A belt of it extends into Bengal, to Midnapore; but it has nowhere been met with in Bahar or the north-western provinces. It occurs also in the Tenasserim provinces of Burmah, and abounds at Singapore in the Malay archipelago. On one occasion I was deputed to the Tenasserim teak forests, where there are large rivers presenting the physical conditions which characterise the delta of the Ganges, and where one is impressed with the difference in the physical character of the inhabitants, and the comparative exemption which certain of those tracts enjoy from the endemic malarious diseases that are so common in Lower Bengal. So far as physical structure is concerned, what struck me most, as differing from the Gangetic delta, was the abundance of *laterite* rock at the mouth of the Salween river, where I was in the habit of going out in a boat among the sludge in the creeks and mangrove forests with impunity in the month of May. I should have considered it highly imprudent to have risked the same exposure at the same period in the mangrove creeks of the Ganges.

5471. Then you would regard these ferruginous soils as salubrious?—I would; but it is a very limited observation, on which therefore I would not lay much stress. There is one thing, however, which must strike everybody who has visited the Burmese regions, as compared with the valley of the Ganges; there are the two great river valleys of the Ganges and of the Irrawaddy. In the delta of the Ganges you meet with a slight and comparatively feeble race, in the Hindoos of the lower districts. But go 6° further south to the Irrawaddy, where there is a higher temperature, a heavier fall of rain, with a similar delta, and you will encounter in the Burmese and Talaens, a strong, well-developed, and muscular race, who are much more exempt from the endemic diseases so prevalent in the other case. Arracan has proved a deadly unhealthy region, and I believe that *laterite* has not been observed on the coast there, or but sparingly.

5472. So also the valley of the Mahanuddy, in Gondwana, and the countries about Seringapatam?—It may be so.

5473. The west coast of Africa also?—It may be.

5474. And portions of Hong-Kong?—It may be.

5475. The soils at those places are all ferruginous, and they are most unhealthy countries, as also in the southern slave states?—It may be so; my observation was limited to the *laterite* district which I had visited.

5476. You have not observed exceptions to the observations which you have made?—I have not; I was much impressed with the difference between the Burmese and the natives of Bengal.

5477. There again there is the element of the difference of race?—Yes; but you beg the question in using that expression, for what has produced the difference of race?

5478. I am merely mentioning a fact?—But climatic and physical conditions, in the long course of ages, may have produced this difference of race.

5479. (*Dr. Sutherland.*) It is very important with respect to India to separate the removable from the irremovable causes of disease. Bearing in mind the diseases which produce the largest amount of inefficiency and mortality, namely, liver disease, fevers of various classes, and bowel diseases, will you be good enough to state which you consider to be the irremovable causes of disease as connected with physical geology and climate?—I consider excess of heat and excess of moisture as among the irremovable causes, and as those which tell most upon the health. Take some of the healthiest stations of the Himalayas, such as Mussourie and Simla, and put the European soldier there, where you have a climate, with respect to temperature, as favourable as that of any part of Europe, with all the exhilarating influences of

mountain air, and every adjunct that can contribute to health; then let him have certain diseases and be exposed to the rainy monsoon there, generally speaking he does not get better. Such affections as bowel complaints, secondary syphilitic symptoms, and everything in the shape of rheumatism and constitutional ulcers, &c. In Ceylon and at Singapore, where the heat and humidity are still greater, the same facts have been observed.

5480. (*Sir P. Cautley.*) Taking the line of the Himalayas, do you consider that any moderate elevations would be good as a position for troops, say under 4,000 feet?—I do not.

5481. In Bengal there are certain places, near Balasore, for instance, where there are elevated hills to about 2,000 feet; do you consider that they would be good positions for troops?—I do not consider that anything would be really good under 5,000 or 6,000 feet.

5482. Would it not be worth while to try those places?—It might be expedient to make experiments upon some of them; but you would have so many of those disturbing conditions in force that impress me so strongly, that is to say, intense heat and moisture at a low elevation, that I consider you would only imperfectly effect the object you had in view.

5483. The high land near Balasore is covered by jungle, and at its foot there are very extensive forests. Supposing that it was considered advisable to place troops upon that high ground, what steps would you take in the first instance?—I would first determine what the physical conditions were as regards structure, configuration, elevation above the sea, temperature, humidity, supply of water, nature of vegetation, and all that class of phenomena. If at a comparatively high elevation, where oaks, pines, and tree rhododendrons grew, I should consider it immaterial to interfere much with the forest, and safe to locate troops there at once. Only such an amount of clearance would be made as was necessary or expedient for the particular site. But if the elevation was comparatively low, and there was dense forest extending from the plains up to the margin of the steppe or height, I would consider it necessary to make an extensive clearance of that jungle.

5484. The sites which I allude to are below those points where the oak and the rhododendron would naturally thrive?—Then I would clear a wide belt of the jungle below the site.

5485. Having done that, would you at once send European troops thither?—Yes, on trial, but I would be very chary about the number, for it must be remembered that I am always considering that European troops sent to a locality of that kind, at a low elevation, covered with forest, never have the fair chance that you can give them if you put them at a higher elevation; in the abstract, they are not eligible localities unless there are certain military or political reasons which make it advisable to convert these spots into cantonments.

5486. (*Sir R. Martin.*) Referring to the subject of mountain climates generally, should you not consider it very desirable that a systematic and detailed inquiry should be made throughout the three presidencies with a view to ascertain the actual climates of the many ranges to be found throughout India. I mean an investigation conducted by well-qualified and scientific men?—But of what kind?

5487. With regard to the nature of the climates, and their characteristics?—A great amount of valuable information, amassed during many years, already exists in India, relating to most of the subjects you have mentioned, and it does not appear to me that any separate scientific establishment or expedition for a fresh investigation is required. A measure of that kind extending all over India, would occupy a long time, and be very costly. It seems to me that it would be better first to collect and put together what is already known, and that could be done by means of the scientific staff of the India office, with a little assistance. Where information

was deficient regarding any particular district, that might be made a subject of special inquiry. The principal scientific points of a strictly physical nature that are desired, are the elevation above the sea, range of temperature, rain fall and humidity, and nature of the vegetation. When you have got these, general and medical observation would supply the rest; there is a medical service spread over the continent, including many officers of high and distinguished qualifications. As I have already said, a great mass of valuable information on the above points already exists, and only requires to be compiled.

5488. As yet, I think, opinions are very much divided about the nature of the climates, according to the elevation, and that circumstance arises from want of due investigation. I am referring to the climates of the mountain ranges generally throughout India?—That may be the case as regards the medical aspect of the question, but it does not appear to me to be so otherwise. There are numerous and excellent observations on most of the principal mountain ranges of India. Take the Himalayas, the Western Ghauts,

and the Neilgherries. The temperature, fall of rain, elevation above the sea at different points, on all of them are well ascertained. In the Himalayas there are stations at intervals from Sylhet on to the Punjab, and there are well known stations on the Western Ghauts and Neilgherries.

5489. But the great ranges in the country of Travancore are utterly unexplored, and so also are many ranges in the centre of India?—The most imperfectly explored of these ranges are probably the Vindhia and Aravalli hills and their offsets. The Travancore mountains are better known. The highest peaks reach an elevation of from 8,000 to 9,000 feet, and the remarkable climate of Courtalam, hygro-metrically humid, but with little rain, has been determined. The vegetation even of the Travancore mountains has been investigated by Wight, a distinguished Indian botanist, on to Cape Comorin. But in reference to the general question, the Travancore mountains being at the extreme end of the peninsula, the position might not be regarded as an eligible one for a great body of European troops, on strategical and political grounds.

The witness withdrew.

Dr. JOHN SUTHERLAND, M.D., examined.

5490. (*Chairman.*) You have examined the various Returns made in answer to the questions sent from this Commission to the stations in India; will you state generally the result of your examination as it bears upon the sanitary condition of those stations?—I must begin by stating, that although I have had an opportunity of examining sanitary conditions in warm climates, I have never been in India, consequently I can only form a relative opinion as to the value of local causes of disease in that country. I shall, therefore, answer the question just as I would answer it were it put to me with reference to our home barracks and stations with which I have an acquaintance. I have examined about 100 sets of replies returned to this Commission in answer to queries relating to the sanitary condition of troops sent under the authority of the Commission to all the stations in India, and the general results of the examination are as follow:—

First, with regard to the water supply:—there is little or no satisfactory information as to the quality or quantity of the water from any one station. No chemical analysis of the sources of supply appears to have been made except in one or two instances. The supply of water is obtained chiefly from shallow wells at no great distance from the barracks. The quality of the water as described is often inferior and bad, and the means of collecting and distributing it are of the most primitive description, and very objectionable as regards health. They would be considered so in this country. We should certainly recommend for our home stations the abolition of the entire mode of supply of water mostly used at the Indian stations, whether as regards the source or the mode of collection and distribution. There has been no application apparently of any modern improvement as regards either the examination of water sources or the means of collecting or distributing water for use either for stations, bazaars, or towns. I think there is one exception, and that a recent one, in the case of Bombay, in which I believe they have introduced better water than they had a short time ago. I am decidedly of opinion that the condition of the water supply, both as regards its domestic use and its relation to efficient drainage, is one of the cardinal defects in the sanitary arrangements in India, and that it is unquestionably a predisposing cause of disease, especially during the prevailing seasons of cholera, fever, dysentery, and other zymotic diseases.

Next as regards the replies as to climate:—The means of observing and recording meteorological facts are, with a few exceptions, very imperfect; recently, I believe, the Government of India has done more in

this direction, but, generally speaking, the information, except in the case of Government observatories, is very imperfect, so that practically the elements of local climate are either unknown, or are very imperfectly ascertained for the majority of stations. There may be other sources of information than those furnished by the returns, but I speak of the returns made to our inquiries as to local climates. There are remarkably few complaints as to the unhealthy nature of local climates or as to any injurious effect from them upon the health of the troops.

I next come to the questions, having reference to the sanitary condition of the stations. My remarks on the results of the replies having reference to this very important subject, must necessarily be very general, covering, as they do, so large a field of inquiry; and I make them with this qualification. Except with regard to the surface cleansing of the cantonments, which appears to be more or less carefully attended to, little or no attention has been paid to what we, in this country, consider the elements of sanitary improvement. There is surface drainage of some kind or other in almost all cases, but no drainage in the proper sense of the word, and even the surface drainage is often imperfect or bad. The rainfall or the surface water is allowed either to sink into the ground, or it is carried away by open drains into ravines, both of which are often very offensive. Privies and urinals are generally without drainage, in the proper sense of the term, and both are often very noxious. Offensive smell from both privies and urinals is a most common condition, and such smells in such a climate, always indicate danger; they always indicate danger in this climate, especially in epidemic localities and during epidemic seasons, and they must indicate danger in India, and of course a greater amount of danger than exists here. The immediate removal of the excreta, such as is practised at the stations, or professed to be practised, is certainly infinitely superior to cess-pools, but to be effectual, the removal must be very frequent and very regular, especially during epidemics. If at any station that system must be continued, because it is impossible to adopt a better, I do not think it would be safe to allow the excreta to remain over-night, and they certainly ought to be removed at the very least twice a day. The present system of dealing with the solid and fluid excreta of stations, considered in relation to its influence on the sanitary condition both of barracks and hospitals, admits of very great improvement.

Generally speaking, the roof gutting of barracks and hospitals is deficient, and the roof water is allowed to sink into the subsoil close to the buildings, keeping

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the subsoil damp where it should be kept dry. The drainage of the cook-houses, ablution rooms, &c., is defective; it is often received into shallow cess-pits emptied daily, a proceeding which is nothing more than an imperfect and expensive mode of drainage. The water is allowed to run into a cess-pit, whence it is emptied and carried away by hand labour; but in many cases the cess-pit is not intended to be emptied, and the drainage soaks into the subsoil.

With regard to bazaars:—Some bazaars are reported to be clean and healthy, but generally large populations have grown up close to military stations without order or regularity, and in one instance, at Bangalore, it is stated that a population of 124,000 has sprung up inside the cantonment without any regard whatever to sanitary arrangements. There are very often dung-pits and cess-pits among the houses in these bazaars; there are very few privies, and the people answer the calls of nature in the open air. There is no drainage except mere surface drains; the water supply is often very bad and unwholesome, and sometimes it is drawn from tanks, which it is stated are also used for bathing, and for receiving the drainage and filth of the station. There is generally some arrangement for cleansing the bazaars, but often not very effectual. The bazaar houses are generally described as overcrowded, and the ventilation as bad; there are some exceptions, but this is the general result. Then, with regard to native towns near stations, there is a total neglect of sanitary precautions as to cleanliness, drainage, and water supply, as well as of regularity of construction, or arrangement of the houses; there is overcrowding of the surface by houses, and all the usual elements are present which in more temperate climates would predispose to cholera, diarrhoea, dysentery, fever, and epidemics generally. In short, if the sanitary defects described in these returns are looked at from our point of view, they would make out India to be necessarily the native country of cholera and other bowel diseases.

With regard to barracks:—The barrack construction contains the elements of simplicity and healthiness, if these were somewhat better used. The principle of construction is simply that of a long room with a high pitched or terraced roof, with doors and windows on the opposite sides, and verandahs to keep out the sun. These are all good points, but they are accompanied with certain defects, as we should consider them here, in detail. For instance, many of the rooms are too long, and contain far too many men, from 100 to 200 or more. It is impossible to ventilate such rooms efficiently. I am of opinion from the nature of the evidence, that quarter company barracks, that is, separate houses for 20 or 25 men, are about the limit to which we should go in this mode of construction in India. There are double verandahs in many of the barracks, which interfere injuriously with the ventilation. The inner verandahs, where there are two sets, are occasionally used as sleeping quarters, and whenever that is the case there are four rows of beds, instead of two, between the opposite doors and windows. The practice of putting more than two rows of beds between the opposite doors and windows is quite inadmissible for barracks or hospitals.

I have here a few examples of the forms of construction adopted in Indian barracks to illustrate this part of the subject. This is a plan of the barracks at Madras, which we should say in this country are hardly fit for troops. This is a plan of a recent construction,—the hospital at Meanmeer near Lahore,—and the defects in the application of a good principle are at once evident in this case. There are, it will be observed, what is equivalent to five ranges of rooms between the opposite windows. It is impossible to ventilate efficiently such a hospital. Here is one still worse, a female hospital at the same station, in which there is a set of cells of the most complicated description,

which can never be kept properly ventilated. As a contrast to these defective structures, I have here the plans for Kurrachee, which at once show the difference between a good healthy construction and a bad construction. This construction is perfectly simple. It consists of one central room with a single corridor round it for protection from the sun's rays, and it admits of the most ready perfilation of air across it; the arrangements for ventilating are very good; there are windows capable of opening under the eaves; there are ventilators all the way along the roof. The hospital plan is similar, and both afford a good specimen of what an Indian barrack and hospital ought to be, except that the rooms are too long and contain too many men.

5491. (*Chairman.*) That fault of too great length is remedied by the simple plan of putting walls across, is it not?—That would not be sufficient for the purposes of health, for barrack rooms in India should be écheloned and separated to such a distance one from another in the arrangement of the station as would ensure entire freedom of external ventilation between the buildings.

The Kurrachee barrack has one centre room, with an open verandah on each side, whereas the Meanmeer hospital has one centre room with two verandahs on each side. Another important matter as regards detail is that the present construction of the doors and windows is apt to expose the men to draughts, and I think that this might be improved with great advantage. In many instances there are no sufficient means of ventilation when the doors and windows are shut, in consequence of wind, dust, or rain, and there are frequent complaints of this matter. In the next place, the cubic space is often very defective, especially in native quarters; in other instances the cubic space appears large, but from the unnecessary height of the rooms it is above the heads of the men, so as to crowd them on the floor, and there is no proper recognition of the fact, that in hot climates ample superficial area for the men, rather than large cubic space, is the element to be considered. Then, another very obvious objection to the present construction is that the barracks are not raised sufficiently above the ground, and in very few instances indeed are they raised at all. Where they are raised the plinth is generally filled in with earth paved over, and there is no free perfilation of air between the floor and the ground. The consequence is that ground malaria enters both barrack rooms and sick wards. In one instance it is reported that a hospital so constructed was pervaded by a very noxious effluvium, the commanding officer ordered one of the flags to be taken up in the presence of several people to ascertain the cause, and the odour that came out was so unbearable that everybody fled.

5492. To what do you ascribe that circumstance; had they been in the habit of depositing nuisances under the floor?—The ground underneath had probably been saturated with organic matter before the hospital was built; it was a flagged floor; in one of the Bangalore hospitals.

5493. (*Dr. Farr.*) All that would have been obviated if there had been a free perfilation of air underneath?—Yes; perfilation of air underneath the floors of all inhabited apartments, and entire isolation of the floors from the soil is essential to health in tropical climates; the amount of isolation from the soil must depend very much upon the nature of the locality. In India it is not safe for men to sleep within the sphere of malaria proceeding from the ground, or within the limit of night fogs. The floors of both barracks and hospitals ought to be raised several feet above the soil on arches; the height varying with the nature of the locality. In low flat positions, troops as well as sick should always sleep on upper stories.

Again, the arrangement of the barrack plan is not always such as to secure a sufficiently free external

ventilation, especially in the native lines. On the other hand, in many cases the stations cover so very large an area of ground that there is good external ventilation. There are, however, good methods of arrangement and bad methods of arrangement, and these plans show both. For example, there are barracks at Umballa arranged *en échelon*; which is a most excellent arrangement for securing a free external movement of the air about the buildings; in fact, it is the way in which all barracks in India should be arranged. Then this diagram shows the station at Bangalore, with an arrangement in part of it, that is inadmissible.

5494. Are the barracks represented there supposed to be a solid mass of building?—There are parallel lines of quarters with very narrow spaces between, but this diagram exhibits it better. A simple comparison by the eye between the one and the other will show at once the disadvantage of the arrangement in close parallel lines, and the great advantage of the Umballa arrangement *en échelon*. There are certain practical results which follow from this. In the native lines the natives often use the space between the huts for depositing all sorts of nuisances; the ground gets saturated with wet and filth, and the wonder really is that there is not far more sickness among the native infantry than there is from the arrangement which these plans exhibit.

With regard to the probable effect of these sanitary deficiencies on the production of disease, I should say that the zymotic diseases which scourge the Indian population, and occasion the largest amount of loss and inefficiency among our own troops, are the same as those which are known to arise in this climate from want of drainage, defective ventilation, and decayed vegetable and animal matter, bad water, and intemperance, especially spirit drinking. The diseases which occur during the unhealthy months are of the same character; the atmospheric changes appear to call the existing local causes of disease into greater activity.

Next with regard to diet. The soldier's ration appears to be ample. Complaints are occasionally made of a deficiency of vegetables. From half-past seven to eight a.m. appears to be the usual breakfast hour; the men having been up before daybreak for drill without refreshment. Dinner usually follows at one or half-past one p.m., so that the heaviest meal is eaten in the hottest part of the day, and the soldier generally spends his whole day listlessly in his barrack-room. Tea follows at five or half-past five o'clock p.m. sometimes as early as half-past four, and there appears to be no refreshment afterwards. Considering what the climate of India is, this system of dieting cannot be conducive to health. The ample ration, disposed of in such a way, together with the very limited amount of work and of exercise, is beyond doubt a predisposing cause of disease among troops in India.

The cooking arrangements as described are of a most primitive description, and the cook-houses are often defective, but at the same time the cooking is not often complained of.

With regard to intemperance, there appears to be more continual and habitual tipping of spirits in India than absolute drunkenness; but it is very questionable whether tipping every day to the extent of the present allowance, namely, about six ounces of ardent spirits daily, or even to half that extent, is not absolutely more destructive to health than occasional drunkenness, especially in such a climate. The great body of the evidence goes to show that spirit drinking in India is a potent predisposing and aggravating cause of disease and mortality, and that it ought to be put an end to as a point of public policy; some of the reporters advocate the practice of selling spirits in canteens, lest the soldiers should get worse spirit elsewhere, but the great majority recommend beer to be substituted, and the sale of spirits in canteens to be abolished.

The means of recreation, instruction, exercise, and occupation, both out of doors and indoors, are everywhere most deficient. Notwithstanding the much greater necessity for providing the soldier with suitable exercise and recreation in India, the means provided hardly ever exceed in amount the deficient supply in barracks at home, and not unfrequently they fall below it. Hence there is no sufficient inducement for the soldier to occupy himself. The tone both of mind and body is lowered, and the soldier's only resource is idleness or vicious indulgence. All, or nearly all, of the reports advocate an increase of the means of occupation. There is no doubt that want of exercise, and the listless manner in which the soldier in India passes his time, is another potent cause of disease.

With regard to hospitals, it appears that they are constructed on the same general principles as barracks with verandahs, sometimes single and sometimes double; the inner verandah is sometimes used for sick, a practice which is inadmissible.

The position of the hospital is generally good, but sometimes it is in dangerous proximity to privies and open drains, or to other nuisances infecting the air in the wards. There is often deficient cubic space, and deficient surface area per bed; the hospitals have no drainage, the water supply is the same as that for the barracks, and open to the same objections, as to the source from which it is obtained, and its manner of collection and distribution. There are no water-closets, and the latrine arrangements are most defective, often very offensive, and in such a climate, unwholesome. There are hardly any suitable lavatories for the sick, and no proper bathing arrangements. Many barracks have large baths attached to them, while the hospitals belonging to these barracks have no proper means of bathing the sick, who are thus virtually deprived of the use of one of the most necessary and important remedial agents.

The means of cooking are of a most primitive kind, and the cooking is sometimes complained of as not being good; but generally the means of cooking are considered sufficient. There is no perfilation of air under the ward floors, and the sick are exposed to ground malaria in consequence; the bedding consists generally of wooden cots instead of iron. In a number of the hospitals they have recently introduced iron cots, but still in many instances there are wooden cots, both in hospitals and in barracks. The ventilation of the hospitals is often defective. Attendance upon the sick is provided for by native hospital servants. It is described as sufficient, but serious cases appear to be frequently attended by the soldier's comrades. We object to comrades being taken indiscriminately from a regiment to act as attendants.

5495. On what ground is that objection made?—Because they are not trained. According to arrangements now being carried out in Queen's regiments, all regimental orderlies will be supplied from the regiment, but they will be trained before being sent to serve, and after being once attached to a hospital they will not be liable to be removed except for misconduct or inefficiency. Generally speaking, we should consider the arrangement of nurses' rooms, sculleries, &c. as defective, and not suitable for hospitals in this country. The native hospitals, according to the description given, are perhaps the most defective of all the establishments for sick; they are defective in cubic space, conveniences, nursing, and everything.

The burial grounds are generally sufficiently removed from cantonments, and properly regulated, but sometimes they are in the heart of cantonments, and bazaars, or native towns, and give rise to nuisances.

With regard to the powers exercised by medical officers, these officers have hitherto had no definite powers as to sanitary matters, and their influence in preventing disease has been uncertain and ill-defined. I am of opinion that the new medical regulations of the 7th October 1859, issued by Lord Herbert, would be applicable to every station in India, and would effect immense good.

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With reference to the evidence on hill stations, there is a remarkable unanimity of opinion as to the propriety of locating troops on hill stations, especially during the early years of service, provided there are no military or other reasons against it, because the question is guarded in this way. There is at the same time sufficient evidence to show that sanitary defects exist at those hill stations, as well as at stations on the plains, and that those defects lead to injurious consequences. One of the returns, for example, states that the barracks and hospitals at Subathoo and Kussowlie (the one 4,000 feet, the other 6,400 feet above the sea level) are considered defective in structure and plan; and that at Mount Aboo, 4,000 feet above the sea, the two barracks have been erected in a malarious gulley. In the case of Wellington upwards of 5,800 feet above the level of the sea, the medical officer states that from want of drainage there was considerable sickness when the station was first occupied. Even at Darjeeling, 8,000 feet above the sea level, the medical officer reports the sanitary condition of the hospital as "bad," and he states that for five years he had to make representations with regard to a privy under a verandah connected with the hospital before he could get the nuisance abated, which rendered the wards on that side so offensive that the sick sent up to that great elevation to recover their health, had to be removed out of them. The practical result is that sanitary precautions have been overlooked both on hills and in the plains, and that whether hill stations are occupied or not, sanitary considerations must be equally attended to, otherwise hill stations will be of very doubtful benefit.

The general conclusion I have arrived at from the whole evidence furnished by these highly important and interesting returns is, that although a somewhat better system in selecting stations exists now in some parts of India than formerly, there is in India no sanitary administration in the proper sense of the term as we understand it in this country, for preventing disease, whether as regards the construction and arrangement of buildings, water supply, ventilation, or drainage, and the present unhealthy state of the troops is in my opinion to a great extent the legitimate result of the absence of a sanitary system, and to the same cause is to be attributed the high rate of mortality, and the great prevalence of epidemic disease among the native population.

5496. (*Chairman.*) When you say that there is no sanitary administration in India will you be kind enough to explain exactly what you mean; are not the medical officers to be considered as sanitary officers?—The medical officers attached to large stations have a certain power of advising, and at large stations and cantonments, as I have said, there are certain means carried out of surface cleansing, and the same thing is done with regard to bazaars with more or less efficiency; but these things, although in themselves very necessary, do not constitute sanitary administration as we should understand it. It appears to me that at the Indian stations there is a want of consistency of procedure, directed from a centre or centres, so that the same system should be adopted throughout upon certain known and well-defined principles and grounds. Unless that is done you may have a commanding officer, or a medical officer, or a resident engineer, with a thorough knowledge of all matters relating to health, and doing everything that was requisite, and the very next occupants of the same station may neglect everything, or even in the same cantonment you may have two neighbouring corps, one of which may be attending to every requisite sanitary precaution, and may nevertheless be suffering from disease arising from neglect of sanitary measures on the part of the other corps, and there are no means of preventing it.

5497. The medical officers have only the power of giving advice?—Yes.

5498. (*Sir R. Martin.*) The medical officer of health has not yet been thought of practically in

India?—There is no evidence of the existence of an officer of health in India furnished by any of these returns. I may say that the principal medical officers at stations appear to have been recently charged with certain sanitary functions; but the question is so important a one, and so large a one, that I do not think that any man whose time is occupied with other duties can attend to them. I think that to meet the local circumstances, the sanitary administration in India should be made a special one.

5499. There is no order and no system?—Neither order nor system.

5500. (*Dr. Farr.*) The duty of the medical officer has hitherto been to treat disease?—Yes; and from the very force of circumstances in India, to attend to a certain extent to the health of the station; but he has no power, and has not been educated for it; he has to pass no preliminary examination for it and the result has been what these reports indicate namely, a great difference in the opinions entertained as to the importance of certain causes of disease. Some officers appear to hold very sound views on the subject, while others, after describing very obvious sanitary defects and their injurious results to health, nevertheless consider their stations as healthy.

5501. In our army from the first the surgeon was appointed chiefly to treat the wounds of the soldiers?—Yes.

5502. That was considered his special duty?—Yes.

5503. And that notion prevails almost as a tradition down to the present time?—Yes.

5504. Even in the medical schools there is no regular sanitary instruction or lectures upon that subject?—None; and to obviate these defects a great improvement has been recently introduced into Her Majesty's service. Every medical officer who joins the service now is obliged to go to Chatham for a certain time, where there is a medical school, and in that school there is a professor of hygiene, who teaches scientifically and practically the sanitary duties of the service. In addition to this, there is a Code of Regulations, prescribing exactly the duties which the medical officer has to perform in the discharge of his sanitary functions, and his relation to his commanding officer in that matter, and what the commanding officer has to do. The medical officer makes a representation in words on any subject affecting the health of the troops, and if the commanding officer does not attend to this verbal representation, the medical officer reports in writing, and the commanding officer must attend to it, or state his reasons for non-compliance to the superior military authority. In addition to this, as the Director-general can inform you, there is a special sanitary department in his office, with a sanitary head, whose whole duty is to look to the health of the army; to him are referred all reports bearing upon the subject, and from him go all instructions through the Director-general to the medical officers, which they are to carry out. Some such system applied to India would meet the case of troops, and also the requirements of stations, provided there were other administrative departments for planning, directing, and carrying out all sanitary works, of water supply, drainage, ventilation, improved plans, construction, &c., required.

5505. Do you recommend a special sanitary department for India, or would you leave it still in the hands of the medical officers of the army?—I do not think that the sanitary service of the army would by any means meet the whole case. I have been often impressed on reading over these returns with the conviction that it would be well that each presidency should have its own sanitary administration, its own health office, and its own agents for carrying out its own work.

5506. Should that be strictly in connection with the army, or do you contemplate its being applied in any way to the advantage of the civil population of India?—I do not see how you can separate the two, except in so far as relates to points of a purely military

character; there are many stations in such close relation with the civil populations, that unless you attend to the health of both you could not expect a good result.

5507. Do you think it possible to maintain our army in India in health if the population continues to be subject to the attacks of great epidemics?—Certainly not. If the army is stationed among or near the native population, the army will be liable to the same attacks as the native population.

5508. (*Chairman.*) You have spoken of the cubic space allowed to the soldiers as being deficient; what number of cubical feet do you think ought to be given to each man in a tropical climate?—That will depend upon the local position of the barrack. If the barrack is placed on very high ground, with the atmosphere playing freely about it, you can do with a smaller amount of cubic feet than in a low locality, where the circulation of the air is less perfect. I should say that for India the minimum should be 1,000 cubic feet of space, and 80 square feet of surface; the maximum should be 1,500 cubic feet of space, and 100 square feet of area.

5509. Is not that almost double as much as is necessary in a barrack at home?—It is about double as much as is necessary in a barrack at home, a little more than double; the average would be about double. With regard to hospitals, we require at home 1,200 cubic feet, and in warm climates 1,500 cubic feet per bed. I should make our regulation for warm climates the minimum for India, that is 1,500 cubic feet, and the amount of cubic space per bed should lie between 1,500 and 2,000 cubic feet for India; in the more exposed positions I would give less, and in the closer positions I would give more.

5510. Would it be advisable, considering the state of the native towns, to lay down as a rule that no buildings not under military administration should be allowed within a certain distance from a station?—I think it would be in the highest degree advisable.

5511. If that were done, what steps do you think would be sufficient to give adequate security?—I should allow no native town to windward; I should send them to the leeward: but you might allow them to build to the leeward, and I should extend the same principle, and lay down certain outlines of streets and roads and open spaces; in fact, before a bazaar is allowed to grow up, the military authorities should lay down a plan for streets and roads, and open spaces, as well as for all sanitary arrangements, water supply, drainage, latrines, &c.

5512. You say that, from the evidence before you, it appears that surface drainage is attended to, but that there is no other drainage?—No; that is to say, there is no subsoil drainage, and no drainage for removing the foul water from privies and urinals, or the water of washhouses or cookhouses, or anything of that kind.

5513. Do you think that the nature of the Indian soil and climate may not present considerable difficulties in the way of subsoil drainage?—I do not see that the fact of the more rapid evaporation, or the greater rapidity with which absorption takes place in some soils, is any reason why the soil should not be drained. I think that in very high and exposed stations, if you had a porous soil and a good fall for the surface drainage, the same attention is not required to subsoil drainage as upon flat surfaces; but in all ordinary cases I do not see that there should be any neglect of subsoil drainage merely because the climate happens to be dry, or the soil porous. A drained porous soil is practically the healthiest of all soils, but a porous soil, if undrained, is speedily saturated with decaying organic matter from the population on its surface, and becomes after a time one of the most unhealthy of soils.

5514. You say that more than 25 men ought not as a rule, to be allowed to sleep in one room; would not that require a great additional amount of supervision; for at present, as I understand it, one of these long rooms, which contains sometimes 200 men, is superin-

tended by only one or two persons?—The practice of subdivision exists in some stations or parts of stations already, even to a greater extent than I now advocate. There is one station in this list in which the number of men per room is 18; in another the number is 40. At Dinapore, there are two infantry barracks, which contain in each 308 men in one room; and there are a number of other barracks which contain only 16 men per room. These are temporary separate barracks. What I advocate is the adoption of a fixed unit of construction. I consider that separate barracks for from 20 to 25 men are, from the evidence, the most suitable for health and administration for India, and these barrack units, besides being properly constructed, must be so arranged as to have pure air freely playing about them.

5515. You complain of the bedsteads used in the hospitals being made of wood; what is the disadvantage of that construction?—The vermin.

5516. (*Dr. Farr.*) You attach great importance to malaria as the cause of diseases in India?—Yes.

5517. How do you think that could be obviated or diminished, or how could the troops be placed in stations so as to be out of its reach?—It is impossible to say whether in any given part of India you could abolish malaria. I am certain that you could diminish it greatly by clearing, cultivation, and drainage; but with regard to what may be considered as the irremovable causes of disease, there is one general observation to make, namely, that the conditions of health at any one place are dependent upon the operation of all the causes at that place; and the true sanitary principle is to remove all those causes that are removable with the certain expectation that the constitution will be better able to withstand those that cannot be removed; so that if you cannot get rid of all the malaria, you will enable a man to stand against its effect, better by removing other causes that may predispose to disease.

5518. There is another cause, the high temperature of India, and its peculiar hygrometrical state with which you cannot deal?—You cannot deal with these, all you can do is to deal with the removable causes.

5519. Do you attach much importance to temperature as the cause of the excessive diseases of India?—Temperature by itself cannot be said to predispose to any particular disease; but there is no doubt that long continued high temperature, by lowering the general tone of the body, makes a person exposed to it much more liable to the operation of other causes than he would otherwise be.

5520. You have seen yourself in England many instances of the ill effects of bad water in increasing the mortality of cholera?—Yes.

5521. Have you any doubt that that is a very important element in the sanitary condition of India?—Not in the least; we have sufficient evidence to show that bad water will produce intermittent fevers, and we have evidence to show that water containing organic matter in a putrescent state, especially animal organic matter, is a most powerful predisposing cause of cholera. The results of our experience during the years 1848 and 1849 went to show that of all the predisposing causes of cholera, water polluted by sewage was the most powerful, and produced by far the largest amount of mortality. During the cholera of 1854 a similar remark was made as to the metropolis generally, and there cannot be any doubt that on that occasion the south side of the Thames, which was supplied with very inferior water, suffered to a much larger extent than it ought to have done; and the same thing applies to dysentery. I have no doubt that impure water is a predisposing cause of dysentery, especially if there happens to be present a constitutional predisposition to dysentery at the time.

5522. That cause of disease is in extensive operation at all the stations in India, as far as you can gather from the reports?—I have little doubt that it is more or less in operation at the majority of the stations, and the reason is that the stations are chiefly

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supplied with water from shallow wells, and those shallow wells are never safe in any ground which is inhabited for any time. The filthy stagnant water of tanks abounding with decaying organic matter from vegetation, surface drainage, nuisances committed on their banks, and other sources of impurity, produces similar results among native troops and among the native population generally.

5523. You mentioned that these very diseases which prevail in India were formerly equally fatal in London?—I said that the zymotic class, including bowel diseases, which is so prevalent in India, is the same that we find connected with the same removable insanitary conditions at home.

5524. In London the bills of mortality show that dysentery, bloody flux, and fevers were the causes of innumerable deaths in the 17th century?—Yes, to a much larger extent than has existed since London was improved.

5525. It is now a sort of tradition to consider those diseases which are so fatal to our army in India as indispensably connected with their position in that country?—Yes; the natural habit of people in rising to a state of civilization, when they see epidemic disease, is to attach it to a locality, and they say that such and such a disease belongs to such and such a place, but they never go further. It requires a much higher advance in civilization and knowledge to ask why the disease is in the place at all. That inquiry has been made and answered in England, but it has as yet been very insufficiently made in India.

5526. From what you find in the returns, do you think that any considerable reduction in the mortality in the army in India may be effected by sanitary measures?—Certainly.

5527. But you can form, I suppose, no estimate of the probable reduction?—That I could not do; that would require a personal knowledge of the climate and stations of India; but I have no doubt that a very considerable reduction in the mortality can be effected. This might be anticipated from the fact that stations in India differ very considerably among themselves in the amount of mortality; there are some stations which are much more healthy than others, and there are some which are much more healthy now than they were formerly, while if the diseases were attached by nature to the country, such changes in the state of health would not occur. Besides, we have ample experience in the West Indies of the most unhealthy of all our military stations ranking among the most healthy under improved sanitary management.

5528. Do you consider it quite necessary to remove a large portion of the army in India from the plains to the hill stations, in order to give them the chance of enjoying tolerable health in India?—That again

would require special knowledge of localities which I do not possess; but on general sanitary grounds, removal to elevated stations involves very important sanitary changes; for instance, there is the lower temperature, and the more healthy hygro-metrical state of the air; and there are also great facilities for obtaining pure water as well as for drainage. During the inquiry that was made in India some years ago as to the places exempt from cholera, it was found that those places which had a natural facility for drainage were the places that were exempt, and for these and similar reasons I think that it is in the highest degree probable that the locating of troops on high ground would be attended with very great sanitary advantages. At the same time, such is the unfavourable sanitary condition of many stations in the plains, arising from the defects in water supply, drainage, ventilation, absence of recreation and exercise, spirit drinking, and similar causes already mentioned, that it is impossible to say how much the mortality there might not be reduced by proper sanitary measures and improved management.

5529. You would carry out sanitary measures at all the great stations in the plains, and you think it is expedient generally to place troops on the high grounds when it is practicable?—Yes; sanitary precautions are absolutely necessary at all stations, whether on hills or plains. It will be of little use to remove the troops to the hills unless the hill stations be preserved in a thoroughly efficient sanitary condition. If this be neglected, you will have at the best no better results than have in past times been realized from the sanitary defects of our home stations, which led to so high a rate of mortality in one of the healthiest climates in the world.

At the same time, as regards India, the evidence all goes to show that whenever it is practicable troops should be placed on the high grounds. There is a difference of opinion as to the elevation, but none as to a proper elevation being selected.

5530. It is well established, is it not, upon many grounds that the atmosphere and the water are purer on the high grounds than upon the alluvial plains?—Yes.

5531. You have not examined the whole of the returns, and, therefore, what you have stated now might be subject to addition or modification, if you see reason to change it from subsequent information?—We still want about 50 or 60 returns from India; but I thought it very desirable to state now what result was to be obtained from the returns that have come in. There may be, with regard to other stations, something that may lead to different conclusions. I have at present spoken only from the returns that I have gone over.

The witness withdrew.

Dr. W. Farr,
M.D., F.R.S.,
D.C.L.

Dr. WILLIAM FARR, M.D., F.R.S., D.C.L., examined.

5532. (*Chairman.*) I understand that you have been making inquiry into the manner of procuring medical sanitary statistics which prevails in India?—I have. I was requested by this Commission to examine the returns in the Indian department, and to prepare a set of tables, which have been submitted to the Commission.

5533. That was when Lord Herbert was chairman of the Commission?—Yes; and we found a great deal of information in those returns; but on the whole it was exceedingly difficult to get precisely what we wanted; for instance, to ascertain the relative sanitary conditions of the several stations in which the army is placed. We almost failed in getting this information from the returns of the Company's troops, in consequence of which we applied to the Director-General of the Army, who was kind enough to request Dr. Balfour to endeavour to supply the informa-

tion from the returns of the Queen's troops. Dr. Balfour has, in consequence, placed before the Commission a series of tables which are very valuable, but still they are defective, as they do not show the mortality at many of the stations for any considerable number of years. It is, therefore, very important that the system which is now in operation in the Queen's army in England should be introduced in India, as that would enable the Director-General to supply a return showing the mortality in each regiment, year by year, from the time it goes to India until its return. In that way there would be no difficulty in determining, from the medical returns, the diseases and the mortality incidental to each station. I wish to express strongly my opinion that the system of recording and analyzing the diseases of the army in England should be extended to India, where it appears to me likely to be more useful even than it is in England.

The witness withdrew.

Saturday, 13th July 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.
 Sir RANALD MARTIN, C.B., F.R.S.
 J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.
 JOHN SUTHERLAND, Esq., M.D.

Sir ALEXANDER MURRAY TULLOCH, K.C.B., examined.

5534. (*Chairman.*) We understand that you have made considerable inquiries into the vital and sanitary statistics of the army?—Yes; it has been my duty to do so for a number of years.

5535. Have you prepared a collection of those statistics which appears in the form of parliamentary papers, and is founded on the experience of some 17 or 18 years?—Yes, it is founded in some cases on the experience of 30 years.

5536. Not only with regard to home service, but with reference to the colonies?—Yes; but at home it is not founded upon more than about 17 years' experience; with respect to the colonies, the experience has been much longer. The information at home is not so complete as it is abroad, owing to the number of changes that are continually taking place among the troops from one town to another.

5537. Do you include India in the statistics which you have collected?—India was not included at the time the statistics of the troops in the colonies were published, as the home authorities had then no means of bringing about any changes they might consider necessary; that rested with the East India Company.

5538. When was that inquiry set on foot?—I commenced it in the year 1835, and it embraces the years from 1816 or 1817 down to 1836; but the results were not published until 1838. A continuation was subsequently prepared by me, bringing the results, so far as regards the United Kingdom, Mediterranean, and American stations, down to 1846.

5539. Have you examined into the causes of disease among troops resident in tropical climates?—Yes, so far as the medical returns have afforded me an opportunity.

5540. Do you find that the excess of the mortality in tropical climates has been considerable over the mortality in the same class and at corresponding ages in temperate climates?—Very much so, indeed.

5541. I believe it was so especially in the West Indies?—Particularly so, the mortality there being about 8 per cent., and about 13 per cent. in Jamaica, instead of $1\frac{1}{2}$, which is supposed to be the ordinary rate among troops in this country.

5542. Is it within your knowledge that a very considerable reduction in that mortality has been effected?—A very considerable reduction indeed; in the West Indies it has been from 8 to 6 per cent., and in Jamaica from 13 to about 7 per cent. on the average of the 24 years subsequent to 1836.

5543. Are you cognizant of the causes which have led to that great diminution in the mortality?—The chief causes I believe to have been the improvements after the year 1836, when the attention of the Government was first called to the enormous loss at these stations. Certain changes were then effected, which you will find detailed in the Report upon the West Indies presented to Parliament in 1838. These consisted of a larger issue of fresh in lieu of salt provisions; an increase in the barrack accommodation; in the frequency of the reliefs; in the attention paid to the comfort of the troops, and to their recreation and amusements. In Jamaica a change also took place by removing the troops to the high lands, where they were beyond the reach, or supposed to be beyond the reach, of malaria.

5544. With regard to two of the remedies which you have mentioned, the issue of fresh instead of salt provisions, and providing better barrack accommodation, I apprehend that those are now carried out throughout the British empire?—Yes, the use of salt provisions are now restricted to one or two days in the week, being only as much as will secure the consumption of the salt provisions required to be kept in store in most of our garrisons.

5545. Speaking from the experience which you have acquired in these investigations, what should you say are the principal causes, at the present time, of disease and mortality in the army, especially in tropical climates?—One of them is, that the cubic space allotted to each soldier is not sufficient. I am aware that great improvements are being made; but looking to what is now the rule, that is to say, 450 cubic feet for each soldier, I do not think that sufficient in a tropical climate.

5546. How many cubic feet would you allow to each man?—About 600 in a temperate climate, and something more in a tropical one.

5547. Would you allow 1,000 cubic feet?—That is more, I suspect, than could be given; a great deal depends upon the means of ventilation, which might render a smaller space sufficient, but I think it should not be under 800 cubic feet in a tropical climate, and as much more as can be spared.

5548. Is it essential that that space should be given, not merely vertically, but also in breadth?—The cubic contents of the rooms should be calculated, and a certain proportion allotted to each, exclusive of the part above the ceiling. The Commissioners are no doubt aware that the heat in the upper part of a building in a tropical climate becomes very great indeed, unless there is an outer covering in addition to that of the barracks.

Another source of disease, I apprehend, may arise from the want of sufficient variety in the soldiers' food by cooking it in different ways. Until very lately they had no change; something between a soup and a stew was the only mode of dressing their meat.

5549. Do you think that the erection of barracks upon high situations, instead of low, is an important element in sanitary reform?—I think it a very important element; but I am aware that it cannot always be accomplished. For instance, in most of the West India islands, where white troops are chiefly employed, there is no elevated land above from 1,200 to 1,300 feet, and therefore you cannot attain a height sufficient to carry the men beyond the reach of malaria.

5550. In Granada there is no elevation, unless you go into the interior?—There is no elevation at all in some places—as in Demerara, for instance—and therefore your power of diminishing the mortality by increasing the altitude is limited chiefly to such islands as Dominica, St. Lucia, and Trinidad; and there, in order to get to a very considerable elevation, it is necessary to go a distance from the port, which is objectionable upon principles of defence.

5551. Even in the West Indies, where everything is on so much smaller a scale than in India, it is found that if you put the troops in the best sanitary position they are sometimes in a place where they are quite distant and not immediately available for the

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purposes for which they are likely to be required?—Certainly.

With reference to other sources of disease within the tropics, I am much disposed to regard idleness as one of them, and that our troops might be more healthy if they worked more there; time hangs too heavily upon their hands. I do not mean that they should work in the middle of the day; but I think that the practice of requiring them to labour in the morning and in the evening might be adopted with benefit to their health, as a variety from the ordinary routine of drill. It has been found both in Martinique and Guadeloupe by the French Government that troops employed on fortifications during proper hours were more healthy than others. Of course, however, this requires to be done with great discretion, and under the strict superintendence of medical officers.

5552. Do you think with the present facilities for constructing light, extensive, and covered buildings, that there would be any difficulty in providing the men with workshops?—In tropical colonies there would be no difficulty whatever, because generally speaking the bamboo, from which you can form the posts, grows extensively there; it will also supply a very light framework for the roofs, which being covered with leaves, you may at a very small expense get any shelter you require merely for the purpose of exercise, or for workshops. Slight erections of this description are often made in the East Indies, for the purpose of furnishing temporary accommodation to the married people, and I think the same practice might be adopted with great advantage in the West Indies. Among other improvements, nothing appears more likely to be beneficial to the men than to have regimental gardens; the spaces around the hospitals also are often covered with jungle, which might be converted into gardens for the use of the patients. Nothing of that kind has yet been done on any general scale; but there are some places in the West Indies where it has been attempted.

5553. Is there not a difficulty in carrying that out, on account of the frequent removal of the troops from stations?—Yes; that has prevented the system from being adopted to the extent that it might be in the West Indies. The objection was, that as “the men do not know when they will be removed, they will not labour for the purpose of obtaining a crop that may be of no use to them.” That objection was taken in the case of regimental gardens, but it might easily be obviated by arranging that a small fund should be appropriated to pay the men for their work, by selling to the different messes the vegetables raised, and which they would otherwise have to purchase at a higher price in the market.

5554. In other words, you would say that the gardens should belong to the station, and not to the regiment that happened to be quartered there at the time?—Exactly. I think that the men generally are fond of gardening, and a very great proportion of them, after they are pensioned, become cultivators, and very successful ones too.

5555. With regard to the age at which recruits enlist, do you think that there is anything to be amended in that respect; do they join the army at too young an age?—Certainly they join the army too young if you have to take them on a campaign immediately. If recruits be merely wanted for the ordinary purposes of drill, as in this country, I think that 18 is not a bad age to take them at, more especially when you consider that at the age of 21 they are often burdened with wives, and have acquired settled habits which do not tend to induce them to enter the army.

5556. Do you think, then, it is desirable that they should enlist at the age of 18, but that they should have two or three years’ training in a temperate climate before they are exposed to a tropical climate, or to the fatigues of a campaign?—Certainly.

5557. I suppose that the preliminary training which is given to them is better given at home than in India?

—It can be best given at home, and is given there. I wish much, as part of that training, that it should be made obligatory upon all recruits to learn to read and to write before being discharged from drill. It was so ordered at one time, but there were doubts whether it could be legally enforced; but if it could be so arranged I am confident that it would be a vast advantage to the army; there is no use in supplying books to those who cannot read.

5558. Do you think that the personal habits of the soldier have improved with regard to temperance and the state of health in which he keeps himself?—I think they are very much improved. I have seen a very great change, both in the soldiers who are in the army, and in pensioners after they leave the army; there has been a very great improvement indeed of late years.

5559. Does it not appear to you that, as compared with the ordinary class of labouring men, the same class as that from which the soldier is taken, there is a want of power to endure fatigue about the soldier when not hardened by actual service, such as you would not expect to find in him; for example, take the number of cases of men who suffer and sometimes die from going through a day’s work, which would not appear to trained men very severe?—Certainly; I think it a great evil that the soldier is not sufficiently trained to fatigue. I do not call it any great fatigue to shoulder a musket or march with a knapsack. The description of fatigue which he requires to be trained to is that which could readily be found for him in building fortifications or in erecting public works.

5560. Setting apart the question of occupation, the actual daily labour of the soldier is not sufficient to keep him in good physical training?—That is my impression, at least in most regiments, but there is a much greater degree of labour in some than in others; I think, too, that the drill of the recruits is made more severe to them than is necessary, considering that they have all their life to learn such details.

5561. Do you mean that they are sometimes overworked and disgusted at first?—Yes; and the success of the volunteers shows that there is no necessity for this, and that a knowledge of the mere military duties of a soldier can be acquired in a comparatively short space of time without such over-work.

5562. Do you think that to any considerable extent the health of the soldier is undermined by venereal disease?—I have very little doubt that it is; but from all I can learn, I doubt whether venereal disease is much more common in the army than in civil life; for instance, the ordinary proportion of venereal disease is somewhere about 120 cases among 1,000 men annually, at least it was so previously to the present year; out of these many arise from want of cleanliness; not more, probably than 100 are really attributable to venereal disease, which is only equivalent to each man being under treatment once every 10 years; and I do not think you will find among unmarried persons in civil life that a man goes through 10 years with only one attack of the disease. I may state as a further example, that I have made careful inquiries into the relative proportion of diseases of that description among officers and men, and I do not find any marked exemption in favour of the former, particularly after taking into account that some of them cure slight attacks without undergoing medical treatment, and others put themselves under civil practitioners, by whom no report is made as to the cause of their illness. Taking everything into account, I doubt very much whether venereal disease is much more common among the military than civilians; but civil practitioners could give a more correct idea upon the subject.

5563. Have you examined into the actual percentage of mortality in India?—Yes, and I submit the following summary on that head, extracted from p. 180 of the minutes of my evidence before the Indian Organization Committee.

TABLE showing the Mortality in each of the Presidencies for a period of 39 years, extracted from the War Office Returns.

Year.	BENGAL.		MADRAS.		BOMBAY.	
	Strength.	Deaths.	Strength.	Deaths.	Strength.	Deaths.
1817	7,284	622	9,092	548	2,607	143
1818	6,203	384	9,306	903	3,645	352
1819	6,219	483	7,656	637	3,417	270
1820	6,156	439	7,043	411	3,076	404
1821	5,732	399	6,989	396	2,907	262
1822	5,899	365	6,949	491	3,164	318
1823	6,584	496	6,838	386	3,082	224
1824	6,894	937	7,388	1,068	2,562	147
1825	6,669	1,086	6,919	1,187	3,178	357
1826	7,877	1,312	6,405	1,081	2,936	344
1827	8,035	583	7,061	656	3,063	171
1828	8,284	633	7,602	434	3,222	209
1829	8,555	618	7,680	290	3,978	117
1830	8,325	406	7,408	219	3,914	160
1831	8,347	431	6,976	268	3,845	94
1832	8,031	346	6,773	418	3,723	79
1833	7,569	403	6,241	571	3,583	129
1834	7,340	394	6,086	444	3,426	134
1835	7,655	272	5,881	215	3,415	102
1836	7,541	369	6,646	254	3,465	139
1837	6,878	355	6,078	362	3,226	148
1838	5,401	327	5,493	269	3,319	141
1839	7,645	499	5,792	405	3,422	380
1840	8,581	1,268	6,255	265	4,402	296
1841	9,438	1,020	5,411	223	5,418	601
1842	12,593	1,698	6,101	292	6,106	668
1843	11,003	1,028	7,699	427	6,066	468
1844	11,280	984	7,850	276	6,323	824
1845	11,108	2,213	7,535	351	4,710	337
1846	11,007	1,103	5,772	264	7,197	681
1847	12,349	781	6,040	227	5,556	139
1848	11,502	1,190	5,321	125	6,208	179
1849	14,703	1,306	5,014	159	6,619	310
1850	17,307	911	4,838	110	5,872	165
1851	17,071	849	4,162	88	5,774	194
1852	16,659	1,196	4,548	304	5,688	194
1853	16,190	950	4,598	215	5,306	102
1854	17,087	782	4,357	143	4,104	90
1855	14,980	532	3,209	80	4,423	80
Totals	377,980	29,970	249,012	15,462	165,947	10,152

SUMMARY of the above.

	Strength.	Deaths.	Ratio per 1,000.
Bengal	- 377,980	- 29,970	- 79.2
Madras	- 249,012	- 15,462	- 62.9
Bombay	- 165,947	- 10,152	- 61.1
	792,939	55,584	70.0

These losses include some 200 or 300 men killed or dead of their wounds during the Mahratta, Pindaree, and other campaigns prior to 1824; also 3,750 who perished in the first, and about 1,000 in the second Burmese war, chiefly from sickness; also nearly a whole regiment lost at Cabul; likewise the casualties during the campaigns of Sind, of the Sutlej, and the Punjab, about 2,000 in all, and nearly 1,200 who died in the first Chinese war, all from sickness, with very few exceptions. The loss arising from the climate of stations now usually occupied on the continent of India may therefore be reduced by about 8,000 or 9,000 men, or to an average of 60 per thousand annually, though the total loss from all causes has been at least 70 per thousand. Since the mutiny, I have ascertained that the mortality, exclusive of casualties in the field, has been little more than half the above average.

5564. Have you any means of explaining to the Commission that remarkable decrease?—The only way in which I can explain it, is by the following summary, which I had framed in order to show whether there was any material difference between the loss sustained by troops who had been for some time in India and those newly arrived in the country.

"Mortality among regiments which were in India prior to the mutiny in 1857-8:—

	Strength.	Deaths.
" In 1858	- 21,307	- 1,706
" In 1859	- 17,466	- 521
" Add broken periods of seven regiments, which left India during the year	- 2,071	- 84
" In 1860	- 11,543	- 244
" Add broken periods of six regiments, which left India within the year	- 1,250	- 67
	53,637	2,622
" Deduct killed in action, died of wounds, &c. in the year 1858	- 190	
" Died of sunstroke and apoplexy	- 142	
	332	2,290

"Upon a total strength of 53,637 men the mortality by disease appears to have been $4\frac{3}{10}$ per cent.

"In addition to the loss then recorded, the 13 regiments which returned home must have carried with them many men of broken constitutions, whose deaths would have affected the Indian mortality, had they remained.

"Mortality among regiments sent out to India in 1857-8:—

	Strength.	Deaths.
" 1st year after landing	- 36,948	- 3,499
" 2nd	- 42,843	- 1,915
" 3rd	- 40,568	- 1,431
		6,845
" Deduct 396 who were killed in action and died of wounds, and 650 who died from sunstroke, making	-	- 1,046

Strength - 119,999 - 5,799

"Being $4\frac{8}{10}$ per cent. in that class of young men newly sent out to India, many of whom, I am sorry to say, were very inferior recruits; but the Government were glad to take any men at that time. Among the old and acclimatized men the loss, as above stated, was $4\frac{3}{10}$ per cent., exclusive of invalids returning with their regiments, so that the mortality does not seem materially to affect one class more than the other when serving under similar circumstances.

"In order as far as possible to show what the loss would be had the men in neither case gone into action, or been exposed to the hardships of a campaign, I have taken out separately the strength and deaths among those corps which, so far as I can ascertain, did not take the field, and find them to be—

"Of 20 regiments which went out to India in 1857-8 on account of the mutiny and were not in action:—

	Strength.	Deaths.
" 1858	- 16,688	- 622
" 1859	- 19,739	- 676
" 1860	- 18,209	- 588
" Add broken periods for 44th regiment sent to China in 1860	- 369	- 3
	55,005	1,889

"Being three and four-tenths per cent.

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"Of eight regiments which were in India at the time of the mutiny and were not in action, the strength and deaths were in—

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	Strength.	Deaths.
" 1858 - - - - -	7,032	317
" 1859 - - - - -	6,841	160
" Broken periods of one regiment sent from India, viz., the 29th regiment in this year - - -	412	18
" 1860 - - - - -	4,765	56
" Broken periods of two regiments sent from India, viz., 12 Drs. and 87th regiment in this year - - -	408	25
	<u>19,458</u>	<u>576</u>

" Being three per cent.

"The two classes approximate so nearly in the results that there seems no good reason why you should not send out to India young men between the ages of 18 and 21, but if you take the field with them, a considerable proportion must be expected to perish from sunstroke, apoplexy, and the consequences of being too young for the fatigues of a campaign."

5565. (Dr. Farr.) You have, for various purposes, made extensive researches into the mortality in the army in India in the different presidencies and the different stations?—Yes; and the following are the results on that head as submitted to the Commission on the Organization of the Indian Army.

ABSTRACT showing the Sickness and Mortality of the Troops of the Line at the under-mentioned Stations of the Indian Presidencies, as nearly as can be ascertained from the Returns forwarded to the Medical Board from 1817 to 1836 inclusive.

Stations.	Period of Observation.	Strength.	Admissions into Hospital.	Deaths.	Ratio per 1,000 of	
					Admissions.	Deaths.

BENGAL.

	Yrs.					
Fort William	17	12,855	23,967	885	1,863	68·82
Chinsurah	7	4,155	6,930	224	1,667	53·91
Dhinapore	9	6,845	14,251	484	2,081	70·70
Ghazepore	14	10,936	16,888	449	1,554	51·05
Cawnpore	19	25,701	46,471	1,495	1,808	58·16
Agra	4	2,701	3,671	49	1,359	18·14
Berhampore	14	13,242	26,494	853	1,985	63·93
Meerut	19	27,328	35,949	862	1,315	31·54
Kurnool	6	5,314	5,252	137	988	25·78
Hazareebaugh	2	1,368	2,308	78	1,687	57·01
Boglipore	4	2,564	4,338	224	1,691	87·36

MADRAS.

Fort St. George	18	13,606	26,009	671	1,911	41·96
Cannanore	15	12,809	18,402	420	1,436	32·80
Trichinopoly	19	15,317	27,394	681	1,788	44·46
Secunderabad	18	13,939	35,555	854	2,555	61·26
Bangalore	21	21,870	34,538	672	1,579	30·73
Quilon	6	4,846	6,576	146	1,357	30·1
Wallajahbad	5	2,398	4,480	242	1,868	100·9
Bellary	10	7,504	14,911	355	1,987	47·3
Arnee	5	3,136	4,518	140	1,440	44·3

BOMBAY.

Colaba and Bombay.	16	11,907	22,195	763	1,864	64·08
Poona	16	19,974	36,140	495	1,819	24·78
Belgaum	10	6,332	10,814	175	1,707	27·63
Deesa	4	2,682	2,879	144	1,073	53·69
Kirkee	10	6,207	9,447	162	1,521	26·09
Karay	8	4,059	10,108	500	2,490	123·18

ABSTRACT showing the Sickness and Mortality of the Troops of the Line at the under-mentioned Stations of the Indian Presidencies, as nearly as can be ascertained from the Annual Sanitary Reports forwarded to the War Office from 1838 to 1856 inclusive.

Stations.	Period of Observation.	Strength.	Admissions into Hospital.	Deaths.	Ratio per 1,000 of	
					Admissions.	Deaths.

BENGAL.

	Yrs.					
Fort William	7	4,683	7,735	272	1,652	58·08
Chinsurah	2	859	2,235	60	2,601	69·96
Dinapore	13	10,915	20,158	903	1,847	82·73
Ghazepore	5	3,002	5,638	276	1,878	91·94
Cawnpore	10	8,985	20,473	799	2,278	88·90
Agra	8	5,847	13,833	355	2,365	60·71
Meerut	14	14,512	21,522	639	1,690	44·03
Kurnool	5	3,434	8,051	268	2,344	78·04
Hazareebaugh	2	1,054	1,710	36	1,622	34·15
Allahabad	2	938	2,325	108	2,479	115·14
Loodiana	2	1,251	2,826	159	2,259	127·10
Umballa	10	13,773	20,627	850	1,497	61·71
Kussowlie	7	5,040	6,160	247	1,222	49·01
Ferozepore	5	4,445	7,817	245	1,759	55·12
Jullundur	5	4,273	7,380	160	1,727	37·44
Lahore	7	5,232	14,901	473	2,848	90·40
Rawul Pindi	4	3,359	6,276	146	1,868	43·46
Peshawur	5	8,182	26,384	588	3,225	71·86
Wuzzerabad	4	6,889	11,436	408	1,660	59·22
Dugshai	3	2,618	3,726	69	1,423	26·36
Subathoo	3	935	1,524	29	1,630	31·02

MADRAS.

Fort St. George	16	11,858	20,804	343	1,754	28·93
Cannanore	17	15,416	24,822	488	1,611	31·65
Trichinopoly	11	7,628	14,599	237	1,913	31·07
Secunderabad	8	7,133	12,243	405	1,716	56·78
Bangalore	17	17,133	24,016	418	1,402	24·39
Kamptee	7	6,014	12,440	287	2,068	47·72
Tennasserim Provinces.	9	9,165	16,218	302	1,770	33·00
Bellary	7	5,290	10,259	257	1,939	48·6

BOMBAY.

Colaba and Bombay.	7	3,606	7,806	219	2,165	60·73
Poona	13	13,663	28,541	451	2,089	33·01
Belgaum	10	7,244	11,909	299	1,644	41·27
Deesa	7	7,473	12,262	250	1,641	33·45
Kirkee	14	9,131	17,218	234	1,886	25·63
Kurrachee	12	12,410	23,662	585	1,907	47·14
Ahmednugger	3	1,154	2,765	66	2,396	57·19
Hyderabad	4	1,744	4,352	74	2,495	42·43
Aden	8	3,983	4,934	138	1,239	34·64

SUMMARY OF THE TWO PRECEDING PERIODS.

Stations.	Period of Observation.	Strength.	Admissions into Hospital.	Deaths.	Ratio per 1,000 of	
					Admissions.	Deaths.

BENGAL.

Fort William:						
First period	17	12,855	23,967	885	1,863	68·82
Second period	7	4,683	7,735	272	1,652	58·08
Total	24	17,538	31,702	1,157	1,807	65·92
Chinsurah:						
First period	7	4,155	6,930	224	1,667	53·91
Second period	2	859	2,235	60	2,601	69·96
Total	9	5,014	9,165	284	1,827	56·64
Dinapore:						
First period	9	6,845	14,251	484	2,081	70·70
Second period	13	10,915	20,158	903	1,847	82·73
Total	22	17,760	34,409	1,387	1,967	78·09
Ghazepore:						
First period	14	10,936	16,888	449	1,554	41·05
Second period	5	3,002	5,638	276	1,878	91·94
Total	19	13,938	22,526	725	1,616	52·01

Summary of the two preceding Periods—*continued*.

Stations.	Period of Observation.	Strength.	Admissions into Hospital.	Deaths.	Ratio per 1,000 of	
					Admissions.	Deaths.
BENGAL—continued.						
Cawnpore:						
First period -	19	25,701	46,471	1,495	1,808	58.16
Second period -	10	8,985	20,473	799	2,278	88.90
Total -	29	34,686	66,944	2,294	1,930	66.13
Agra:						
First period -	4	2,701	3,671	49	1,359	18.14
Second period -	8	5,847	13,833	355	2,365	60.71
Total -	12	8,548	17,504	404	2,048	47.26
Meerut:						
First period -	19	27,328	35,949	862	1,315	31.54
Second period -	14	14,512	24,522	639	1,690	44.03
Total -	33	41,840	60,471	1,501	1,445	35.87
Kurnool:						
First period -	6	5,314	5,252	137	988	25.78
Second period -	5	3,434	8,651	268	2,344	78.04
Total -	11	8,748	13,903	405	1,521	46.30
Hazareebaugh:						
First period -	2	1,368	2,308	78	1,687	57.01
Second period -	2	1,054	1,710	36	1,622	34.15
Total -	4	2,422	4,018	114	1,659	47.07

MADRAS.

Fort St. George:						
First period -	18	13,606	26,009	671	1,911	41.96
Second period -	16	11,858	20,804	343	1,754	28.93
Total -	34	25,464	46,813	1,014	1,838	39.82
Cannanore:						
First period -	18	12,809	18,402	420	1,436	32.80
Second period -	17	15,416	24,832	488	1,611	51.65
Total -	35	28,225	43,234	908	1,531	32.17
Trichinopoly:						
First period -	19	15,317	27,394	681	1,788	44.46
Second period -	11	7,628	14,599	237	1,913	31.07
Total -	30	22,945	41,993	918	1,829	40.00
Secunderabad:						
First period -	18	13,939	35,555	854	2,555	61.26
Second period -	8	7,133	12,243	405	1,716	56.78
Total -	26	21,072	47,798	1,259	2,268	59.74
Bangalore:						
First period -	21	21,870	34,538	672	1,579	30.73
Second period -	17	17,133	24,016	418	1,402	24.39
Total -	38	39,003	58,554	1,090	1,501	27.94
Bellary:						
First period -	10	7,504	14,911	355	1,987	47.3
Second period -	7	5,290	10,259	257	1,939	48.6
Total -	17	12,794	25,170	612	1,959	47.8

BOMBAY.

Colaba and Bombay:						
First period -	16	11,907	22,195	763	1,864	64.08
Second period -	7	3,606	7,806	219	2,165	60.73
Total -	23	15,513	30,001	982	1,933	63.30
Poona:						
First period -	16	19,974	36,140	495	1,819	24.78
Second period -	13	13,663	28,541	451	2,089	33.01
Total -	29	33,637	64,681	946	1,923	28.12
Belgaum:						
First period -	10	6,332	10,814	175	1,707	27.63
Second period -	10	7,244	11,909	299	1,644	41.27
Total -	20	13,576	22,723	474	1,674	34.91
Deesa:						
First period -	4	2,682	2,879	144	1,073	53.69
Second period -	7	7,473	12,262	250	1,641	33.43
Total -	11	10,155	15,141	394	1,491	38.80
Kirkee:						
First period -	10	6,207	9,447	163	1,521	26.09
Second period -	14	9,131	17,218	234	1,886	25.63
Total -	24	15,338	26,665	396	1,738	25.82

These results do not exhibit the loss at all the Indian stations during the 39 years included in the

first table, but at those only where regiments have been stationed for the whole or the greater part of a year; they are also exclusive of the loss on long marches, which is often very heavy; but it has been considered more advisable thus to found the results on incomplete data, than to incur the risk of adopting what might prove to be incorrect.

5566. What number of men do you think it would be necessary to send out in order to make good the excessive loss occasioned by death?—Suppose the army to consist of 80,000 men, upon that 80,000 men the loss would be 60 per thousand, therefore you would have to raise 4,800 men to supply that loss.

5567. In addition to the mortality at home incurred among the same men?—No, not in addition; you will always lose at least 2 per cent. in India. You can never expect to have as small a loss there as at home.

5568. (*Chairman.*) But supposing the Indian army to be only 70,000 men, the loss, according to your calculation, upon that number would be 4,200?—Yes.

5569. (*Dr. Farr.*) To what extent are you of opinion that that loss could be reduced?—It might, perhaps, be reduced to about 1,400 men annually, but that is upon the supposition that you selected only healthy stations, and kept the troops there; I am aware, however, that this cannot be done. You must always occupy some unhealthy stations, and abide by the loss, which might be as much as 4 or 5 per cent., even with the best arrangements. But there is no necessity for the whole of the force in India, of 70,000 men, to be so exposed; for example, suppose you kept 20,000 in unhealthy positions, the remaining 50,000 might be quartered in stations on the hills, or in localities known to be healthy. The loss there would be only about 2 per cent., or 1,000 annually; the loss on the remaining 20,000 exposed, at, say even 5 per cent., would be another 1,000; making a total loss of only 2,000 men a year, instead of 4,200; This country could, from what I know of recruiting, be able to supply that number, and also to fill up the vacancies by invaliding, and the time expiring for which men had entered the service. But I question very much whether, during an active war, you could keep up 70,000 men in India, exposed to the mortality which has been usual during the last 40 years.

5570-1. Will you be good enough to state the full extent of our loss in India? I suppose you would not imagine that we should always be able to govern India without employing troops in the field, or without incurring losses as heavy as have already been incurred. Is it not, therefore, right to assume that the mortality would be represented rather by 70 per thousand than by 60 per thousand?—I do not think that you will ever have the same loss that you have incurred in your campaigns as heretofore. I believe for instance, that in the first Burmese campaign 12 men at least died from disease or mismanagement for one that fell by the sword, which I hope is never likely to occur again.

5572. The ordinary mortality among men of the same age as those serving in the army in England is not more than 10 per thousand; I mean taking the civil population?—That is correct, and I should be glad indeed to see the mortality of the army reduced to one per cent. I think it quite possible to do it.

5573. If proper care be taken of the army, you do not think that it will naturally experience a higher rate of mortality than the general population of the country?—I think it ought to be reduced to nearly the same, but there are advantages which the civil population enjoy over the military, which require to be taken into account. Among the men in our army in England, for instance, you have a vast number who have been serving in foreign climates, and perhaps one-half have there contracted disease which often occasions mortality in this country, whereas it is not so with the civil population.

5574. Cannot you eliminate that by taking, as an example, the Guards?—Yes.

5575. Who experience really a higher rate of mor-

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tality than the troops of the line?—Yes; but that is owing to causes connected with their residence in the metropolis, and which do not extend over the whole force in the kingdom.

5576. At any rate, the heavy rate of mortality in India is a matter that you must consider of the greatest importance?—Yes; and too much attention cannot be paid to it, not merely on the score of humanity, but because if you ever have a European war there is likely to be the greatest difficulty in supplying the casualties which must occur in India among so large a body of men.

5577. Besides the loss by death, there is a great loss, is there not, by invaliding?—Not nearly so great as is supposed; the proportion by invaliding is not very much.

5578. What does it amount to in 1,000 men?—I think only about 15 or 20 annually.

5579. That would make the 60 or 70 per 1,000, how much?—Before adding them you must take into account that the medical officers have been in the habit of including as invalids men who have served their time.

5580. But cannot you separate them?—No. Having completed 21 years' service, which is the ordinary period in the army, they are discharged as worn out without any disease being specified. You will find, in the different tables, that this class constitutes a large number, who, instead of being men likely to die, are, in many instances, very healthy indeed.

5581. What is the annual loss out of 1,000 men by death, invaliding, or disability?—I should say about 75 per 1,000, excluding casualties in the field.

5582. Do you consider that this mortality is necessarily connected with tropical climates?—To a certain extent; for instance, I think you will always be liable to it in the West Indies; because there, you cannot carry the men up to a sufficient elevation to avoid it.

5583. Have you any returns showing the mortality among the officers in the East Indies?—Yes, so far as regards the Bengal presidency, where out of 1,184 deaths among officers, the proportion occurring annually in each rank and at each age was as under:—

	Colonels, average Age 61.	Lieut.- Colonels, average Age 51.	Majors, average Age 40.	Captains, average Age 36.	Lieut- tenants, average Age 18 to 33.	Cornets and Ensigns, average Age 18 to 33.	General Average of all Ages.
Died annually per thousand of each rank	59·4	48·4	41·0	34·5	27·5	23·4	31·2

5584. What age would represent the ordinary age of the soldiers in India?—I think you might call the average age about 27.

5585. Assuming the mortality to be 60 per thousand, omitting loss in war, what is the mortality among the officers at a corresponding age; should you add anything on account of the officers coming home?—The mortality among the officers would, according to the returns, be about one-half of that which takes place among the troops at corresponding ages, but it is probably reduced at least one-third by the facility of coming home, and it would be a great advantage if arrangements were made by which soldiers who had frequently suffered from tropical disease in the East Indies, could be removed to regiments serving in colonies where that kind of disease did not exist, precisely in the same way as an officer who finds that the climate of India does not suit his constitution, exchanges into a regiment serving at the Cape of Good Hope, Australia, or America.

5586. Do you think that that could be practically carried out?—I think so; and a suggestion was made with that view by the Committee on Recruiting, of which I was a member.*

5587. Can you furnish the Commission with any information about the mortality amongst civilians in the East Indies?—Yes, I can. The civil service

	Above 50 years of age and 30 of service.	Age 45 to 50, service 25 to 30.	Age 40 to 45, service 20 to 25.	Age 35 to 40, service 15 to 20.	Age 30 to 35, service 10 to 15.	Age 25 to 30, service 5 to 10.	Age 20 to 25, service 1 to 5.
Died annually per thousand of each class	48·6	36·4	35·4	23·4	16·6	20·8	19·9

has a much lower rate of mortality than the military.

5588. That is shown, I believe, by the fund accounts?—Yes. For a period of 46 years, from 1790 to 1836, they supply the following results on this head:—

Between 10 to 15 years' service is the period when leave to Europe is most generally obtained, which may affect these results.

5589. Do you think that any addition should be made, as a correction, to that rate of mortality?—Certainly.

5590. I mean by the removal of persons who would die if they remained in India?—Yes; but it is not that which causes the difference in the mortality between military and civilians so much as the nature of the duty which an officer has to perform in the native force in the East Indies, to which these returns refer, by having to go upon detached parties, and to march through the country sometimes for months together, escorting stores or treasure from one part to another; the shifting of quarters also entails the necessity for an officer, whether of the native or European force, going through many unhealthy places; and I have no doubt that the difference between the mortality of officers and the mortality of civilians may be sufficiently accounted for by these circumstances.

5591. The civilians are generally stationed at one place?—Generally in one place; at least they do not move about to the same extent as the military.

5592. In Calcutta?—No, in different stations.

5593. All over the country?—Yes; their stations may in some instances be unhealthy, but, of course, they try to make them as healthy as they possibly can, and in selecting a place for head-quarters, they endeavour to select the healthiest spots they can find.

5594. That is an element which may partly account for the low rate of mortality among them?—Yes.

5595. Then it would not appear so unreasonable to assume that the mortality of Europeans in India need not be much greater than you have mentioned?—No; I should say it need not exceed 2 per cent., if you selected healthy stations and found employment for the men in various ways, and if you had any means of increasing the proportion of European marriages.

5596. Are you of opinion that marriage would reduce the mortality?—Yes, I think so; but I am not an advocate for it upon military grounds.

5597. You have mentioned several circumstances which you think might lead to a reduction of the mortality in the army. The greatest result, I believe, was obtained in Jamaica from removing the troops up to the high grounds?—Yes.

5598. What was the elevation of that station?—It is about 3,500 feet at Newcastle.

5599. Until your researches, the troops had been kept upon one of the unhealthiest parts of the island?—Yes, in several parts which were notoriously so.

5600. No attention had been apparently paid by the authorities to the immense mortality that took place there?—The fact had been before them that at Maroon town, which is upon high ground, although not so high as Newcastle, the mortality was considerably lower than in the plains, from yellow fever rarely prevailing there; but no return had been prepared showing the exact difference in the mortality from official sources.

* See page xvii of Report on Recruiting Commission.

5601. It had not made much impression upon the Government?—No.

5602. Is not the same thing likely to be the case in India?—We have been told that we must keep a large force at Allahabad, where the mortality, according to your table, is at the rate of 115 per 1,000?—Yes, I have no doubt of it. Allahabad is notoriously unhealthy; it is situated at the confluence of two rivers, where immense masses of mud are exposed, besides decayed vegetation; and I am afraid that you cannot well avoid having a certain number of troops there; but there is no reason why they should not be changed more frequently.

5603. Do you think it has generally been known that the mortality has been so high at Allahabad?—Yes, it has been long known. In Bengal I am sorry to say that I can mention very few that are healthy, except hill stations. Meerut has been usually a healthy station; the mortality, upon an average of 40 years having been only about 35 per 1,000, which is not high for Bengal. Madras shows the most favourable results with regard to health. At Fort St. George, with all the inconveniences of being the capital of the presidency, the mortality upon an average of 34 years, has been only about 40 per 1,000; at Cannanore it has only been, upon an average of 35 years, 32 per 1,000; Trichinopoly, where it is very hot, 40 per 1,000; and at Bangalore it has only been, upon an average of 38 years, about 28 per 1,000; that is a station at which you might keep a very large proportion of troops in reserve at a very small cost of life.

5604. You would advocate the policy of keeping a large proportion of the troops at healthy stations, such as Bangalore?—Yes; and to relieve the men at the unhealthy stations from them occasionally, so as to give the soldier a prospect, if he is at an unhealthy station, that he will in a short time get out of it. At Bangalore the supplies are abundant, and there is every facility for keeping a great number of troops. Poona, in the Bombay Presidency, is also healthy; there, upon an average of 29 years, the loss has been only 28 per 1,000; it also affords great facilities for cantoning a large body of men; as likewise Kirkee, where, upon an average of 24 years, the loss has been only about 25 per 1,000.

5605. Then there is the station at Kayra, at which the mortality seems to have been enormous?—It was, on the average of several years, 123 per 1,000 annually, till it had to be abandoned from its unhealthiness; but there is no doubt that you can find among all those stations some at which a large proportion of troops might be quartered without the great loss of life which takes place at present.

5606. Both on sanitary and on political grounds you think it of the utmost importance to save the lives of the soldiers?—Yes.

5607. Do you, on military grounds, see any reason why a concentration of troops in healthy places should not be maintained?—No, now that you are getting railroads laid down; the difficulty before was that in the event of any sudden disturbance it would cost so much time to bring troops where they were wanted; but now, with the facilities afforded by railroads both in Bombay and Madras, there will shortly be little difficulty in doing so. Although in Bengal no stations in the low grounds or near rivers are healthy, there are a number on the hills, where the mortality is usually not above 2 or 3 per cent. From these the men could be brought down with great facility to the plains, and when brought down, every one would, from their superior efficiency, be worth two of those that you had formerly in the plains.

5608. Our army in India has been scattered all over the country in small detachments?—There has not been much concentration at any particular part, and perhaps it could not well have been otherwise considering the circumstances of the mutiny; but now is the time to change all that, and the military authorities, I think, might fairly be called upon to

state what is the number of men that they must keep at the unhealthy stations indicated by the preceding tables, and then all beyond those might be quartered in the healthy ones, subject to removal when wanted for relief or any great military or political object; but it does happen that when the locating of a large force is left entirely to the authorities on the spot, a regiment may be brought to a particular place without due consideration as to whether it is healthy or not.

5609. Are the results as shown in these tables generally known in India?—I do not think that they are, unless they have been published since my examination before the Organization Committee; there is no summary that I am aware of that has ever gone out to India.

5610. Practically you think that those results have not been much taken into account in selecting stations?—Very probably not, but I do not think that the authorities have been in a position to do so up to this time; however the country seems now so far settled that any great sanitary arrangements might be worked out with ease. Most of the high lands too have advantages for the location of troops in addition to health; for example, the cost of feeding them at these elevated stations would be materially diminished, for the meat is usually very bad in the unhealthy parts of the country, and comparatively dear; whereas in the healthy places there is usually plenty of grass, and wheat is abundant, so that you get bread cheaper. At such stations too the labour of the men might be made available in reducing much of the cost at present incurred for accommodation. It affords a further and very important consideration in this question that unless some measures be introduced to lessen the mortality among the troops, the cost of transport to keep up the European army which it is contemplated to maintain in India will be enormous.

5611. What number of men should you have to send out every year to maintain an army of 70,000 men?—The calculation I submitted to the Organization Committee on that head was, that if each regiment had to be relieved once in 10 years, there would be 8,000 men required for relieving the regiments alone every year.

5612. That is for 80,000 men?—Yes; 8,000 men would be required to relieve the regiments every 10 years, and 8,000 men would come home with their regiments, making 16,000 passages to be provided besides those for 5,600 recruits who would be required to replace the men who died, calculating the deaths in 80,000 men at 70 per thousand. There would also be about 4,000 invalids and time-expired men, who had completed 10 years service, to be brought home; and about 4,000 recruits to go out to replace them.

5613. (*Chairman.*) You are assuming the army in India to be maintained at 80,000 men?—Yes.

5614. But do you think that that will be the number maintained?—Yes, when 60,000 men were named as the probable number of the army the Indian Government had a large European army of their own besides. Now that is to be amalgamated with our Line army, and therefore I think there will not be fewer than 80,000 men, or between that and 70,000, altogether in future.

5615. (*Dr. Farr.*) What is the average time occupied in the passage to India?—About three months and a half now.

5616. So that about 7,500 men would be constantly on the sea?—Yes.

5617. Have you made any calculation as to the expense?—The expense amounts to a very large sum indeed; so large that it would be between 250,000*l.* and 350,000*l.* annually, unless some means be adopted of selecting healthy stations, and so reducing the mortality; if you did so, a great part of these men to be relieved would like India, and would remain at those healthy stations, and not wish to come home at all; they would volunteer into other regiments, and in that way you would save the cost of transport.

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There would not be the same number of invalids, and probably a great part of the time-expired men would re-engage.

5618. Do these men who die serve, on the average, the full term of 10 years?—No.

5619. So that you have more frequent changes than if the men enjoyed better health?—Yes.

5620. This economy in the transport of men, you think, might be fairly taken into account in considering the expense?—Yes; and now that railroads are becoming general throughout India, there would be no difficulty in making the reliefs, which has been one great objection hitherto.

5621. (*Sir R. Martin.*) Of all the causes which reduce our armies through sickness and mortality, fever, I presume, you find to be the greatest cause in all tropical climates?—In some places; but it is dysentery in others.

5622. In Bengal it forms, does it not, by far the greater item?—I have no doubt of it.

5623. Next in order of frequency, would stand dysentery, diarrhoea, and liver disease?—Yes. I think there is no doubt that those three diseases and fever will embrace nearly the whole of the mortality.

5624. None of those strictly tropical diseases are found to prevail in the mountain ranges of tropical climates?—Dysentery prevails; but it may be doubtful whether it originated there.

5625. It has been assumed that it has been generally carried thither from the plains, either directly in the instances of men suffering from bowel complaint, or by men in reduced health going from the plains to the colder regions, where they are seized with bowel disorders, but not tropical dysentery?—I am not aware of the distinction; I believe, however, that several regiments which have gone to the hill stations suffered from dysentery and diarrhoea; but in most cases their health had been affected before, and therefore it is a question whether the disease originated there, or if they brought with them a predisposition to it.

5626. If the latter, it would rather go to establish the fact that the mountain ranges are better calculated for the preservation of health than the cure of disease?—I believe those in Bengal are found to be so, but there is a considerable difference between that part and the Neilgherries, the country about Bangalore, and about Poona, in so far as those are extensive table lands, whereas in Bengal the stations I allude to are principally on mountains of very considerable elevation, with deep valleys intervening, where there are sources of malaria.

5627. Is not syphilis also a very powerful cause, directly and indirectly, both of sickness, mortality, and invaliding?—There can be no doubt of it; but, as I have already stated, I do not think that venereal is so general as to account for any considerable proportion of the mortality.

5628. It would act more in an indirect way, by reducing the general health through the disease and through the remedies necessary for its cure?—Yes.

5629. That is your opinion?—Yes; and it also adds very materially to the amount of invaliding?—I know this by the number of men who are pensioned on account of disease which had obviously originated in syphilis.

5630. (*Dr. Farr.*) In the proportion of the whole number constantly sick in the army, does not syphilis constitute a large part of the actual sickness of the army?—Yes; in all the returns that I have framed, you will see what a number have been under treatment for that disease.

5631. Does not that form a very large proportion of the sickness in the army?—Yes.

5632. What is the total amount of the sickness in the army?—Usually five per cent. at home; I have no exact statement of the numbers constantly sick from syphilis, but only of the number of cases occurring annually, many of them I am aware are very lingering.

5633. So that it forms really a very essential part of the sickness of the army?—Yes, no doubt of it; but in India, you have no greater proportion of venereal disease, with a very large proportion of other sickness.

5634. Out of 120,000 men, for instance, in England and in India, how many are labouring under syphilis?—The proportion of cases in England, taken on the average of 10 years, would be about 60 per thousand annually. I cannot get the information for India without analysing the returns of venereal from that country, which would involve great labour.

5635. (*Sir R. Martin.*) Speaking of the stations on the plains generally throughout India, does it not happen, even at the healthiest of them, that in the course of a residence there the constitution of the European soldier becomes deteriorated?—Certainly, and, what is worse, their spirits break down, and I have very little doubt that, in many instances, they resort to dissipation from no other cause than the apparent hopelessness of getting out of an unhealthy station.

5636. It has been repeatedly stated before this Commission that the men sink in their frames, and especially in the chest?—I cannot say that I have observed that; but I have observed among a great number of the men belonging to the East India Company, who have recently been discharged, a great deficiency of chest; whether it arises from that cause or not I cannot say, but as compared with the men of other regiments, they are generally small-chested men.

5637. Another evil attending a residence on the plains of India is, that owing to the heat the men cannot take that amount of exercise which is necessary to preserve them in good muscular condition and in health?—There can be no doubt of it; they cannot take that degree of exercise which is necessary.

5638. I believe you have made extensive observations on the question of acclimatization in hot climates?—Yes.

5639. Will you be good enough to state the results of your observation on that subject?—My views were expressed as far back as 24 years ago, in the report upon the West Indies, when I had to go very fully into the question, before the military authorities would consent to bring about a change, then strongly advocated by me, and by which, instead of the troops being kept for 10, or sometimes for 12 years,—in the West Indies, they could be relieved every three years. This was objected to, not merely by military, but by medical men, on the ground that the oftener reliefs were effected the greater would be the tendency or the supposed tendency to sickness and mortality, owing to the want of acclimatization. I went over the returns for about 40 years, for the purpose of getting at all the facts on the subject of acclimatization, and the result is published in my report on the West Indies. It extends over two or three pages, and is supported by a calculation deduced from the returns of every regiment that had been in the West Indies for a period of 40 years, and which clearly showed that it was erroneous to suppose that any great mortality necessarily arose from the circumstance of the men being new to the climate. Upon that a great change was introduced, under which the troops were, in the first instance, sent to the Mediterranean to serve for three years, then to the West Indies to serve for three years, and then to America to serve for the remainder of the period, usually about four years. There were some financial advantages attending this arrangement as well as those connected with health. For instance, it had been found that when troops were sent direct to the West Indies, comparatively little service was got out of them before they died or were invalided; that when they were sent direct to America they deserted, sometimes as many as 200 or 300 in a year, and little service was got out of them either, as it was almost always the young soldiers who deserted. But by this

new arrangement the soldiers who were sent out to the Mediterranean had usually served for about two years in England, this, with three years in the Mediterranean, made five years' service, and when they were sent to the West Indies to serve for three years more, of course those who died there had given a greater proportion of service than if they had been sent direct. By the time that the regiment reached North America most of them had thus given, as a minimum, about 11 years' service, after which, if a man deserted, he would, by sacrificing his prospect of pension, be rather a gain than a loss to the Government. That principle was adopted for reliefs, and I looked upon it with great apprehension for a long time, lest any evil consequences might arise, although I had done everything I could to ascertain that my premises were correct. But I am glad to say, after an experience of 24 years, it is found that the mortality since this change has been only 6 per cent. in the West Indies instead of 8 per cent., as formerly; therefore I hold that point, as to acclimatization, to be clearly settled, more especially as in the West Indies there has been no very great change, by moving the troops to elevated localities, as in Jamaica, which could account for such reduced mortality.

5640. An opinion is generally entertained by the medical officers of the army that, when placed under more favourable sanitary conditions, the soldier residing in a warm climate has the functions of his body brought, as it were, to a balance which is favourable to his condition, and that men so circumstanced have been more capable of encountering the great fatigues of long marches, and have been less subject to disease than new-comers. Do you believe in the doctrine so far as that goes?—I do not think, so far as I can ascertain, that there is much difference between the two, or that the circumstance of a soldier's constitution being deteriorated by repeated attacks of disease during long residence, is likely to produce the result you speak of.

5641. You would say that a residence in an unhealthy climate must necessarily produce injury for every year's residence?—Yes, and that is strongly borne out by the very returns I have already quoted to you regarding the officers of the Indian army, showing that the mortality usually increases with age and rank, but as the colonels, the lieutenant-colonels, and majors have, as a general rule, lived longer in India than the rest, if length of residence would have saved them from the ordinary run of mortality, they ought to have sustained a lower rate than their juniors instead of a higher.

5642. The result of your investigations would lead you to reject the doctrine of acclimatization *in toto*?—Yes; I would certainly not attempt to found any sanitary measures upon it.

5643. (*Dr. Gibson.*) Has not the mortality among the troops in England been reduced below that of the civil population of the same ages at our large stations, such as Aldershot?—I understand that it has been so, from some calculations that have been made by Dr. Balfour. I have not had the returns, but I have every confidence in his calculations, and I am happy to find that there is so great a change in the mortality of soldiers in this country, where great sanitary improvements have taken place.

5644. (*Dr. Farr.*) Are you aware of anything to account for that?—The great difference, as compared with former years, is that more attention is paid to the space that a man should have in barracks. I look upon that as the greatest of all the changes that have been effected. One can easily imagine this from the fact that the lower classes of our population who live in towns, or in the more confined parts of them, die at very nearly the same rate as the military have hitherto died; but those who live in healthier situations, and have a cottage to themselves, with the wind perhaps blowing through every portion of it, are healthy, notwithstanding all they undergo; they are also exposed to all descriptions of

weather during agricultural operations, but it seems to do them no harm.

5645. To that you attribute the great decrease in the mortality, and the greatly improved health where people live so much in the open air?—Yes; I think also a very great advantage is likely to be obtained by having separate buildings for a limited number of men, instead of their all being in one barrack. It has often surprised me that so much expense should be incurred, amounting, I believe, to about 80*l.* or 90*l.* a man,* in order to obtain enormous barracks, when soldiers would be much more likely to be healthy if in smaller buildings that would hold only 10 men each. This would avoid much of the disturbance at night; for if there happens to be one drunken man in a barrack room, he is continually making a noise; and if two or three come in wet, it is very inconvenient to all by creating damp in the room. It is also a very serious matter in a sanitary point of view, that if one man be seized with contagious disease, it may extend over a very large number, therefore I think that all our exertions should be not to build enormous barracks, but to have small and inexpensive ones, in the erection of which, owing to their simplicity, the services of the soldiers might perhaps be made useful.

5646. (*Chairman.*) But that is totally contrary to the present practice?—Yes, and I cannot understand how it happens that we pay more for the accommodation of the soldier in the present day than would build separate cottages with a room to himself; that this is the case, you will find if you refer to the cost of barracks.

5647. (*Sir P. Cautley.*) Does not it stand to reason that four small barracks for 100 men would cost more than one large barrack for 100 men?—So you would suppose, but I only look at the result; it depends entirely upon the mode of building. It is true that you have more walls in four barracks, but you have thicker walls for the 100 in a large barrack; you have only one roof, but you must have stairs, and all those additions come to be very expensive.

5648. (*Chairman.*) All that you desire with respect to quiet, and preventing the spread of contagion, would be sufficiently secured by dividing a large and extensive barrack by strong partition walls?—Yes, but you must carry them all the way up, which is very expensive.

5649. (*Dr. Gibson.*) Do you think that a building divided in that way would be as healthy as small detached buildings?—No, and you will find that a small cottage containing four rooms could be built for somewhere about 150*l.* If you were to put two men into each of those rooms, you would have accommodation for eight men, for a sum which at 5 per cent. would be only 7*l.* 10*s.* a year. I have returns as to barracks which show the expense to be nearly five times that sum in this country, and I have some from India which make it ten times as much.

5650. And the saving would be greater in India, or in any country where the Government had an unlimited command of men?—Yes; in India, I think that the greater part of the buildings could be erected by the men. When I was inquiring into the mortality in the West Indies, I pointed out the great advantage that it would be if the men could be removed to Maroon town,† and an objection on the score of expense was raised. It was said that on the low grounds there were plenty of barracks which had been erected at an enormous cost, and it was a great pity that they should not be occupied. In order to get over the difficulty with regard to the expense, it was suggested that the troops at Maroon town should be employed in building huts for themselves,

* A summary recently prepared of the average cost of 10 barracks makes the rate 86*l.* 15*s.* for each man and officer quartered in them.

† See p. 103 of Report on Sickness, Mortality, &c. of Troops in the West Indies and Jamaica.

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which was done. The 68th regiment was employed to build them, which they were very glad to do, that they might not remain in an unhealthy locality. Though only of wood, they lasted for about seven years, and cost about 30s. a hut. The men got nothing but a pair of shoes each for the tear and wear incident to such work, and the nails and iron work were furnished to them. This shows what soldiers can do for themselves. In Burmah we were obliged to build our own barracks. I grumbled much about it at the time, but I have often thanked the general officer who forced me to this expedient. In India you have an abundance of wood, and everything to enable you to build cheaply in those healthy stations, and the men could assist in the mornings and evenings.*

There is another advantage which I think might be attained by the men being located in the higher stations. It may be possible for them to be supplied with beer manufactured there, and I am afraid that if they are not so supplied, the enormous expense which is at present incurred in sending beer out to them from this country will ultimately have to be discontinued. I understand, from some returns that I have before me, that the East Indian Government are paying now very nearly 200,000*l.* a year for the cost of supplying beer to the troops; there is no difficulty, so far as I am aware, in brewing beer in India. Good hops and barley can be raised in the country, and a low equable temperature, such as is required for brewing, can be found at Bangalore, the Neilgherries, and various other places.

5651. (*Sir P. Cautley.*) Are you aware that it has been tried in Bengal and also at Mussourie?—Yes; and that is the very reason why I advert to it.

5652. (*Chairman.*) You are probably aware that there is no difficulty in making beer in India, but the difficulty is to get the men to drink it?—Yes; because the beer you refer to was not made by professional brewers, but by an officer who knew little about it, though anxious to do his best in so important a matter as the introduction of beer at a moderate rate.

* At page 46 of the Appendix to the Indian Organization Report, Colonel Baker states the cost of barracks for a regiment of the line at 15,000*l.* a year, being at the rate of about 12*l.* per man annually.

The witness withdrew.

Mr. DANIEL SIEBE, C.E., examined.

5659. (*Chairman.*) You are, I believe, the manufacturer of J. Harrison's patent ice-making machines?—Yes.

5660. What quantity of ice can be made with this machine?—A machine requiring a 10-horse power engine to work it (consumption of coals about one ton in 24 hours) will produce four tons of ice in that time.

5661. What is the cost of manufacturing this ice in London?—It is estimated by Mr. Harrison to be less than 10s. per ton, including interest upon capital; such, I believe, would be the case upon a large scale, with a machine capable of producing from 10 to 20 tons per diem; my experience with a four-ton machine has led me to estimate it at about 15s. per ton.

5662. Is it proposed to cool the air of rooms by this means?—Yes, by circulating cold water through pipes upon the same principle as rooms are warmed; the pipes being placed close to the ceiling to allow the cold air to descend, or by passing the air through the tubes of the refrigerator, and cooling it direct.

5663. (*Sir P. Cautley.*) What is the cost of the machine, including steam engine, and for what will it be delivered in Calcutta, Madras, or Bombay?—The cost of a four-ton machine and steam engine, boiler, &c., is 1,650*l.* The cost of a one-ton machine, steam engine, &c., is 650*l.* I am unacquainted with

5653. (*Sir P. Cautley.*) At Mussourie the beer was brewed by a professional man, and his beer was very well liked by the officers, but the men did not approve of it?—But they would have approved of it if they could have got no other.

5654. It will not bear carrying?—But if you had men upon the high lands you would not require to send it to them, you would brew it on the spot; if, for instance, you had 10,000 at Bangalore, you would brew the beer to be used by the men on the spot.

5655. The hops are all imported, and I was informed by Mr. Bowley, the person who brewed beer, that he had great difficulty, in certain parts of the process, in keeping up an equable temperature; the hops he obtained from England. They have been within the last few years pressed into a very small compass, and there has been no great difficulty with regard to them?—Hops, I believe, will grow in India.

5656. But they do not flower perfectly?—In that case they could be got from Europe; any alternative seems better than the present costly system. I find, for instance, that in 1859, in Bengal alone, the quantity consumed amounted in one year to 73,000 hogsheads, and the sum it cost the Government was 2,608,510 rupees, which is such an enormous expenditure that I am very much afraid it can not be continued.

5657. It was with reference to that point that I put the question when you mentioned that there would be great advantage by locating European troops on the hills on account of the cheapness of feeding them. When you come to consider that the beer has to be transported on men's backs, particularly up the Himalayan mountains, and that there is not the facility of obtaining meat there which you imagine, in all that line of country, so far as economy goes, these circumstances would seem to be rather against it?—My argument was that the beer could at hill stations be brewed on the spot, consequently there would be no expense in carriage, and sheep are usually cheap and good in all mountainous countries where the temperature is low as in the Himalayan ranges.

5658. Most of the sheep that are served out in barracks are brought from below. They may be fattened up as well as they can?—The sheep at Bangalore are very fine, and at Poona they can be had at a very moderate rate.

the cost of shipment to India, having always delivered the machines to the merchants here in England, who attended the shipment.

5664. What materials are used or employed in the manufacture?—Ether, chloride of sodium (ordinary table salt), and water.

5665. What amount of ether is expended during a day in the manufacture of four or five tons?—About two lbs. of ether are lost per day, depending entirely upon the soundness of the machine.

5666. What description of ether is necessary; and what is the price of ether?—Sulphuric ether is preferable, which costs 1s. 8*d.* per lb.

5667. What amount of salt is expended in the manufacture of four or five tons of ice; and at what cost?—It appeared so small, that I have not paid particular attention to it, but as far as I am able to judge, 56 lbs. would be amply sufficient. The price of salt is, I believe, 2s. per cwt.

5668. Can you explain shortly how a room would be cooled, and how kept cool by the use of the machine, say to 60° Fahrenheit?—The machine could be placed in the basement of the building, or in an outhouse, and connected with the apartments by means of tubes; in the apartments rows of copper tubes could be attached to the ceiling, or what would perhaps be preferable, a false ceiling of sheet copper could be employed, a pump attached to the machine,

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causing the cold water to circulate in either case. In cooling the air before entering the apartment, a blowing fan would be requisite to force it through the tubes of the refrigerator, then conducted by means of wood or earthenware pipes to the apartments, and means taken to diffuse it generally without causing a draft.

5669. It is understood that only portions of the machine offer difficulty in repair; are valves with spiral springs attached or connected with it; from what cause are they likely to get out of order; is it merely from wear, or from accident?—The only portions which are somewhat difficult to repair are the four valves, two inlet and two outlet; an ordinary mechanic, however, with the use of a small lathe, &c., could repair them. Ordinary wear and tear is the cause of their getting out of order, or the breaking of a spiral spring.

The witness withdrew.

ADDENDUM.

EXTRACT from Supplement to the CALCUTTA GAZETTE,
Saturday, 22 June 1861.

From the Military Finance Department, to the Secretary to the Government of India, Military Department,—
(dated Calcutta, the 23rd May 1861.)

SIR,—WE have the honour to submit, for the consideration of Government, a Report on the introduction of a new machine for making ice, of which we have been favoured with an inspection and demonstration of its capabilities, and the result appears to us to be so satisfactory, that we should not be doing our duty faithfully to the Government did we not at least bring this prominently under notice.

2. Our attention has been directed to this matter in consequence of our being aware of the largely increased consumption of ice in hospitals and barracks in the various military stations in India, and the great difficulty and expense with which this necessary is at times procurable; and also in certain districts and seasons of the uncertainty of supply. And as we have noted with earnest attention the desire of Government not only to provide for its soldiers and others every necessary, but to provide such necessities at the most reasonable cost, we introduce this subject as one well worthy of attention, as the Government has now become a large and certain consumer for the necessary to which this paper immediately relates, both with regard to its sanitary as well as its financial bearing.

3. By the courtesy of Mr. Calder, of the Firm of Messrs. D. Wilson and Co., we have been enabled to test the properties of this machine, and the advantages which it affords of giving a steady and certain supply of ice throughout the year, no matter in what situation;—and we are of opinion that much benefit would be derivable from the establishment of an ice factory at most of the cantonments, if the Government would take the initiative in proposing the measure, and offering its support on certain conditions; and if the residents in cantonments will also take their part in its establishment and management, a course which we have but little doubt they would be glad to adopt, on being made aware of the opinion of the Government in reference hereto.

4. We would therefore suggest that inquiries should be set on foot with a view to ascertain, in the first instance, what private means would be available towards the establishment of these ice machines; information being at the same time given as to what might be the expected product and return to be derived therefrom, as illustrated in the following paragraphs.

5. It will be seen from the accompanying copy of letter from Mr. Calder, that

Machine No. 3 size	-	-	Rupees.	5,000
Engine for ditto	-	-	1,500	
Cost for freight and other necessities at starting	-	-	1,000	
Total Rupees	-	-	7,500	

on an outlay of Rupees 7,500, as per margin, for a No. 3 size machine, and an engine and other apparatus for working the same, and with an additional daily expense of rupees 14-4, detailed in the margin for production of ice, 1000 lbs. of ice can be available every day; and calculating upon the data set forth, the cost of ice thus obtained is less than one

Cost of Ether	-	-	Rupees.	1 0
Ditto Coal	-	-	3 8	
Ditto Salt, 4 seers	-	-	0 8	
Ditto Oil, 2 pints	-	-	0 4	
2 Men's wages for Ice Machine	-	-	0 8	
2 ditto ditto Engine	-	-	5 0	
Engineer's pay per day	-	-	2 0	
Wear and tear of Machine and Engine per day	-	-	1 0	
Interest of money per day	-	-	14 4	
Total Rupees	-	-	14 4	

5670. Supposing that a machine is erected at a place distant from the means of repair, what portions ought to be supplied in duplicate?—A spare set of the above-mentioned valves and springs, and spare brasses for the bearings, screws, bolts, &c.

5671. What is the cost of these duplicates?—About 50*l*.

5672. What establishment is requisite for the maintenance of the machine?—One skilled mechanic and three or four labourers.

5673. (*Chairman.*) Is there anything else you would like to add in explanation?—No; except that before applying the machine for cooling rooms in India, I should advise experiments to be tried in England, in order to ascertain the best means of applying the cooling power. With regard to making ice, that has been thoroughly tested, and would, therefore, not require any preliminary trials.

piece (three pie) per lb., whereas ice procured from a private firm costs not less than one anna for the same quantity in Calcutta; therefore, comparatively, the cost of ice obtained by such a machine is to the cost of ice purchased from a private firm as 1 is to 4-4, or in other words greater than four times the cost of the former, and irrespective of the charge for conveyance.

6. Although these data may be subject to variations according to locality, some of the items above mentioned in the margin may, by the circumstances of the country, be in excess of the price set against it; and, vice versa, others might be reduced. But on the whole they serve as a good basis for calculating the probable expense that will be incurred for a pound of ice thus produced in any part of the country; and perhaps it may not be too wide an assumption if we assert that the rate per lb., as above stated, is susceptible of diminution. The item of allowance for the engineer being the only one capable of altering the case to any considerable degree, we would therefore beg to bring to the notice of Government the fact that almost every regiment could furnish a man capable of working such a machine, and suggest that advantage may be taken of this—should our suggestions be entertained—as it will afford the twofold benefit of causing a reduction of outlay and provide means of useful employment to the men.

7. In further explanation on this point, viz., the cost at which ice can be produced by the ice machine, we have the honour to append, for the perusal of Government, a detailed statement drawn up by our colleague, Lieutenant-Colonel Simpson, who, in company with Assistant Commissary General Captain R. C. Wroughton, inspected the working of the machine, which, by Mr. Calder's kindness, they were made thoroughly acquainted with, and have been enabled to report upon accordingly. We would here observe, that the result have as to cost and quantity of ice produced daily may be considerably modified by the use of a No. 1 engine, which is capable of producing a larger quantity, and so as to be in an inverse ratio of the two items of cost and produce; and that this, in our opinion, would be a strong argument in favour of employing the larger description of machine.

8. In suggesting the establishment of ice-making machines, either directly by the Government or subsidized by it, we believe that we are bringing under notice not only a most useful but an economical measure. We consider that they would soon repay any advance made or cost incurred, in the great difference in price at which the ice would be supplied; and that they would afterwards be self-supporting, and even to a certain degree profitable, we have no doubt. On the whole, we believe that we are introducing a matter to the notice of Government which is well worthy of its serious consideration, and we beg leave to recommend it accordingly. At the same time we would wish to record our sense of the great courtesy exhibited by Mr. Calder in first pointing our attention to this matter, and afterwards in allowing so free access to and giving so full information respecting the machine.

P.S.—Since writing the foregoing letter, we have obtained from the Examiner, Commissariat Accounts, certain data showing approximately the cost of ice supplied for hospitals in the Bengal Presidency during the season of 1860, which we append hereto, and to which we beg reference. The quantity actually delivered and the time of delivery are not clearly stated, but the figures indicate that ice has been supplied at a much higher cost than that at which it might be expected to be obtained by the machine; and as

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it is stated also that in many instances the quantities furnished have been so delivered, only when procurable, it is but fair to suppose that a much larger quantity would have been used could it have been obtained.

APPENDIX.

STATEMENT of Cost of Ice supplied for Hospital use, during the Season of 1860-61.

Station.	Daily Supply.	Period.	Cost.	Remarks.
Agra -	23½ Seers.	Season	500 0 0	Average daily supply.
Allahabad -	106 "	Do.	1,272 0 0	
Bareilly -	13½ "	Do.	164 14 4	
Benares -	Unknown	Season	768 0 0	For 12 Shares.
Barrackpore -	None	None	None	
Cawnpore -	Unknown	Unknown	288 0 0	
Dacca -	None	None	None	
Dinapore -	None	None	do.	
Darjeeling -	None	None	do.	
Ferozepore -	18 Seers	Season	144 0 0	When procurable.
Fyzabad -	24 "	1 month	182 12 9	
Jullundur -	17 "	Season	211 13 9	Ditto.
Kussowlie -	None	None	0 0 0	
Lahore -	32 Seers	Season	280 14 0	Average daily supply.
Lucknow -	Unknown	Unknown	625 0 0	
Meerut -	63	Season	594 0 0	
Mooltan -	14	Do.	129 8 0	
Peshawur -	16	Do.	367 0 0	Ditto.
Presidency -	Unknown	Do.	472 8 0	Per 3,780 Seers.
Rawul Pindi -	11	1 month.	360 0 0	Per 9 Shares at 40 Rs. per Share.
Saugor -	None	None	0 0 0	
Sealkote -	Unknown	Season	174 5 3	Per 27 Shares.
Umballa -	22 Seers	Unknown	66 0 0	11 Shares, at 6 Rs. per Share.
Total Cost -			6,510 12 1	

(Signed) G. BALFOUR, Colonel,
President, Military Finance Department.

From A. CALDER, Esq. to Colonel G. BALFOUR, President, Military Finance Department.—(Dated Calcutta, the 9th April 1861.)

I HAVE now the pleasure to send you sufficient data in respect to cost of ice machine, engine, &c., also the cost of a pound of ice produced by such a machine.

The cost of the No. 3 machine is - - - Rs. 5,000
Add cost of engine for ditto - - - " 1,500
Ditto of freight and other necessities at starting - - - " 1,000
Rs. 7,500

Such a machine is capable of producing at least 1,000 lbs. of ice per day.

The cost of such production per day is as follows:—

Ether - - - - - Rs. 1 0
Coal - - - - - " 3 8
Salt, 4 seers - - - - - " 0 8
Oil, 2 pints - - - - - " 0 4
Two men's wages for ice machine - - - - - " 0 8
Two ditto ditto for engine - - - - - " 0 8
Engineer's wages per day - - - - - " 5 0
Wear and tear per day of machine and engine - - - - - " 2 0
Interest of money per day - - - - - " 1 0
1,000 lbs. of ice cost - - - - - " 14 4

which is less than one pice per lb. (please examine). The ether is imported in drum cases with gun-metal screw caps, quite safe, and no waste.

Our catalogue herewith, page 8, will give you a sketch of machine. Bear in mind, that it is essential to have a supply of good water.

STATEMENT drawn up by Lieutenant-Colonel Simpson.

The statement of the patent Ice-making Machine furnished by Mr. Calder, of the firm of Messrs. D. Wilson and Co., where the machine is now in daily operation, is satisfactory. On its receipt, I, in company with the Deputy Commissary General, Captain Wroughton, inspected the machine when working on the 10th April 1861.

1. I availed myself gladly of Captain Wroughton's experience and talents as a machinist, and also because that officer had in 1859, when in London, thoroughly investigated the patent then just licensed. His opinion was at the time so favourable, that he had at one time determined to bring one out to India, but as his position then was uncertain, he was deterred by the risk he ran of not being able to superintend its erection and working.

2. I may premise that the machine we inspected was found to be working under many disadvantages, the room containing it being adjacent to the hotel kitchen, and the engine in close proximity; moreover, the heat was streaming through an exposed roof, and while the condensation worked was of very high temperature, the wooden refrigerator was not jacketted, thus causing the ether to enter the evaporator at a high temperature, and the entrance of caloric into the refrigerator to be excessive.

3. Notwithstanding all these disadvantages and drawbacks, the production of ice was steady and complete.

4. It is considered there are few positions or climates in India where the powers of the machine could be more severely tested, as there are in all places means of modifying intense heat, none of which were in the present instance applied, but, on the contrary, the heat of the climate was aggravated by the artificial heat gendered by the engine and the kitchen fires.

5. Having satisfied ourselves completely on this point, we assumed the production of ice under circumstances in any of the stations of India to be equal to that now realized by Messrs. Wilson and Co., and therefore Mr. Calder's calculation serves as a base on which to frame a financial statement.

6. The excess on expenditure over Mr. Calder's working estimate in distant up-country stations may be on the following items:—

Ether—cost of transit up-country - - - 25 per cent.
Coal or wood - - - - - 50 "

The other items may be considered as constant or capable of diminution.

7. There is only one of any moment worthy of notice, viz., the engineer.

8. Most European regiments would furnish more than one man capable of attending to the machine, which is indeed very simple, consisting principally of a double cylinder and pistons working two induction and two discharge valves, and occasionally an air pump, to maintain the vacuum complete. All therefore that is required is a steady man accustomed to engineering, and who will keep every part scrupulously clean.

9. We may, however, arrive at very large deductions in cost of production, rated by Mr. Calder at less than one pice per lb., or say 35 seers per rupee.

10. This is by adopting No. 1 size machine, the out-turn being four-fold that of the one under review.

11. As the same (10-horse power) engine would work No. 1 size we have no extra expenditure in coal.

12. The next charge is ether,—the leakage is but slightly increased by size, indeed, size is favourable to correctness of fit; but allowing

50 per cent. increase, we have Rupees - 1 12 0
Salt, say 100 per cent. " - 0 8 0
Oil, 50 per cent. " - 0 2 0
Two men extra for ice " - 1 8 0
Wear and tear " - 6 0 0
Interest of money " - 3 0 0

Total increase of No. 1 on No. 3 size " - 11 14 0
Add Mr. Calder's estimate for No. 3 size " - 14 4 0

Cost of 4,000 lbs. of ice " - 26 2 0

produced daily by 12 hours' working, being at the rate of 130 lbs. per rupee, or more than 1½ maunds.

13. When therefore it is considered that this out-turn is a certainty, can be doubled by working night and day, and gives block ice of double value from its extra keeping properties to the pan-ice now made at stations in the north-west, the certainty of its superseding can only be effected by the relative price at which the two methods can be worked.

14. Now an eight seer share of ice generally costs 60 rupees per season in Northern India, and is supposed to secure to the fortunate holder a supply for six months in each season; but what with total and partial failures through unfavourable weather in December and January, on an average, less than half this period may be held to represent the usual benefit derived from the shares; but admitting the full six months' supply to be always forthcoming, the shareholder will receive in lieu of his rupees 60, seers 1,456, being at the rate of 24 seers per rupee; but the same quantity produced by a 1st size engine would cost but rupees 22'8, besides lasting double the time in the ice basket. A small engine such as was inspected would give a similar quantity for rupees 45.

15. The buildings, &c. must, however, be estimated for, and they are few and simple: a small two-roomed building with thick roof and enclosed verandahs is all that is re-

quired,—no pits, nor platters, nor beaters or collectors, &c. &c.

16. This would be, say, rupees 2,000, and could easily be paid out of the ice made by putting on a trifling per-centage on the charge.

17. Government has already become a large and certain customer through hospital consumption, and has showed so much interest in there being a regular supply of ice for the sick soldiers, as in some instances to order money to be advanced from the public Treasury for the purpose of erecting the buildings and pits of ice concerns in the old system.

18. It is believed that this paper holds out no false or inflated hopes, but if what it states is true, ere long the patent ice machine will be in many stations; for if a Saxon community has heretofore always struggled through the uncertainty of climate, and the scarcity of labour for ice lifting to success, it will not fail to accept a plan which is perfect

in its action, equal in its delivery, and economical in its cost.

19. What is now sought to be urged is, that in the present unsettledness of things, and the late large expenses of the community, Government should come forward and advance freely for the purchase of engines, and repay itself from the issues of ice to hospitals.

20. There will be no risk, for the ice machine is destined to become "an institution," and to be felt as one of the first wants to be relieved by any Indian community; and as the manufacture of soda water, an article standing far below ice as a luxury, has already fallen in many instances into the hands of the natives, so likewise it is believed that ere long no city of any note will be without its ice engines (ice being an article most highly prized and relished by every native who can afford to purchase it), and the scenes of a Cabul bazaar to be re-acted in India by there being ice sold in every bazaar.

Mr. D. Siebe,
C.E.

13 July 1861.

Thursday, 17th October 1861.

PRESENT :

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir RANALD MARTIN, C.B., F.R.S.

J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.

WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.

Dr. FREDERIC JOHN MOUAT, Surgeon Major, Bengal Army, examined.

5674. (*Chairman.*) You have served, I believe, about 21 years in India?—I have.

5675. Has your service been chiefly in the presidency of Bengal?—My service has been in the presidency of Bengal; but I have been on duty as high up the country as Lahore. I was then engaged on inspection duty.

5676. Have you served with native or European troops, or in what capacity have you served?—I have served very little with troops. I first served with European troops in Fort William. I was then with the 21st Fusileers. I was subsequently in medical charge of the 47th native infantry, and was afterwards attached to the artillery at Dumdum. I was then transferred to the civil department, in which I have remained ever since.

5677. You have published a report, I believe, on the state of the jails in India?—I have published several reports on that subject.

5678. Have you served long enough with native troops to have acquired some practical knowledge of the manner in which they are housed, and the sanitary conditions under which they live at their stations?—Quite so. I have seen them in almost every station, from Calcutta to Lahore, and in the Eastern Provinces.

5679. The native troops hut themselves, do they not, receiving some assistance to enable them to do so from the Government?—That is generally the case; in fact, it is almost universally so. The attempts which have been made to house them in barracks have been very unfavourably received by the native troops.

5680. For what reason?—Partly on account of their caste prejudices; for example, men of different castes and religions do not like to be associated together in the same room; in some cases from having their families—their women and children—with them; but in almost all cases, on account of the preference which the natives have for isolation and privacy—a home of their own.

5681. Is it the general custom for them to take their families along with them?—Not in the old Bengal army; it is so in the Madras army, and in some local regiments, but in the regiments of the Line, the old Sepoy regiments, they very seldom had their families with them.

5682. (*Sir R. Martin.*) Especially the high caste Hindoos?—Scarcely ever. My regiment contained an unusual proportion of Brahmins, and I do not think any of them had their families with them, unless they had sufficient means to house them comfortably, and to isolate them in the way that they liked.

5683. The 47th regiment was a general service corps, was it not?—It was.

5684. And, therefore, there were fewer high caste men amongst them?—Not so; for, curiously enough, in consequence of the great popularity of its commanding officer, it had, when I belonged to it, a larger proportion of high caste men than any other general service corps. Colonel Pogson was a man who was well known in Oude, and very popular with natives. As a rule in the general service corps, there are comparatively few high caste men, in consequence of their objection to cross the seas.

5685. (*Dr. Gibson.*) You have referred to barracks which have been built for native regiments?—Yes, at Akyab, in Arracan, barracks were built for the local battalion, but the men would not live in them, although they would have been much more comfortable in every way than in their huts; they still preferred pigging after their own fashion in the huts. There is another place besides that which I have mentioned. At Dorunda they have built barracks, and the men have inhabited them; there they have not raised any very great objection to doing so that I heard of; that was on the south-east frontier.

5686. (*Sir R. Martin.*) In that case, caste was the sole obstruction, I presume?—No, not with them; for they were almost all Mughls and Burmese; but the objection was equally strong amongst them.

5687. It has been found in many instances, that the low caste men give as much trouble about caste as men of a higher caste?—The lower castes give a great deal more trouble, as they are more tenacious of such privileges as pertain to their respective castes; it is the case also in prisons.

5688. (*Chairman.*) In the huts are the men together, or are the huts generally small?—They are small, and they are generally occupied in this way; each man has his own hut, and if there are any members of his own immediate family with him they live with him, but not otherwise.

5689. The men do not club together?—No.

5690. A native objects to go into a barrack because he prefers a home of his own, however small or uncomfortable it may be?—Yes, and he likes it to be as similar to the one he has left behind him in his native village, as possible.

5691. You are probably of opinion that the feeling in favour of that mode of living is not likely to alter?—I should say certainly not, with the present feelings of the natives as to caste, for they are probably more tenacious on that score now even than they were before the mutiny and the issue of the Queen's Proclamation.

5692. Then you look upon it as a necessity, that where native troops are employed they must be allowed to hut themselves in their own way?—At present I am afraid it is so.

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5693. Of what material are the huts in general built?—They are generally built of mud: mud walls with grass roofs, or roofs covered with palm leaves.

5694. A thatch of palm leaves?—The thatch is unusually of grass; those built by Government are tiled where tiles are procurable, from their incombustibility.

5695. To what extent, as a general rule, does the Government or any authority interfere in the building of those huts, in order to see that the conditions are such as they ought to be?—There is very little interference; in fact, the natives would not tolerate much interference. In the matter of interference that of the officers appears to be confined to causing the huts to be built in regular lines, leaving a space between each, and the means of digging a trench for the purposes of drainage; but with regard to the interior of the hut, there is no supervision of any kind exercised; in fact, none would be submitted to by the great majority of the Sepoys; they will not allow you to approach within their bounds, or to come within their doors.

5696. (*Dr. Farr.*) Do the huts consist of single rooms?—Yes; except in the case of native officers, who have two, rarely more; they build a Zenaana compound, which is a small space outside, in which the women can carry on their different occupations without being seen.

5697. Is there any attempt made to drain the ground round about the huts?—Only by digging trenches.

5698. What becomes of all the dirt that accumulates round about a station?—They are very dirty places, but people are employed by the cantonment officers to clean these places and remove all the filth, but at the best of times the native lines are dirty; and if left to themselves they never would clean them; they would accumulate every possible species of filth there.

5699. There is no objection, I suppose, to the enforcement of external cleanliness, provided the interior of the houses is not interfered with?—Not the least objection.

5700. Is there any interference on the part of the Government for the purpose of seeing that there is a proper amount of space given to a hut?—Not in the interior. The commanding officer generally possesses influence enough to see that they are built with tolerable uniformity and regularity, but beyond that no interference is exercised; certainly there was not in my regiment, although the commanding officer was so popular that he could have done whatever he wished, yet he refrained.

5701. (*Sir R. Martin.*) Are there any other cases besides the question of hutting in which caste interferes with the sanitary arrangements in a native cantonment?—Yes, there is with regard to their personal habits of ablution, and what they term their *burri fudger* and their defecations generally. In all such matters it is very difficult to deal with the habits of these people.

5702. As regards their personal habits, they are generally cleanly, their ablutions are regular, are they not?—With the Hindoo Sepoy particularly so; cleanliness is one of the injunctions of his religion; but it is not so much so with the Mahomedan Sepoy, and still less so with the Madras Sepoy, and the Mugh is probably the dirtiest of all in his lines. On parade and on duty great personal cleanliness is enforced.

5703. How is the water supplied to the native lines?—Invariably from tanks in the lower provinces; in some of the up-country stations it is procured from deep wells, but almost always from tanks and wells combined, where there is good well water.

5704. The tank is used for bathing, is it not?—There is generally a special tank set apart for that purpose; but there is in every cantonment one large drinking tank which is popular among them, and contains purer water, and a guard is placed over that in order to prevent bathing, and to prevent dogs and animals being washed in it.

5705. Then there is some attention paid to the purity of the water?—Yes, as far as such means as they have in cantonments go, the greatest possible attention is paid to it.

5706. Generally speaking, is the supply of water abundant?—In Lower Bengal it is very abundant always; the water is so near the surface that there the tanks are very rarely dry; in the upper provinces at the driest season of the year the water is usually impure, and contains salts from the soil.

5707. (*Sir R. Martin.*) But it is all conveyed, is it not, by hand labour?—For domestic use entirely by that means; they carry it themselves; amongst the Mahomedans it is carried by bheesties or water carriers, who carry it in goat skins.

5708. (*Dr. Farr.*) How does the water get into the tanks?—It is generally from the rain-fall during the rainy season, and partly from the drainage of the adjoining soil, surface drainage; more rarely from springs in the soil.

5709. Does not the surface water which thus drains into these tanks often convey many impurities into them?—No doubt of it; after a heavy fall of rain the water is very muddy and dirty, and it takes 24 or 48 hours to subside and become clear.

5710. A tank in India is like a horse pond, is it not?—Yes, except that it is more uniformly deep, and the banks and sides are kept clean.

5711. (*Chairman.*) It is often lined with stone, is it not?—The old tanks, which were constructed by the Mahomedans, were so, but not those of the present day; they are simply excavated. In some places they are puddled with clay to prevent leakage, and there are generally brick steps constructed, ghauts as they are called, leading down to them, to enable the men to bathe and take water at all times.

5712. (*Sir R. Martin.*) Are not the tanks frequently filled also from neighbouring rivers?—In Calcutta they are, but I do not think there are any means of doing it in any other place that I have seen, except during high inundations in stations situated on the banks of great rivers. At Calcutta the *Lal Diggie* is periodically filled at high tide, and many other tanks in that city are filled from the aqueducts.

5713. (*Dr. Farr.*) The natives themselves attach importance to pure water, do they not?—Yes.

5714. And they ascribe many diseases to impurities in the water?—Yes, at every station which is unpopular among them the diseases are ascribed first to the impure water, and next to bad air.

5715. Do you think that that opinion is well founded?—Yes, I do.

5716. What diseases do you think may be more particularly referred to impure water?—It is difficult to say what specific diseases are traceable to it alone, but worms and bowel affections are probably those most frequently so caused.

5717. Have you observed any instances in which disease could to your satisfaction be referred to impure water?—In a marshy district I have no doubt that impure water has a tendency to produce diarrhoea, especially when, in a very dry season, the wells, and even the tank water, are more or less loaded with salts, diarrhoea is very rife in those cases, and the same thing occurs from water that is drunk from tidal rivers; for even in the hot season when the tides are very low, the water is to a certain extent brackish.

5718. (*Sir R. Martin.*) That description of water must necessarily disturb the bowels?—I think so; it certainly has that effect upon Europeans. I accompanied a detachment of sailors to Assam during the mutiny, and the water was all taken in alongside from the river: a most frightful outbreak of cholera occurred within 24 hours after our embarkation, and the men attributed it to the water.

5719. On the score of caste do you think that the natives would object to the conveyance of the water in iron pipes?—They would at first, for they are very suspicious in all matters of this kind. I do not think that any permanent objection would arise to it.

5720. (*Chairman.*) That would be very much a

matter of tact and management, would it not?—Yes, quite so; there are no people who are more amenable to tact and management than the natives of India; you can do almost anything with them by quietly explaining matters to them, and not enforcing anything violently.

5721. Do you think that in practice there is any considerable mortality, or any considerable amount of disease among the native troops which is to be ascribed either to the uncleanness of their stations, to impure water, or to a deficient supply of water?—The chief diseases which the natives are liable to are endemic and epidemic diseases in the various parts of the country in which they serve, and no doubt those would be very much influenced by the quality of the water, and bad conservancy.

5722. What are the prevailing diseases among the native troops; do they suffer as much from cholera as the English do?—Yes, in the epidemic outbreaks they suffer frightfully from cholera, fever, and dysentery, and whenever they are serving out of their own native localities, they appear to be just as liable to the devastating ravages of epidemic disease as Europeans are; indeed I have never known so many men belonging to a European regiment to be in hospital at one time in such circumstances, as occurred in a native corps. I think that in one instance 900 men were sick out of a battalion a little more than 1,000 strong. This occurred at Dacca, shortly before the abandonment of the native lines in that place.

5723. (*Sir R. Martin.*) The native army of Bengal, when quartered in the upper provinces, has always suffered much more than when serving in Bengal Proper, has it not?—There are no natives of Bengal Proper in the regiments of the line. Up country Sepoys invariably after the second year's residence in Lower Bengal became sickly. They appear to be pretty healthy during the first year, they decline in the second year, and in the third they become very unhealthy.

5724. The diet has a good deal to do with it, has it not; as they take to eating rice, which is strange to them?—Yes, but I do not think they take so much to that, as is generally supposed. Lord Ellenborough's order has enabled them to buy atta at very much the same price as they could obtain it for in the bazaars of the upper provinces. At the same time the native soldier is usually very penurious, and if he remits a large proportion of his pay to his family, he takes to the cheapest diet himself, rice, and that disagrees with those who have been accustomed to eat wheaten flour.

5725. A change from wheaten bread to rice has almost always been found prejudicial, has it not?—Yes, invariably so; up country men certainly suffer, and so do prisoners from the same provinces.

5726. (*Chairman.*) The diet of the Sepoy is entirely of his own choice, is it not?—Entirely so; no influence is exercised over him in that matter, but the Government try to procure for him the largest quantity and best quality of the food to which he has been accustomed. Great trouble is taken in the regimental bazaars by the commanding officers of regiments, for upon that the contentment and happiness of their men very greatly depend. In Arracan and Burmah I think the native troops suffered almost more than the European soldiery from endemic sources of disease, and in the eastern districts of Bengal regiments have been more than decimated by fever, dysentery, and cholera. The dietary doubtless had much to say to this.

5727. Regarding as inevitable the present objection of the natives to live in the barracks provided for them, and assuming that the hutting system must continue, is there any general regulation which you could suggest as calculated to diminish the mortality among the native troops?—If the huts were properly ventilated, built with greater regularity, with a sufficient amount of space, and if subsoil drainage were insisted upon as a practice, which it is not now, in addition to surface drainage, and the huts were made watertight, their health and condition would be improved.

5728. Those things could be done in the first instance, when the hut was being erected, could they not, without any objection on the score of interference?—The objection of the Sepoy would be to the expense entirely; if he had to pay more for it he would object very forcibly, but if it were to be done at the same cost, he would not care about it.

5729. (*Sir R. Martin.*) In lower Bengal would it not be a very great advantage if the huts were raised off the ground?—Yes, every native does that with his hut, but when he does it he makes a hole at the door, from which he procures the earth used in raising the floor, and this becomes the receptacle of all the refuse from his hut, so that any advantage that might result from raising the hut off the ground is counteracted by the filth which is deposited at its very door. The stench and effluvia are very great in native villages from this cause.

5730. They would not object, I suppose, to so much interference on the part of sanitary police in the cantonments as should clear and level the ground?—I should say not at all, especially if the matter were simply explained to them, and that what was done was on purely sanitary grounds, and upon no other grounds.

5731. (*Chairman.*) What they would object to would be interference with a hut after it was built and occupied, and not while it was in course of erection?—They generally build it themselves, and I think they might raise some objection, although I do not know that they would do so now, since more mixed castes are enlisted; any objection on their part would not be very strong if the Sepoy knew that as a condition of his service he must submit to these regulations, and if they were explained to him beforehand.

5732. I presume that under the present system the amount of space occupied by native lines is enormous?—It is very large.

5733. Does that lead to much practical inconvenience, or do you think that improved healthiness is secured by the dispersion of the men over a larger area?—I think that improved healthiness is secured, and as ground in most cantonments is very cheap, the Government can procure any quantity they please at a comparatively small cost for the construction of native lines.

5734. (*Sir R. Martin.*) In point of fact too much has been heretofore conceded to the Sepoy on the score of caste, and which it is now found could be dispensed with?—Yes, a very great deal too much, and many pleas of caste were admitted which were entirely erroneous.

5735. For example it has been found in China and within the garrison of Lucknow that the highest caste men would perform the most menial offices for their officers and families without appearing to think that they were infringing upon the rules of their caste?—I do not say without infringing upon the rules of their caste, but they do not object to do them, and in China they volunteered to perform services which no Hindoo was ever known to perform before that time.

5736. But on their return to India no objection was made, I believe, to those men by their families on the score of caste?—We can scarcely follow them into their villages; I rather think that they kept their own secret. The highest caste Brahmins have always told me that they had no objection themselves to do such things, but that their objection was on account of the treatment they received when these things became known in their own homes, and, in fact, on service they will do anything, because they are all in the same boat and no one dares to tell against the other; the secret is kept, but the bond of caste is altogether loosened.

5737. They will go very far to serve their officers, and are very attentive to their wants?—They will do anything for an officer who treats them kindly.

5738. (*Chairman.*) What is the mode of life among the native troops in the different stations; their military duties, I presume, do not occupy any large part

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of their time?—The chief part of their time is occupied in lying on their backs upon their charpoys at the doors of their huts, smoking and sleeping; they are fond of gossiping, and have no great occupation.

5739. In point of temperance and sobriety there is nothing to complain of?—In the Bengal army there is nothing to complain of; but the Mughls and the Sikhs are very fond of drink, quite as fond of drink as the Europeans, and the low caste Hindoos are also rather fond of it. The so-called Christian drummers were scandalous in that respect; they were usually low Portuguese.

5740. I presume that if more occupation were found for the native troops they would not be very unwilling to do what was required?—A Sepoy would not be unwilling, if he knew that it must be done as a condition of his service.

5741. (*Sir R. Martin.*) They are fond of athletic exercises, are they not?—Yes, they are, and once or twice in a week they wrestle and play among themselves; they have a kind of native gymnasium in the lines of nearly every regiment.

5742. (*Chairman.*) Is that practice encouraged by the officers?—It used to be so; and the old class of officers used not only to encourage it but they gave the men money towards it, and would, on festivals and holidays, be present to witness the exercises and games, and that had the effect of attaching the men very much to their officers. Some of the officers used to enter the lists and wrestle with the men, and sometimes beat their own best wrestlers, and they became very popular with them in consequence.

5743. (*Dr. Farr.*) You are aware that the mortality amongst the native troops, as it appears in the returns, is not high?—It is about 1·60 per cent., I believe.

5744. That rate of mortality is much lower, is it not, than the mortality among the European troops?—It is very much lower.

5745. Sir Alexander Tulloch has stated before this Commission that about 70 Europeans in 1,000 died; but according to the returns, only 16 in 1,000 natives die?—Yes.

5746. Is that, in your opinion, a correct statement of the mortality among the native troops?—No, I do not think it is.

5747. What is the fallacy that you perceive, if any, in that statement?—There are several. The chief one is, that a man who has not served a sufficient length of time for a pension, if very sick, and if the sickness be of such a kind to make it practicable to grant him leave, applies for leave to go home, and he goes home, where he dies from the effects of disease which he had contracted with his regiment; such a case is not brought into the mortality register.

5748. Do you feel certain that such a case as that is not reported?—Quite certain; three or four cases of the kind occurred in my own regiment. I waited upon the superintending surgeon, and asked him if I was to introduce those cases into my mortality register, when I heard of their deaths, and he directed me not to do so, as those men died away from the regiment, and not in hospital: they were ultimately struck off the rolls of the regiment from overstaying their leave.

5749. (*Sir R. Martin.*) A record of that kind is merely kept for military purposes?—Yes; it is not a record of deaths. It became accidentally known to me that these men died. One man died within five or six miles of the station. I rode out to see him, and tried to persuade him to come in again, but he would not; he preferred dying on the spot.

5750. When these men join a regiment, do they undergo any examination?—Yes; they are very carefully examined. The supply of recruits was unlimited, consequently all physical blemishes and defects were carefully examined into, and most of the commanding officers endeavoured to select the finest, the strongest, the healthiest, and the handsomest fellows they could get; the supply was practically unlimited.

5751. Are they always examined by a surgeon?—They are invariably most strictly examined by a surgeon.

5752. Are the Sepoys fine healthy-looking men when they join a regiment?—No; they are at first rather lean and hungry-looking; but the improvement in the physical condition of a Sepoy when he once gets upon pay is remarkable.

5753. What length of time have they to serve before they become entitled to a pension?—I am not aware of what it is at present; they used to enlist for a short time, seven years, I think; a part of the army enlisted in order to become acquainted with their duties, and then to enter the service of neighbouring princes.

5754. Is there any limit to the time within which they are not entitled to a pension?—Undoubtedly. I have not the regulations at hand to refer to, and I do not know exactly the period of service that is necessary, but it is a very long period.

5755. The wife becomes entitled to a pension, does she not?—Under some circumstances she does. For example, if a man is killed in battle, or he has served the full length of time to entitle him to a pension; but if he should die from natural causes within the limit of time for which he would become entitled to a pension, she would get nothing.

5756. Practically, do the men remain long in the service?—The old class of Sepoys used to remain a considerable length of time in the service; it had become almost a hereditary profession with them, and the facility of replacing them was so great that very few inquiries were made after deserters; and if they became discontented with a regiment, they left it.

5757. If they become ill, are they discharged?—Not necessarily. There are regular medical committees held; the commanding officer cannot discharge them. There are special invaliding committees before which they appear, and the proceedings are conducted with great care and attention.

5758. For what diseases chiefly are the men invalidated?—Rheumatism is one; and among the Sikhs I suspect that syphilis is the most prevailing cause; they are eaten up with it, worse even than the European soldiers. Among the Hindoo Sepoys it does not prevail to the same extent. The Mahomedans also suffer from it; but rheumatism, the sequelæ of fevers, the effects of dysentery, and various internal organic affections, are the diseases which usually cause invaliding.

5759. Is consumption a common disease among them?—There are so few *post mortem* examinations made that the fact is not generally ascertained; but I believe that consumption is more rife amongst them than has been established by actual examination of the bodies after death.

5760. In the cases where the men go home and die, and do not appear in the returns, what kind of diseases do they chiefly suffer from?—Chiefly from the sequelæ of fevers, and a curious kind of atrophy, or wasting away of all the tissues. Without any actual apparent tangible or specific disease, they waste away, and become the most extraordinary living skeletons. I never saw human beings with so great a tenacity of life, and so little flesh upon their bones; they were ultimately nothing but skin and bone.

5761. Cholera and fevers either kill them immediately or they recover from them, I presume?—Yes.

5762. But chronic diseases of that character would last so long that a man would be sent home, and probably die, and not appear in the returns?—The fact is that very many of the men do die at home, and all Hindoos prefer dying, if practicable, at some holy place, or on the banks of any of the sacred rivers.

5763. What allowance, in your opinion, is it necessary to make for that; how much, for example, would you add to the 16 per 1,000?—I think it would more than double that number. I believe that when they are serving in foreign countries the mortality among native troops is quite as great as among Europeans.

5764. That mortality would appear, I suppose, in the returns?—Yes.

5765. And does appear?—Yes; but a great part of the mortality that occurs under other circum-

stances, so far as I know, never finds its way into the returns, or at least it used not to do so ; it may more recently have done so.

5766. After proper allowance has been made for that, still the mortality among those men would be much lower than the mortality among the Europeans ?—Not so much so if they remained as the Europeans in India do until they die, or are eliminated by invaliding.

5767. If you raise the mortality from 16 to 30 per 1,000 that would not be half so high as the mortality among the Europeans ?—But then you should add to that the number discharged by invaliding as unfit for service, and who die from the effects of diseases acquired while they are doing duty as soldiers.

5768. Upon the whole therefore you would say that they do not suffer to the same extent from disease as Europeans soldiers do ?—In ordinary circumstances, they do not.

5769. To what circumstance do you attribute that ?—That they are serving in a tropical climate, which is their own native climate; that they bear exposure to heat better; that, as a body, they are certainly more sober; and that they suffer very much less from accidents, injuries, and acute inflammations of any kind; inflammation runs a very mild course with them.

5770. In some respects they are not so favourably circumstanced; for example, I suppose they are not so well fed ?—According to our notions they are never so well fed as the European soldier is.

5771. What is their pay as compared with the pay of the European soldier ?—I think it is about one-third of the pay of the European soldier.

5772. But the native does not get meat, does he ?—He can buy it.

5773. But he does not ?—If a Hindoo, he generally does not. The Mahomedan buys meat; the lower classes certainly live upon meat. The Mughs and Burmese invariably do, and upon fish.

5774. In the upper provinces they get flour, do they not ?—Yes, and vegetables, milk, ghee, spices of various kinds, and sugar.

5775. Is the diet of the native soldiers well regulated ?—Yes, amongst those who have not expensive families to support; many of them are in capital physical condition.

5776. Have they sufficient means to support themselves and their families ?—In the Madras army they appear to have sufficient; they have an allowance there both for women and children.

5777. Would not some advantage be gained if they lived separately in huts, so that when epidemic diseases prevailed they should not be spread through large rooms or wards ?—As a sanitary measure possibly it might be so; but as a measure of discipline it entirely prevents the European officers from getting at a knowledge of anything that is occurring, for they can concoct anything under the sun, under the very noses of their officers, who may otherwise be looking very strictly after them; the native lines are a perfect Alsatia.

5778. If the huts were put in a good sanitary condition, and the dirt removed, would it not be an advantage that the men should live in separate huts rather than in large barrack rooms ?—I do not see that in a sanitary point of view. If they had sufficient space, and the barracks were properly constructed, and were well ventilated, I should prefer placing the single men in barracks, both on the ground of discipline and on the ground of health. I do not think that they would suffer, as they are exposed to very few contagious diseases.

5779. At the present time the cubic space in a hut per man is very small, is it not ?—That depends upon the penuriousness of the man; it may be a place just capable of containing him, while another man may have comparatively a magnificent hut.

5780. (*Dr. Farr.*) What proportion of the men are married ?—We know very little about their domestic economy; in India generally you may safely assume that every native is married.

5781. Does syphilis prevail to a large extent ?—

Among the Sikhs to an enormous extent; they do not carry their families with them; they are just as gregarious in their amours as the British soldier, and in that way one woman who is popular among them, may affect a whole company.

5782. Is there any communication between the native lines and the European troops ?—None whatever.

5783. Or in the field ?—There they are not in lines, they are in tents; but they do not mix much together. The best known example of the contrary occurred at Jellahabad, where the men of the 13th light infantry and 35th native infantry fraternized entirely together.

5784. I suppose they would obtain their water from the same sources ?—The water is always brought to the European soldier.

5785. But they would have it from the same source as the natives ?—Yes.

5786. And if the water were infected by one class of troops it might injure the other ?—Yes.

5787. (*Dr. Gibson.*) Do the natives use latrines and urinals ?—None whatever; they are like the Israelites of old, they go and deposit their excreta on the plain; but they do not bury it as the Israelites did.

5788. And that gets washed into the tanks, does it not, when the rain falls ?—Yes; a heavy shower of rain washes down all soluble matters through the natural percolation of the soil, and it must find its way to the tanks.

5789. (*Chairman.*) Is the evil you have described a remediable one in your opinion ?—No; I do not think that any compulsion would, in ordinary circumstances, make them go to a latrine. I know of no instance, except in Fort William, and there they did it; but the latrine was placed over the fort ditch, and it became a source of the utmost abomination. I was appointed a member of a committee to examine into the sanitary state of that fort, and the ditch was most filthy; it was a reeking and abominable sewer for the deposit of all the faecal matter of the garrison, and this ditch surrounded Fort William in every direction; but there they were obliged to go to the latrines, because the police would apprehend them, and they were punished if they went on to the plain. They likewise defecate when they go to bathe in the river, and pollute the water, although there is a strict rule among themselves that they are not to do so in the tanks in which they bathe.

5790. (*Dr. Farr.*) You have made some reports upon the diseases and mortality among the prisoners in India ?—Several.

5791. What is the rate of mortality among the prisoners who are admitted in a healthy state ?—Those who are admitted in a good state of health enjoy fair average health; but they are, generally speaking, a very dissipated class, and extremely sickly.

5792. What is the rate of mortality among the prisoners who are in confinement now ?—Last year I am afraid it has averaged 12 per cent. upon the average number who were in custody in Bengal.

5793. Can you furnish the Commission with any information about the rate of mortality among the native populations in the villages ?—There is very little known that is reliable.

5794. Is the rate of mortality among them higher than it is in Europe ?—In some districts it undoubtedly is.

5795. (*Sir R. Martin.*) In damp malarious districts, for instance ?—There the population is sickly and unhealthy; you cannot go through such a district without noticing the anæmic and emaciated appearance of the people.

5796. It differs very much, does it not, in different parts of the country ?—It does.

5797. Are not the most elevated districts the healthiest ?—Certainly; in the Punjab, in Oude, and in Rohileund is a very fine population. In some parts of Lower Bengal also the people are in good case.

5798. (*Dr. Gibson.*) The natives deteriorate, do they not, when they are transported from one dis-

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strict to another?—They deteriorate very much indeed.

5799. If they go, for example, from a hot climate to a cold one?—Yes; in that case a native soldier is useless; he becomes half torpid in a state of cold; he wraps up his head to protect himself from the cold, and, as a sentry, is then utterly worthless.

5800. What diseases are produced by exposure to the cold?—On the retreat from Cabul a large number of the natives of India lost the use of their hands and feet from the cold, and they were much more subject to frost bites than the other men, and also to internal congestions. They are accustomed to oil the surface of the body, which they could not do under such circumstances, and local congestions were caused, chiefly of the lungs; they also suffered from abdominal diseases; rheumatism was also very frequent amongst them in such cases.

5801. You stated that a barrack had been constructed in which the native troops were quartered without any objection on their part?—Yes; I did not hear of their raising any great objection to it. That was at Dorundah, one of the stations at which the local battalion which had been there had mutinied, and these men were placed in barracks which were built in a healthy part of the station, but they were not, in my opinion, properly constructed.

5802. Were they built in the same way as European barracks are built?—Yes; very much like those that are built at Hazareebagh now, with pent tiled roofs, and tiled floors, to which the natives have a great objection, for they prefer mud and clay floors, and for them those floors are more healthy, I believe, than tiled, or brick, or stone floors, especially where the natives sleep on the ground.

5803. Were the barracks to which you refer occupied by one regiment or by more?—They were occupied, I think, by three regiments in succession which went to that station.

5804. What was the result in that case?—There was no unusual sickness or mortality among them that I heard of. I was at the station at the time that the Inspector-General of Hospitals made his visit, and I went round with him; the men seem to be healthy.

5805. Did they appear to be more healthy than if they were in their own lines?—Not more so, but I should say very much the same; there was a good average standard of health among them.

5806. (Chairman.) Is there anything which it occurs to you to suggest in addition to what you have already told us with respect to the native troops?—I do not know exactly in what way you could improve their present condition; they are well paid and well clothed, and, for their own purposes, well-fed,

and when discipline is strict, they are undoubtedly well-behaved. I do not think it is possible to improve the condition of the Sepoy; I know that it was Lord Dalhousie's opinion that they had every possible advantage given to them in the shape of pay and pension, and indulgencies of every sort, and this I also believe. They are better paid and better off than the same classes of the civil population. I certainly think it is necessary that their officers should be acquainted with their language, and with their manners and customs, and that they should be men who would be content to serve with natives, and take an interest in them, for unless they manage to make themselves personally liked by them, the bond of obedience is slight, and in that case any relaxation of discipline would be accompanied by an absence of cleanliness, and of all those conditions which are essential to a high standard of health.

5807. (Sir R. Martin.) The native soldier always looks to the individual officer, and never to a Department?—Yes, he always did so in the old regiments before all power was concentrated in the Adjutant General's office; the colonel then was the father of the regiment, and every one of the officers more or less associated with the men, and remained with them, and there was nothing on service that those men would not do for their officers.

5808. (Dr. Gibson.) What are the feelings of the natives towards the medical officers?—One of very great gratitude to those who are attentive and kind to them; but if a medical man is careless and inattentive, nobody will go near him if he can help it.

5809. Are the natives generally treated by European medical officers?—It is generally so in the regular corps; in the irregular corps they prefer being treated in their own lines in the huts. If the case is a severe one, the men go to the regimental hospitals. In the lines the native doctor treats them. In very severe attacks of disease, and in all surgical cases, they themselves prefer the European medical officer, in whose skill and remedies they usually have great confidence. This is always the case where the European surgeon does his own work, and does not leave his men too much in the hands of native doctors.

5810. (Sir R. Martin.) Generally speaking, you would say that their feeling is of the most kindly nature towards the surgeon?—Until the mutiny, I certainly should have said so, but at that time the medical officers suffered just as much as the other officers; the medical officer is generally very well liked, if he takes the slightest care of his men; he does not come in contact with them upon any question of discipline.

5811. (Chairman.) His business is to afford relief, and not to inflict punishment?—It is so.

The witness withdrew.

Dr.
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Dr. GEORGE CHARLES WALLICH, Bengal Army, retired, examined.

5812. (Chairman.) You have served, I believe, for 16 or 17 years in Bengal?—I have served for nearly 17 years.

5813. Has your service been chiefly with native troops?—Yes.

5814. At what stations have you been?—I have been at a great number of stations; the chief ones were Barrackpore, Berhampore, Ferozepore, Loodiana, Kurnool, and Meerut; I have been both in Lower Bengal and in the Upper provinces.

5815. You have served over the greater part of the Bengal presidency including the north-west?—Yes, and at one station in Central India.

5816. Have you had, during your service, ample opportunities of observing the sanitary condition of the native troops generally?—Yes.

5817. For example, with regard to the manner in which they are quartered at the permanent stations?—Yes.

5818. The Commission have been informed that the natives build their own huts, receiving some assistance from the Government for that purpose, but that there is no great interference on the part of

the Government to compel them to observe any sanitary rules in building them, and that drainage is very much neglected?—Drainage is completely neglected; the huts are very much huddled together, but drainage is utterly disregarded; ventilation is not properly attended to; and, in the rains, from want of drainage much inconvenience must be felt. In many of the stations the Sepoys rather encourage the growth of jungle round their very doors, and in Barrackpore I have seen large quantities of jungle, which was quite sufficient to stop any ventilation, growing up round their huts; the jungle consists of high grass and bushes, which they plant.

5819. Is that done for the sake of obtaining shelter or for what purpose?—I do not know that it is done for the sake of shelter, because it is not high enough for shelter, but it is sufficiently high to obstruct the circulation of air; the doors of the huts are also very low, and the men have to creep into them. The jungle is quite sufficient to obstruct all due circulation of air.

5820. I presume that the general outline of a station to be occupied by native lines is marked out

by the officers?—Yes, the general outline is marked out by them, but the rest is almost entirely left to the natives themselves.

5821. Roads I suppose are carried through?—Yes, there are certain lines of road running between them for each company, but the arrangement of the huts is left very much to the men themselves; in fact it depends chiefly upon how much a man chooses to lay out upon his hut.

5822. Is there for every man, or for every set of men, a certain amount of space assigned?—I think there is.

5823. For instance, for every company?—Yes, there is, generally for the average number.

5824. The huts are not placed at regular intervals, are they?—Very often they are not, but lately they have been more regularly built.

5825. Does the Government exercise any control over the choice of the materials and the amount of space that is allowed: the number of cubic feet?—I do not think it does; the men can only get one set of materials, the bamboo and the straw, with a little mud put over it at times.

5826. Are these huts, for the most part, of a permanent character?—No, they require renewal after a few years; they are left by one regiment, and then the next regiment that comes in takes them up. They are very slenderly built, merely bamboo with matting. They are of no value; I suppose that a hut does not cost above two rupees. The men sleep generally, except in the rains, outside; if they can possibly do it they have their bedsteads outside.

5827. Do you think that in that respect any improvement is possible, or that it would be objected to on the part of the men?—I think that the objection ought not to be allowed. And in the same way with diet; in all cases with native troops, when treating them medically, it is an absolute farce not to exercise some kind of control over their diet while they are sick.

5828. Do you suppose that it would be possible to induce them to live in barracks after the manner of the European troops?—I think it would be quite possible. I think that hitherto they have not done it because we have allowed them to do so much as they chose; but I do not think that they would object to it under certain restrictions, such as could easily be understood.

5829. Do you speak upon this subject from any experience that you have had?—Yes, I know that they did not object to go, during an unhealthy season at Berhampore, into European barracks, indeed they were very glad to do it.

5830. The Commissioners understand that in the Bengal service there is not a very large proportion of the men who have their families with them, but that in Madras and Bombay the number is great?—I believe so.

5831. Assuming that it were possible to keep the lines in good sanitary order, do you think that that is a more unhealthy mode of life than the soldier's life in barracks?—I should say so, certainly.

5832. Do you think that there is no increased liability to disease when several hundred men are placed in close proximity to each other?—I think not with proper ventilation.

5833. Are not epidemics more liable to spread?—Not if the ventilation is properly attended to; indeed, I should think less so than in the low huts.

5834. Except that it suits the habits and prejudices of the men, you do not think that there is any advantage in the system of hutting?—No.

5835. (*Sir R. Martin.*) Altogether, you would give a preference to permanent barracks after the European fashion?—Yes, with certain modifications, in order to suit the natives.

5836. (*Chairman.*) If that were impossible, do you think that much could be done in the way of improving the condition of the native lines?—I think that a great deal might be done in all our stations, both in the selection of localities and in drainage, and in the water supply; more especially, an improvement might be made in the quality of the water which they use chiefly in Lower Bengal, and also in the Upper

provinces, but not to so great an extent, for cooking purposes.

5837. Does the water come from tanks?—It does, chiefly.

5838. Are impurities to be found in the water that comes from those tanks?—A great quantity. At Barrackpore one or two of the tanks were kept for drinking purposes; but during the rains, from percolation and the overflowing of the water, impurities are washed into the tanks.

5839. What remedy do you see for that state of things?—There is very little, I think; it is difficult to offer any opinion upon the subject. I refer to very minute particles of decaying vegetable matter that are floating about, and which are carried into the water, and produce disease. It has been hitherto thought that malaria results from impalpable or gaseous matters, but I believe these matters have a palpable nature, which may, in time, be traced under the microscope; and these minute matters are washed into the tanks. You cannot take up any portion of the mud that has been overflowed after the rains without finding that on the surface it is one mass of minute plants and minute animals. Although the surface looks quite like ordinary fine mould, it is not so; and I believe that these causes of miasmata may become quite palpable under the microscope.

5840. (*Dr. Farr.*) The water, you think, is charged with organic matter?—Completely so. I do not speak upon this subject merely as a matter of supposition, for at Berhampore there are large and splendid barracks, but they are placed in the midst of a series of tanks, and with respect to those tanks I have reported that they were charged with vegetable matter, but the answer was that this vegetable matter was cut down and cleared away with large rakes as soon as it grew up. But it is not this larger kind of growth; it is the water that is charged with the minute particles I have described. In one part of Berhampore the unhealthiness is so great that the Europeans will not live in it. One house has the name of fever hall, and, as certainly as anyone goes to live in it, he takes fever. Although the water appears to be perfectly clear all round the station, yet during the rains the country is inundated, and the whole of these minute particles are washed in, and the soil is left to dry up after the rains, which produces miasmata.

5841. You have known cases in which you thought you could trace disease to the water?—Yes.

5842. That was the vegetable matter, but do you not think that animal matter may also cause disease?—Yes; most certainly.

5843. What diseases do you refer to?—I refer to fevers, dysentery, and cholera. Many minute organisms heretofore considered minute animals, are minute plants; but they have hitherto been considered as animals.

5844. You have, I believe, paid a great deal of attention to minute botany?—Yes.

5845. You cannot refer these diseases to any particular form of vegetation or animal life?—No; the reason why I mention it is this, that although the whole subject is, in my opinion, completely in its infancy, with regard to the attack of cholera up in the north-west provinces of which we have heard, we shall know nothing about the cause unless we begin with something tangible, and I believe that what I have mentioned is the small end of the wedge.

5846. Would you recommend that the water used in India by the troops should be carefully examined by the microscope?—No; I do not venture to recommend that, although no doubt such an examination, in India more especially, would be fraught with beneficial results. I should collect the rain water and have it stored away. I think that that would have a great effect in preventing a great deal of disease in Bengal. The thing would be perfectly easy, because the quantity of rain that falls is so great that a quantity might be collected which would be quite sufficient for the largest garrison, and I should store it away in iron tanks.

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5847. Covered tanks?—Yes, they should be carefully covered, and the water should be collected in open spaces, away from jungle of any kind.

5848. How would you bring the water down to the stations?—There are plenty of open spaces to collect it in. A few miles of extent would be sufficient for the purpose.

5849. The water, I presume, differs in character according to the soil, and it is purer on the high grounds than on the alluvial plains?—Yes, at Raneegunge, for instance, the water is very pure in certain places, where there is a hard iron soil, but, below in the hollows, where there is a great quantity of mould, the water is not so pure, and I know that it is surcharged with minute particles of living vegetable matter.

5850. Do you think that we know enough now of the effects of these elements to justify us in saying that the Government should incur considerable expense in supplying the troops with pure water?—Certainly.

5851. Which water could always be obtained in the ordinary seasons?—Yes; I cannot venture to say absolutely that these minute matters produce diseases but I think that we are justified in inferring that they do, in the absence of any other known cause; we talk of malaria, but we do not know what it is.

5852. A theory was started before this Commission of this kind, that these plants rather purify the water by disengaging the oxygen, in your opinion is that so?—No, it has been only very recently, within the last two years, that a number of very remarkable facts have come to light. Most of the scums and films resting on stagnant waters and damp surfaces generally which we see in this country and all over the world are actually derived from these minute living plants that I have been speaking of; they go on propagating, and thus repeating themselves for a certain number of generations, possibly for years; but at a certain time, and under certain conditions, an alteration takes place in the series of phases of development, and I think it is very probable that under certain conditions, of which we know nothing now, these same little organisms affect the human body, while at other times they would not affect it.

5853. Do you mean in some of their transformations?—Yes.

5854. When passing into a state of decay?—Yes, or, more correctly speaking, during the various changes they undergo.

5855. (*Dr. Gibson.*) Independently of that, the habits of the natives, who defecate all over the surface of the country, must necessarily cause the water in the tanks to become impure?—Yes, it is so; in point of fact the natives have no idea of taking sanitary precautions. For instance, a man will eat and drink and perform his evacuations actually on the very same foot of water, standing in it, or close to it; he has no idea of impurity as long as it happens to be Ganges water.

5856. The European troops and also the native troops drink the water from these tanks?—Yes; there is nothing else for them, and the same causes will operate with Europeans in an increased degree.

5857. (*Chairman.*) Would not the practice of filtering the water be an effectual remedy for its impurities?—Yes; but it would be difficult, I think, to do that upon a sufficiently large scale.

5858. Would that be more costly than storing up rain water?—Yes, I think it would. At Barrackpore there is no other water but that which is taken from the tanks; it is pure looking water that you get from one particular tank; it is clean, but it is nevertheless full of living vegetable matter.

5859. (*Dr. Gibson.*) Do you think that filtration alone would so purify the water as to make it safe to drink it?—Continued boiling would perhaps be the greatest safeguard; but many of those lower organisms will stand an immense amount of heat, and then when they are placed under circumstances which are favourable to germination they will grow again.

5860. (*Dr. Farr.*) Are there any circumstances

that, in your opinion, would explain the different rates of mortality among the native troops and the European troops, as connected with the water supply?—I think that the climate, the water, and the peculiar mode of life taken together, are sufficient to account for the great rate of mortality among Europeans.

5861. Do you happen to know the rate of mortality among the native troops?—No, not as an average; it varies so much.

5862. Have you made any calculations upon the subject?—Yes, but it is four years since I was in the country.

5863. In your experience what diseases chiefly prevail among the natives?—Dysentery, fevers, cholera, and rheumatism; the three first are the chief fatal diseases, and these I think will eventually be traced to impurities in the water.

5864. Have you reason to believe that we get in the returns an account of all the deaths which might be considered fairly returnable in a regiment?—Yes; certainly.

5865. Is it not the practice to send the men home when they become ill?—Yes.

5866. Is that done to so large an extent that men are sent away who may die at home?—Yes, and I have protested against the practice of sending men away, because they are so sick that cure appears improbable.

5867. What are the diseases generally from which they suffer?—Chronic dysentery and fevers.

5868. You do not mean acute fevers?—No; they do not send men away in that state; but I have seen men sent to their homes when they have been hardly able to crawl, and a couple of men have been told off to escort them.

5869. After they have been suffering from ague, for instance?—Yes, or general debility. It is often the case, that when it appears they are beyond cure they are sent away.

5870. When the homes of the men are very distant what is done then?—Still they go away; it is their great craving; they themselves desire it.

5871. Do you know what term of service is required before they become entitled to a pension?—I really do not know that; but the rate of pension depends upon the period of service.

5872. Do they remain long in a regiment generally, or do they pass through it quickly?—Some of them will remain for 20 or 30 years. In the majority of cases the natives do not seem to suffer from long service.

5873. Does consumption prevail much among them?—Not much.

5874. Have you had many to treat for syphilis?—Yes, in some stations; but all that depends upon the bazaars; in Lahore and in Meerut there is a great amount of syphilis.

5875. Are many of the men married?—They are married, but very few of them have their families with them; a great many of them have women in the bazaars.

5876. Not living in the huts with them?—Never, I believe.

5877. That is not the case among any class of native troops?—I have never seen them; certainly not among the higher orders of them, and I do not know of any case.

5878. It is not so common as to make any very great distinction between them and the European troops in that respect?—It is about the same; very few of them have their wives and families with them; they leave them at their villages.

5879. What would you suggest as the most likely way of diminishing the diseases which are prevalent among the natives?—I should recommend great care to be taken in the selection of cantonments, proper attention being paid to ventilation and drainage, and some limitation as to diet. When the men are maintained in hospital at a great expense to the Government, besides the loss of their services, they are getting medicine from the surgeon, whilst they are at the same time completely at liberty to adopt any diet which they

choose. I remember a very marked case of a man who was under my care. I was sure that he was indulging in free diet, and I happened to pass by when the men were eating their dinner, and I saw an immense pile prepared which this man was going to eat. I let him eat it, but immediately afterwards I gave him a violent emetic. This man was taking quinine at the time, and suffering from a most obstinate fever; but there I saw an amount of food which it was even difficult to believe that a healthy man could devour.

5880. (*Chairman.*) This arises, does it not, from the system of placing men in huts?—The men are allowed to eat their dinner outside the hospital; this man was a sick man.

5881. (*Dr. Farr.*) The Government allows a sick man to be supplied with expensive drugs, but gives you no control over his diet?—Yes.

5882. And there is very little control over their huts?—None whatever; there is no control. It is the duty of the medical man to report what he sees; but, unless the officer commanding the station has some fund at his disposal for the purpose of effecting alterations, it is of no use; the reports cannot be attended to.

5883. Then in that case you have no power of preventing disease?—None whatever.

5884. You have only power to give them drugs when they are sick?—Yes.

5885. You have no power to do anything else?—No; you may represent a thing, but it has been so much the custom to give in to all their prejudices, that no one would meddle with them.

5886. Very strict rules have been laid down for the guidance of European troops, and it is seen that they are strictly carried out?—Yes; but the natives are invulnerable.

5887. Is there anything in caste that would prevent such interference as was necessary for a man's good?—I think it is one of those cases in which it becomes a matter of humanity and of right to insist upon it.

5888. Do you think the Government, if they were to do so, could then get as many men as were required for the service?—If they made it known that they would not take men except under those conditions, I am sure that they would soon get over it, except, perhaps, in the case of the high caste men.

5889. You have mentioned several stations; what stations do you think should be selected by preference, if the Government had the power to place the native troops where it chose; ought they to be placed upon the low or upon the high grounds?—Most certainly upon the high grounds, without following the too general custom of selecting a post, because there is not the vestige of a tree near it, for trees are beneficial instead of being otherwise, as long as they have not got a thick underwood beneath them.

5890. By whom are the stations selected?—Generally by committees, but a station is generally chosen in a military point of view; it is merely a choice between one half mile of ground and another.

5891. Has the medical officer anything to say to that?—Very little indeed officially.

5892. Has he to give his opinion in writing on the eligibility of a station?—He has to sign the papers of the committee, but not to give his opinion in writing; he may protest if he likes, but he is overruled.

5893. Is the selection of stations not made so as expressly to secure the health of the men, but generally rather for military reasons?—I think for the latter, and it is very difficult to do it entirely with regard to sanitary considerations, though a great deal might be done no doubt.

5894. Sanitary considerations have not hitherto been thought so much of as you think they ought to be?—I think not.

5895. You have no control, have you, over the clothing of the men?—None whatever; all regimental clothing is laid down by rule, but out of the cantonment they may do whatever they like; in fact they very seldom wear anything except a small piece of cloth round them.

5896. (*Chairman.*) Do you think it is possible or expedient to interfere more than the authorities do at present with the personal habits of the natives?—I think that when the services of the men are purchased at a very high rate, the Government are perfectly justified in exacting those services to the greatest possible extent, and where you do not do a man any harm or wound his religious feelings. I do not think that a man would object to measures of sanitary precaution, for instance, living in barracks, or a particular limitation as to diet, if he knew that the Government was determined not to employ men who would object to being so treated.

5897. As a rule the native troops are very sober, are they not?—They are very sober.

5898. With the exception of the Sikhs?—Quite so; a great many of them eat opium and bang, which is Indian hemp; but very few of them drink.

5899. I take it, as a general conclusion from what you have said, that you think that the worst evil in the native lines is the impure quality of the water supply?—Yes; and that the lines are badly arranged.

5900. There is a great want of sufficient drainage?—Yes; and also a want of ventilation.

5901. Is there any suggestion that you would like to offer with regard to the sanitary condition either of the native or European troops?—I think that a good deal might be done to improve the condition of the European troops in India by preventive measures, such as giving them quinine, when they are still in barracks or not actually in hospital. By having inspections so that when the medical officer thinks that a man is likely to become sick he should use preventive measures. I am sure that diseases, such as fever, cholera, and dysentery, do not attack a man unless he is in a particular condition of body,—unless he is already out of order. I think that a great many precautions might be taken in India to prevent disease by treating men before they are actually attacked by it. I think that that could be done by more careful inspections of European troops, for you constantly see men who have been for a long time looking unhealthy, flaccid, and pale, but they do not come into hospital, and those are the men who have these attacks.

5902. What kind of preventive measures would you suggest?—I think that by giving one or two doses of ordinary medicine you may frequently prevent a man from being attacked by disease, or when his system is out of tone by giving him quinine, which is one of the most valuable preventives that can be used in India, not only as against the one or two specific diseases, but against other diseases.

5903. Is not that in the power of the medical officer of a regiment now?—Yes; but it is not done; in the first place quinine is a very expensive medicine, and a man cannot step out of his way to do what no one else has done.

5904. (*Dr. Gibson.*) In fact, it would be necessary to introduce some system to make your suggestion generally useful; what would you recommend?—I would suggest weekly inspections for the purpose of picking out the men who were not actually ill, but men who seemed to have a tendency to become ill.

5905. Are not inspections made weekly?—Yes; but that is chiefly for syphilis; if you see a man who is really ill enough for hospital, he is picked out.

5906. Do you think that a weekly inspection would be sufficient for the purpose?—I think so, especially if the men were encouraged to say when they felt themselves slightly ill during unhealthy seasons or the continuance of epidemic diseases.

5907. Soldiers are not very much disposed to do that?—No.

5908. Would not a daily inspection interfere with the duties generally?—Yes.

5909. If a man is taken ill on a Monday morning, and he is not seen till the Saturday following, one would think that a weekly inspection would not be sufficient?—No, but a man is sometimes for weeks and months not well; he loses his appetite, he feels

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listless and heavy, and he gets an attack of disease, which he probably would not have if his symptoms were earlier attended to, and he was treated as I have suggested.

5910. Would you take those men into hospital, or excuse them from duty?—No, I would merely give them a dose or two of medicine, and perhaps relieve them from duty for one day, while under the operation of the medicine.

5911. But would a single dose of medicine, do you think, be sufficient to restore a man to health?—I am talking only as to a man being excused from duty.

5912. (*Chairman.*) You have pointed out that the military system only recognizes a man being either well or ill?—Yes.

5913. And that it often happens that a man without being positively ill is unwell and predisposed to illness, and that if the medical officer would deal with him in that state it might prevent his being attacked with illness?—Yes.

5914. You also suggest that a man should be encouraged to apply more often than he does now to the medical officer?—Yes.

5915. (*Dr. Farr.*) And you would treat him out of hospital?—Yes.

5916. That would be a novelty, would it not?—Yes.

5917. Do you see any objection to treating certain diseases out of hospital?—You could not treat disease in this manner. It is not disease that I mean when

you allow a man medicine and his diet is restricted; I merely allude to having the power of encouraging a man to come to you when he feels slightly ill, and to give him in such cases slight doses of medicine, without sending him into hospital or exempting him from all duty.

5918. Have you paid much attention to cholera?—Yes; I have seen most serious outbreaks of cholera.

5919. Is it preceded, in India, by premonitory diarrhoea?—I think that it generally attacks men who are predisposed. You cannot tell what it originates from; but a healthy man is not generally attacked with cholera, it is, generally speaking, the man who is out of sorts.

5920. And suffering from slight diarrhoea?—Yes, which merges into cholera. In cholera the only cases that are cured are those which are treated in the early stage.

5921. (*Dr. Gibson.*) In practice, is not that done?—Not often. The men have not an opportunity of coming in; they come into hospital after the first stage, which is often extremely short, and cholera cannot be treated successfully except in the first stage, it is so rapid.

5922. Do not the medical officers encourage the men to come when they feel at all indisposed?—Yes, and the men will come in when cholera is raging; during the prevalence of cholera it becomes doubly necessary to do so.

The witness withdrew.

Friday, 18th October 1861.

PRESENT:

THE RIGHT HON. LORD STANLEY, M.P., IN THE CHAIR.

Sir PROBY CAUTLEY, K.C.B.
Sir RANALD MARTIN, C.B., F.R.S.

J. B. GIBSON, Esq., C.B., M.D., D.G.A.M.D.
WILLIAM FARR, Esq., M.D., F.R.S., D.C.L.

Sergeant-Maj.
W. Walker.

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Sergeant-Major WILLIAM WALKER, 1st Battalion, 8th Regiment, examined.

5923. (*Chairman.*) How long have you served in India?—20 years.

5924. In what presidency have you served?—I have served in both the Bombay and Bengal presidencies, and also in South Arabia.

5925. At Aden?—Yes.

5926. In the course of your service have you had reason, at any time, to complain, or do you think there has been any inclination on the part of the soldiers to complain of the rations which have been supplied to them?—Not in the slightest degree; the soldier in India is better fed than he is in England.

5927. Does that remark apply to every station?—Yes, with the exception of when on field service. I have been speaking of garrison duty; the men then are better fed in India than they are in England. Of course, on field service they must put up with what they can get.

5928. Is there variety in their food?—Yes, they get roast, boiled, and baked, and altogether the different rations are far superior to what they get in England; I do not mean in the quality of the food, but it is far superior for the use of a man, because every soldier in England must confine himself, at the most, to two descriptions of food, either boiled meat or, if he chooses to pay for it, he may have a baked dinner; but every soldier in a company in India can order his own dinner to be prepared by the native cook, and the cook is bound to bring him that dinner; some get curry, some get baked meat, some get stews, and some get food of other descriptions; the soldier may make his choice of 20 different dinners.

5929. (*Sir R. Martin.*) Are fruits and vegetables abundant?—Very abundant.

5930. (*Dr. Farr.*) During your period of service has there been any improvement made in the diet of the soldier?—Yes, a great deal, especially with regard to the bread, which, when I first went to India, was of a very inferior description to what I found it to be afterwards.

5931. Has any improvement taken place in the

supply of vegetables?—They are much the same as they were, but since the cultivation of the English species of potato in the hilly part of Bengal and Bombay they have been able to supply the troops a great deal better than they used to be. The potato was considered a dainty 20 years ago in India, but now potatoes are served out to a regiment in plenty.

5932. Did you get vegetables in sufficient quantities at the earlier period of your service in India?—No; in the first period of my service in India I did not know what the potato was.

5933. Did you get vegetables at all?—We used to get carrots and pumpkins.

5934. Do you remember the date when the improvement was made in the diet of the soldier?—No; but I know this, that during the last 12 years in India the soldier has been liberally supplied with vegetables.

5935. Do you think that circumstance has had a good effect?—Yes.

5936. It has pleased the soldier?—Yes, and, in fact, the soldier has more vegetables supplied to him than he can make use of.

5937. With regard to the supply of liquor to the soldier, I believe beer is very abundantly supplied to him?—It is plentiful at every station, and of the best quality.

5938. Is it obtained at a moderate price?—Yes, the soldier can get it quite easily, and the price of beer is cheaper than it is in England; even reckoning the cost of carriage, it is only 3d. a quart, draught porter, which is issued to the troops; but the Government is at a certain loss by the sale of it.

5939. (*Chairman.*) Have you seen anything of experiments which have been made to brew beer in India?—No.

5940. You do not know how far the attempts have answered?—No; I know that there was a brewery 20 years ago in Poona, but it was kept by a man who had been a soldier; I forget his name now, but it failed to a great extent.

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5941. (*Sir P. Cautley.*) Have you been at Meerut in the Upper provinces?—I have marched through that district, but I never lay there.

5942. You have never had any beer that was made at Mussourie and Landour?—Not that I am aware of, but I have drunk beer all over India almost.

5943. (*Dr. Farr.*) Do you mean beer that was made in India?—I will not be sure of that; I could not vouch for that; but I dare say that a great part of it was, although they palmed it off for English beer.

5944. (*Sir P. Cautley.*) The men do not complain of the quality of the beer generally speaking, do they?—They do not; on the contrary, the men have always been perfectly satisfied with the supplies of ale. There is one thing that I may mention, that if the commanding officers of regiments did not take means to prevent even beer itself from being adulterated, there might be complaints made by the men, but which we have never had made in our regiment; but I have heard of complaints that have been made that the beer has been mixed with water, but it was drawn up in such a rapid manner, with perhaps 300 or 400 men coming for it as quickly as they could be served, the froth was on the beer, and the men would scarcely detect it, but if it was left to stand for a while, that would test its quality.

5945. (*Sir R. Martin.*) Does what you have stated apply to the beer which is supplied direct from the commissariat?—Yes, it applies to that; there is a non-commissioned officer who receives 5*l.* a month from the Government, in addition to his pay, to look after the canteen, and perform the duty of that particular situation; of course, if he is dishonest, and he might be to a certain extent; there is roguery in all trades, and if they are not looked after there are means of doing such a thing.

5946. (*Chairman.*) But I suppose that the men would very soon find it out?—Yes, and they would report it immediately, but upon the main question about the liquor, I have never heard any complaints made of the quality of the liquor that is supplied by the Government to the troops, and which is supplied at a reasonable price, the beer being cheaper than they could get it in England, and, if anything, of a better quality.

5947. What quantity of spirits is a soldier allowed to draw?—If he draws beer he is only allowed to draw one dram (speaking of the Bengal dram, there are 40 to a gallon); the liquor is made in one of the Government factories, and is of the best quality.

5948. (*Sir R. Martin.*) You speak of rum?—Yes.

5949. (*Chairman.*) May a soldier draw that one dram at any hour of the day?—No, he is not allowed to draw it until after 12 o'clock in the day; no spirits are allowed to be sold at any canteen or cantonment in India until after 12 o'clock. Should a man think proper to drink his quart of beer he is allowed one dram of spirits and no more.

5950. I suppose that means are taken to prevent a man from selling his dram of spirits to another?—Yes, he drinks it at the table in the canteen—he must have a pass from his commanding officer to take away one dram from the canteen, and if liquor is found in the possession of any soldier in India without a written pass from his commanding officer, he is immediately placed in confinement and called to account for it; neither is a civilian allowed to sell liquor to any soldier without a written authority from the officer commanding the station in which the civilian resides.

5951. (*Sir R. Martin.*) In the case of a man not consuming beer, how many drams is he permitted to have per day after 12 o'clock?—Two drams, one after 12 o'clock in the day and one at night.

5952. (*Chairman.*) Does any considerable quantity of liquor get smuggled into the stations?—There are instances in which it is smuggled in, but that is of the worst description; it kills many soldiers.

5953. From your experience do you think that there are a considerable number of men in every regiment who obtain smuggled liquor?—It used to be the case formerly, but recently the military police

have been brought to such perfection that it is almost impossible to smuggle a single glass of liquor into a station.

5954. (*Sir P. Cautley.*) But it is the fact, is it not, that they cannot prevent grog shops being established just on the outside of the cantonment?—The grog shops are there solely for the use of the natives; if a European soldier enters one of them he is immediately made a prisoner, and if a native is seen to sell one drop of grog, or to give one drop of grog to a soldier, he becomes immediately liable to a very heavy penalty; one that would ruin him for a year.

5955. I presume that the soldiers are allowed to go out of the cantonment?—They are allowed to walk about the cantonment to a certain extent, the same as at Aldershot, but he is not allowed to purchase spirits; there is such a strict injunction laid upon the natives that no merchant would even give a bottle of beer. For example, in my rank, he could not give me a bottle of beer without I had permission to purchase it; the orders are very stringent in India about that. I know that in the time of the late Sir Charles Napier the canteen regulations were altered; they used at that time to be kept open from daylight in the morning till tattoo in the evening, but you were only supposed to obtain a certain quantity of liquor, but then you had the whole day to get it in; a man would, perhaps, get one or two glasses of grog before his breakfast, and Sir Charles Napier stopped those morning drams altogether, and since that time, in the order that was issued, it is laid down that no soldier shall be allowed to take liquor of any description, more particularly spirits, before 12 o'clock in the day, and there has therefore been a great change in the system, but it caused men at first to run after contraband liquor, and that is of the worst description, and kills almost anyone who uses it for any length of time.

5956. But you say that although there are grog shops outside the cantonments, and although the soldiers are allowed to walk outside the cantonments still the police is so well maintained that you do not think any considerable number of men find their way into those shops?—I am convinced of it.

5957. (*Sir R. Martin.*) Do you refer to a military police or the ordinary police of the country under the direction of the magistrates?—The military police; the ordinary police of the country, the black police, would not dare to interfere with the men, they would be afraid; they might report to the magistrate that they had seen a soldier in one of those shops, and the magistrate might take notice of it, but they would not dare to lay hands on a soldier, or take him into custody; indeed there is a very strict order in India against anything of that sort in order to prevent collision between the troops and the natives.

5958. (*Chairman.*) It has been stated by some witnesses that it would be better if no spirits were issued to the men at all, and if nothing was given to them but beer: what is your opinion upon that point?—I do not think that that would do; speaking from long experience in India I do not think it would do at all, for there are some men with whom a glass of spirits would much better agree than drinking beer, and with others it would be just *vice versa*, and I therefore think that it would not be a good thing to do away with spirits altogether in India. I think it would still further drive the men to seek for it elsewhere.

5959. As far as your experience has gone you do not think that there is much excess or drunkenness among the men?—Not so much as there used to be.

5960. (*Dr. Farr.*) But still I presume that cases of drunkenness do occur in some regiments?—There is plenty of it every day in every regiment in India, and it will be the same as long as the British army is there; they obtain the liquor in the canteens through great neglect on the part of the non-commissioned officers, who frequently get punished for their neglect; the men get more than they are allowed by the commanding officer; he issues an order that a man may have so much supplied to him.

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and through either improper favour being shown to him, or certain neglect on the part of the non-commissioned officer, he obtains more than he ought to have. There is a rule of this kind, a man, should he be punished by the commanding officer, there is a mark placed opposite to his name, so that the sergeants shall know that he is a defaulter; the men come in by files, and there are two markers, one for each wing of a regiment, and when a man comes in he gives his name, or his regimental number, and the sergeant immediately looks to see if he is a defaulter, and if so he is confined at once for attempting to come there for liquor, he need not ask him whether he has been there before. If he is not a defaulter he gives him a mark for one glass, or a pint, and the man walks to the counter of the canteen, and a sergeant, or a servant under his superintendence, issues to the man the grog, or beer, and he is supposed to drink it himself; as soon as he drinks it he walks out; there is a non-commissioned officer and a sentry at each door, and a man must go round and again pass the sergeant before he can get any more, and the sergeant would be strictly responsible that he did not drink two glasses at once; so that it must be either neglect of the sergeant, erring intentionally by a gross neglect of his duty in allowing a man to go there, and have more than the regulated allowance, or else there might be one here and there who might mistake the name of a man, and do it in ignorance, or he might be one who was not well acquainted with every man in the regiment.

5961. Then cases of drunkenness do occur from neglects of that kind in the canteen?—Yes.

5962. And not from the soldier getting native spirits?—No. There is another thing that I wish to mention, that in the hot season of the year the soldiers are not allowed to go near the canteen until sundown; they are confined to the barrack room during that season, which lasts from about the month of May until October; during that time they are strictly confined to the barracks during mid-day, and a non-commissioned officer will go round to each company and collect the names of the men who require beer for their dinner; a man may put himself down for a quart of beer, and the money is collected at the same time from the men and handed over to the non-commissioned officer; he then goes with a written pass signed by the senior non-commissioned officer of the company to the canteen sergeant, draws the liquor, and brings it up to the barrack, and issues it to the men at the dinner hour; there may be men who get drunk in that way, because a man is allowed to take his quart away, and place it on the table and drink it with his dinner, and he may give his comrade a drink.

5963. (*Dr. Farr.*) Is a quart of beer considered equivalent to a dram of spirits?—Yes.

5964. Can a man have beer without any spirits?—If he drinks beer at all he can only have one dram, if he gets only one half pint of beer he can get only one dram of spirits.

5965. But he is not bound to have the dram at all, is he?—No; if he has it he pays for it, it is not served out as a ration; that practice is done away with now in India, and there is no such thing even on field service.

5966. What is the price of a dram of spirits?—Four pice, or one anna.

5967. How much beer can a man obtain for the money which he pays for a dram of spirits?—He pays six pice for a pint of beer, and three annas for a quart.

5968. Is it the fact that a great number of the punishments of the soldier are incurred by him for crimes committed in a state of intemperance?—Yes; a great many.

5969. Do you consider that a great portion of the crimes committed by the soldier in India may be referred to the use of intoxicating drinks?—Yes.

5970. (*Sir R. Martin.*) It used to be so in your earlier period of service, that much of the crime arose from drunkenness?—Fearfully so.

5971. But has not that greatly diminished lately?—Yes; crime has diminished in India more so than in England; there are fewer prisoners in India. In my regiment we had fewer prisoners in India than in England.

5972. With regard to the issue of spirits; if you began with a recruit, and gave him beer, might you not carry that on, and continue to issue beer to him throughout his course of service?—That would be forcing a thing upon some men that they would not like to put up with; they would not think it right; they would consider that as taking a liberty with them that they would not like, and they would obtain liquor elsewhere. If you could effectually prevent a man from getting what you deprived him of, that would be right enough; but it would be scarcely possible, I think, because there are such means through native servants and other people going about, that if they wished to get a glass of grog, they would have it in spite of all the authorities in the place; as long as they could leave their barrack-rooms, they would get it if they put their heads to work.

5973. You think, probably, that it is best to leave it as it is to the will of the men?—Yes, and to the discretion of the commanding officer.

5974. (*Dr. Farr.*) Suppose the men were supplied with tea, coffee, and wine, which they might purchase in the canteen, and spirits were suppressed, do you think the men would object to that?—The men, I am sure, would object to being deprived of the use of spirits, as a general thing.

5975. But they do not always drink spirits in England?—No.

5976. Then why should they wish for it in India?—I do not know; but they generally prefer a glass of spirits on certain occasions, and now more especially when the soldier generally gets used to it during the campaigns, and they require a stimulant of some kind after a long march, and during a fatiguing march, and during hard work. I know that in the late mutiny, during one 30 mile march, without any food, from Lucknow to Cawnpore, the troops got as much as two glasses of grog given to them, by order of the general commanding, to get them along.

5977. That, no doubt, on medical grounds, was an advantage to them, but if they were to be convinced that spirits were injurious to their health, and did them, upon the whole, harm, would they, do you think, object to the substitution of other drinks?—If they could be convinced of that, decidedly not.

5978. (*Sir R. Martin.*) Do not even sober men like to have the choice of getting a dram of spirits occasionally?—I am sure that they do; and I think that they would behave far better, if they thought that they were not deprived of it by force. I think, also, that it would be a good thing if meetings were held, at which the soldiers were invited to attend, and where the medical gentlemen would point out to them, in a plain manner, the errors arising from drinking in India, and give the soldiers a lucid explanation of the injurious consequences. That would be better than all the general orders that might be issued; the men generally might not go at first, but some few might go, and they would tell their comrades, and so it would pass on from one to another, and I think that that would be a very good way of bringing the men to consider their own safety, and of abstaining, to a certain extent, from drinking spirits.

5979. (*Dr. Gibson.*) Still you do not think it would be possible to convince the men of the injury they did themselves by the use of spirits?—I do not think you could; it might be possible to convince some men.

5980. (*Sir R. Martin.*) When men go into hospital sick from intemperance, does not the surgeon usually admonish them on the subject?—The surgeon reports the subject to the commanding officer, and the patient, when he comes out of the hospital, if he survives, is handed over to the commanding officer, to be dealt with by him, and he is then punished for tampering with his health. Any soldier who is pronounced by

the surgeon to be suffering from the effects of liquor, is considered a proper subject for the commanding officer to deal with, and that would appear against him; and when he is discharged, it will be a very serious bar to his obtaining a pension.

5981. (*Dr. Gibson.*) Does not the surgeon more frequently remonstrate with the man himself, rather than report him to the commanding officer?—Yes, I have known them many times to do that; but in a case of delirium tremens, which I was speaking of, the surgeon always enters the man as a prisoner at once.

5982. (*Chairman.*) Upon the whole, you do not think there is room for much improvement with regard to the canteen system?—I think there is not much room for improvement in the system that is pursued at the canteen, indeed I am sure that it could not be improved. I am speaking, of course, of my own regiment; I do not know exactly whether we do not differ from some other regiments; some regiments may work in a very different way in their canteens, but I am speaking of the 1st battalion of Her Majesty's 17th regiment, and the 1st battalion of the 8th.

5983. (*Dr. Farr.*) Who were your commanding officers in those regiments?—My commanding officer in the 17th Regiment was the late Lieutenant-Colonel Pennicuik, who was killed at the battle of Chillianwallah, and Colonel Robertson commanded the 8th a portion of the time in India; the present Colonel Greathed commanded the regiment for a long time, and then Major-General Longfield.

5984. (*Chairman.*) Have you heard any complaints from the men as to their clothing, or of the way in which they are supplied with their clothes and accoutrements?—No.

5985. There has been a considerable alteration in the clothing, has there not, in the last two or three years?—Yes, there has been great alteration, but there has been a greater alteration since we left India in the clothing of the army. It was much the same all the time that I was in India as to the furnishing of the clothing to the men; it was the khakee clothing that they used during the mutiny, a dust coloured khakee which they wore as uniform; the men used to prefer purchasing it themselves, and they were never prevented doing so by the commanding officer if they could procure an article of the same pattern and of the same quality. Our commanding officer of the 8th regiment never interfered with the men in that; it was necessary that it should be of the regular pattern, and of the same material, but they could sit down and make it themselves.

5986. (*Sir P. Cautley.*) They could not purchase it so cheaply themselves, could they, as they could get it from the Government stores?—They might get the cloth very cheap, and if they chose to have it cut out and make it themselves it would be far better made than the article that they would be served with from the stores, because there would be more pains taken in the sewing and making up of it, although of a similar material, but the men had no complaints to make about the clothing.

5987. (*Sir R. Martin.*) For the hot weather, and during the rains that kind of dress was a great improvement, was it not, upon the old red jacket?—Very great, but the men had to wear the red jacket in the rains. It was a great improvement on the white clothing that used to be worn, and showed itself so in the mutiny; the troops in India wore white calico, and the commanding officers immediately saw the utility of darkening it as much as possible, or of turning it into some colour to disguise the men as much as possible from the enemy, and the khakee suit is almost an invisible suit, indeed it is the best clothing that I have ever seen issued to the soldier for Indian service; it is unsightly, but it is of the best colour, and of the very best description for service.

5988. (*Sir P. Cautley.*) The movements of the men are less interfered with, are they not?—Yes, a great deal less; the dress is very loose.

5989. (*Dr. Farr.*) Is flannel worn at all by the men?—Yes.

5990. Flannel shirts?—Yes, each man is obliged to be in possession of two flannel shirts, and two flannel bands; he must have them as a portion of his kit.

5991. Those articles of clothing make him comfortable?—Yes, they are mostly worn in the rainy season, and a man is punished if he is found to be mounting guard without his cholera belt on; it is irksome to many men, but they are obliged by the medical men to wear them.

5992. (*Sir P. Cautley.*) Have you found that the men suffered much from the tightness of the shoes?—No, the ammunition boot is the best boot that can be got for the soldier; the Government boot that is served out.

5993. Do they generally fit well?—They are fitted in the quartermaster's store; you need not take them unless they fit you; the quartermaster is there and the officer of the company is there also with you, but you need not take the boots unless they fit you, if you do not find them easy,

5994. Can they get them altered if they do not fit them?—No.

5995. (*Sir R. Martin.*) Do you consider the ammunition shoe the best for all seasons in India?—Yes, I consider it the best boot for India; it protects the foot from the burning soil; the soles are stronger than the native boots, and protect the feet, and in the wet season they keep out more wet than the Indian leather; the Indian shoes wear out in no time on the macadamized roads in India.

5996. The blue barrack trousers are generally approved of by the men?—Yes, because they are easy to wash; that is the principal reason why they are approved of so much by the men.

5997. They are easy, are they not, for marching?—Yes, very good for that purpose, and as soon as a man comes in off a march he can wash them, wring them out, and hang them up, and have them clean to put on again in an hour.

5998. (*Dr. Gibson.*) Do you think canvass leggings would be good?—They could not be worn except in the cold season; they would do very well for the cold season for drill purposes.

5999. But I mean on the march or in a campaign?—Yes; they are very serviceable then, on the march especially. In some parts of India, when marching through sand, it works up through the trousers, and gets into the boot, and down into the sock, and works about the feet and cuts the skin. The gaiters on the same principle as those which the Highlanders wear; they are very good, and much of the same description, either under the trousers or over them.

6000. (*Sir P. Cautley.*) What head-dress was considered the best?—The best head-dress was one that we used in Colonel Greathed's brigade. We used it going from Delhi down to Cawnpore—a plain forage cap, the Kilmarnock—with a padded calico cover over it, and a turban fastened round it; it was sword proof, and you could make a pillow of it.

6001. Had it any flap behind it?—Yes; which covered the back of the head from the sun, and it was light and comfortable; it fitted the head and sat easily.

6002. Do you think it was better than the shako?—Yes, far better; for you could use it for a pillow at night; if you were on picket and you wished to lie down, it formed a pillow of itself.

6003. (*Sir R. Martin.*) Did the men find that it kept their heads cool?—I will not say that; but they liked it the best. I do not say that it was as cool as the helmet that we got under Lord Clive. The helmet is very light and cool, but it is not so comfortable to the men; it is an awkward thing to have about, and it is liable to fall off if the men are out skirmishing. It does for parade or garrison work.

6004. (*Sir P. Cautley.*) The head-dress which you prefer is the turban, which is very nearly the same as the native turban?—It is much the same as the native turban; you can put the pugger to several uses.

6005. (*Dr. Farr.*) That is not generally used in the army in India, is it?—It was used by the whole

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of the Delhi field force ; that was the first time that I saw it worn by the troops. From Calcutta the men were all served out with that helmet.

6006. (*Chairman.*) Is a stock worn by the men ?—The stock has been discontinued in India altogether, except when parading in full dress in European clothing as they call it ; but which is only twice a year for general inspection.

6007. (*Sir R. Martin.*) Is the stock which is worn the same stiff leather material that it used to be, or has it been changed of late years ?—It has been changed for one that is far better, like that which I have on.

6008. Is that the description of stock which is served out to the common soldier ?—Yes ; I wear exactly the same as the private soldier does ; this is the regulation stock, and the piece of leather which you perceive in front prevents its slipping up on the throat, and keeps it down.

6009. (*Sir P. Cautley.*) Do the men complain of the knapsack that is worn now because it impedes their motion ?—No ; they prefer it to one that was sent down last week to our regiment to be approved of—a new pattern. We tried it on some of the sharpest field days that we have had at Aldershot ; we tried it on several of the men, but they did not approve of it. They liked it as far as this was concerned, an opening behind. There was a flap to cover the coat, so that in the rain it would prevent the coat getting wet. On picket, if it commenced to rain they could turn the flap down over their great coat till such time as they wished to put it on ; but the straps on the front pressed too tightly on the shoulders. One strap comes down to fasten on the waist belt, that draws the waist belt up, and draws the man into that position. That is the fault of it.

6010. (*Sir R. Martin.*) But the knapsack is never carried by the British soldier in India ?—No ; except on general inspections ; it was formerly, but is not now. Under Sir Charles Napier we did all our work in heavy marching order.

6011. (*Sir P. Cautley.*) Generally speaking the greater portion of the men's things are carried for them, are they not ?—A soldier in India walks without his knapsack, with the exception of a general inspection, or when his colonel orders a marching order parade ; but there is no drill, no knocking about with the knapsack. He marches out sometimes in the cold season in marching order ; but, as a general rule, the knapsack is not used in India. The soldiers' articles are carried for them.

6012. Do you think that the equipment of the soldier as it is now is as good as it well could be ?—I think it is.

6013. (*Chairman.*) Have you heard any complaints made about it ?—Not the slightest.

6014. Have you, in the course of your service, ever been quartered at a hill station ?—No.

6015. But you have probably seen and have been acquainted with many men who have been so quartered ?—Yes.

6016. Can you state to the Commission what is the general feeling among the men as to the hill stations, do they like them or not ?—Yes ; they invigorate the men ; it makes a striking alteration in a man. If a man has been sick with fever or anything at all, if he is sent to the hills and returns in a few months' time, he comes back quite a new man altogether.

6017. (*Sir P. Cautley.*) Do the soldiers like the hill stations ?—Yes ; and a great thing it would be in Bengal if this system could be adopted, if they could only mass the main body of the troops in the hot weather at the different stations in the hills, letting the regiments take its turn about for duty in the plains, in the strongest forts and places about, and let the native troops do the remainder of the work ; but it would be a good thing, I think, to mass the troops there, and send them down, the same as they do in England, to the different camps for drill with the native troops during the cold season. If that were done it would be a great thing, I think it would be the best thing that ever was done, for the

men, during the hot weather in the plains, cannot sleep at night from the heat ; they cannot do anything ; they have no energy about them, and they go and get drink to put a little life into them ; and they would not want it in the hills.

6018. They become dispirited and listless from the idleness of the cantonment ?—Yes ; they cannot go out, while, if they were in the hills they could walk about all day ; but they must stop inside the barrack down on the plains. It would be a great thing, I think, if that could be done, perhaps the greatest thing that ever was done for the army, and it is so considered by every soldier.

6019. Although confinement to the barrack in hot weather is necessary, still the men find it very irksome ?—Yes, they do ; they would rather be out in the sun, and some men might be out in the sun for years and years and never become sick, but upon others who go out in the sun, it would take an effect upon them.

6020. (*Dr. Farr.*) Will you be good enough to describe the daily life of the soldier when quartered on the plains in India ; beginning with the morning, for example, what time does he rise ?—He must be up 20 minutes after gun-fire ; but the time varies, sometimes at four o'clock, and sometimes at five o'clock, in hot weather, say half-past four. He must be up at five, as the parade is generally at half-past five or a quarter to six, and the parade must be over shortly after sunrise, a quarter past seven. Then there is breakfast ; after breakfast he amuses himself in the barrack room. Then there is a parade at half-past ten in side arms in the barrack room ; then he cleans his accoutrements ; after that he has his dinner.

6021. He does not go to bed again ?—He can if he likes ; that is, he must not go into bed, but he can lie on it ; the bed is made up. Then the afternoon parade takes place ; then he has his supper, and after that he has nothing to do until the tattoo beats at eight or nine o'clock, as the case may be.

6022. Is he allowed to go out of barrack in the hot season ?—Yes, at certain hours.

6023. He is not shut in ?—In the hot season, he must stop within the barrack between eight in the morning and four in the afternoon ; if he is caught out of the barrack, he is liable to be confined, except he is on duty.

6024. How does he amuse himself during all that time ?—Some of them read, some go to sleep, some play at dominos, but they are not allowed to gamble ; cards are never allowed, but they may play at dominos or chess, and backgammon.

6025. During the rainy season, what is the course of life in the plains ?—There is very little change. The men cannot go out. It is exactly the same ; but the parade cannot be outside. There are three parades per day, and, as they cannot be outside, they have them inside the barrack. In the evening almost all the men stroll round about the barrack in some way. If they are delicate, they cannot walk very far ; but you find them generally outside taking an airing.

6026. Do the men object to being shut up in the barrack in that way ?—They like to walk about, and they have skittle alleys and ball courts, and places of that kind, when they can once get out.

6027. What evils do you think would arise from their being allowed to go about ?—I think that it would be very injurious for the men to go out in the middle of the day in hot weather or in the rains ; it would never do, because they would get wet through, and where one man might be careful to change his clothing another man would be too lazy, and lie down in his wet clothing, and get rheumatism or fever, and perhaps lose his life.

6028. That is the state of things in the rainy season and in the hot weather ; what course of life do they lead in the cold season ?—They are very comfortable in the cold weather. They commence with drilling in the morning ; there is none in the middle of the day, no matter whether it is the cold or the hot season. They are generally drilled in the evening again, say after four o'clock in the cold weather, and the men then have plenty of amusement,

cricket, and other games ; but there is one thing that, I think, would be very good for them in the stations, and that is to have more plunge baths for the men. It is a bad thing not to have them. There should be one close to each wing of a barrack, so that a man could go in hot weather under cover to these plunge baths. It would be very easy to have for them a covered bath in the same way as in the model barracks at Agra, so that they could go to it without being exposed to the sun. There is nothing that the soldier likes so much in India as a plunge bath.

6029. (*Sir P. Cautley*.) Would you have the men paraded for that purpose?—No, I would let them go as they thought proper, and I would have a sentry at each bath, to prevent the men stopping there too long, for you will find men who in the very hot weather would stop there for hours, and injure themselves, men who are just fresh from England.

6030. (*Dr. Farr*.) Then the men in the hills would escape many of the disadvantages of the hot season below?—Yes ; they would escape the whole of them.

6031. In fact they would enjoy a climate nearly like that of the plains in the cold season?—Yes ; they enjoy in the hills much the same sort of climate as that in England.

6032. Of what hills are you speaking?—I speak of the large range of hills that divides Bengal from Afghanistan, the Himalayas.

6033. You have been at Poona?—Yes ; there is another splendid sanitarium there.

6034. You would prefer an elevated place, such as Poona and the stations around it, to the stations down on the plains in the Bengal presidency?—Yes ; but there is a vast difference between Poona or any part of the Bombay presidency and Bengal. At Poona the men could play all day long, while at Agra and Calcutta you cannot move out without risk.

6035. The men enjoy health in Poona and in such stations almost as much as they do in England?—Exactly the same ; the only thing is when cholera sets in.

6036. But they suffer, do they not, from some diseases which they do not suffer from in England?—Yes.

6037. (*Sir R. Martin*.) But even the climate of Poona is not so cool as the climate of the mountains?—No, although it is at a considerable elevation ; but in Bombay the heat is not felt the same as it is in Bengal. The plains in Bengal are the places where the main body of the British troops in India are, and there thousands of men die ; I am convinced that their lives might be saved if they were massed upon the hills.

6038. Speaking of the cold weather in Bengal, do not the men complain in the long dull nights of the lights in the barracks being put out early in the night?—I do not think so ; the men are not forced to go to bed till about a quarter past nine in the cold weather, they must be up at about half-past five o'clock in the morning if they have a day's work to do.

6039. You have not heard any complaints on the part of the men on that score?—No, there is always one light allowed in one barrack room.

6040. (*Dr. Gibson*.) Is that a sufficient light to enable the men to read?—No ; but it is so that the duty can be correctly done, so that the non-commissioned officer could see anything that was going on ; if necessary, he would light another lamp, but one only is allowed in each barrack room for the purpose of the duty being performed.

6041. (*Sir P. Cautley*.) Had you workshops in your regiment to give employment to the men?—We have carpenters and shoemakers, and tailors. In the model barracks there are workshops for the different trades, but we never lay in one of those model barracks.

6042. Would it not be a very good way of occupying the men to give them the means of working at their different trades and supplying them with tools?—It would be a most excellent plan.

6043. That plan has been adopted in the Punjab a good deal, I believe?—Yes.

6044. Did you see any of the barracks there that had at one end a workshop, and at the other a reading room?—Yes, I have seen the reading room in one of the barracks at Agra, in the North-west provinces ; at Agra they have a reading room, and the soldiers are under cover when going to the necessary, or to the wash-house ; they can go without being exposed to the sun ; they are the only ones on that system that I have seen.

6045. (*Sir R. Martin*.) If the men had the benefit of their own work, would it not be an encouragement to their industry?—Yes, a great encouragement.

6046. (*Chairman*.) Do you think that more could be done than has been done to provide the men with occupation?—If they were encouraged to work at their own trades as they do at Aldershot, it would be a good thing ; the soldiers there do the whole of the work, and there are carpenters and stone masons, and they do it all themselves under a new regulation there in camp, and they take a pleasure in it ; it is a variation they consider to their daily life, and it would be the same in India. I think that they would take a pleasure in it, and there is nothing in India that tends so much to keep the soldier in health as to keep his mind employed ; if he is allowed to lounge about and to lie down almost any man will get sick there.

6047. I suppose that in point of expense it costs less to employ native workmen than to employ soldiers?—It is not a tenth of the cost, but the work is not done so well, except certain things ; the native tailors, for instance, are generally very good, especially those who work for the ladies, making dresses and things of that sort ; the soldiers' wives generally make their own, but the natives work far cheaper and far better than Europeans generally could do ; they are very good with the needle, and very good at embroidery or anything of that sort.

6048. (*Sir P. Cautley*.) Have you seen with any regiments means supplied for athletic exercises?—Nothing of that sort.

6049. (*Sir R. Martin*.) No exercising grounds?—I never saw anything of the sort in India, nothing but the skittle alley and cricket ; it was on their own parade ground that they were exercising themselves at that. I saw nothing in the shape of the other. I understood from the question a particular piece of ground set apart for those public amusements.

6050. Yes ; the native regiments have them?—Yes ; but I never saw anything of that sort, and I think it would be very good if they had something of the sort supplied without putting the soldier to any expense, and a person appointed to look after it.

6051. It has been stated before this Commission that an experiment of that sort was made, and that the men took to it at once, but that they soon tired themselves completely, and left it off ; they found that they got stiff, and they overdid the thing?—That might be so certainly, and they could scarcely keep it up in the hot weather.

6052. (*Chairman*.) Nor would it be desirable, I presume, that they should?—I should say not. The medical officer would not allow it ; they will not allow the men to be drilled in the middle of the day.

6053. (*Dr. Farr*.) Was there no garden attached to your regiment?—Yes.

6054. How did that work?—We had several men who were gardeners, and we let them off duty for the purpose of attending to this garden ; any man was allowed to walk in the garden as long as the things were not interfered with ; and the commanding officer visited it, and made every inquiry, and saw that they had proper seed placed in it ; we used to get a certain quantity of vegetables from the garden, in addition to what we received from the commissariat, and vegetables of the best description.

6055. Do you think it is an advantage to be able to obtain good and fresh vegetables from a garden of your own?—Yes ; good vegetables are the best things in India.

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6056. Do you think that it would be generally satisfactory to the soldiers if a garden were attached in that way to the stations?—Yes; if you could have it large enough to supply a little more; they are generally not large enough.

6057. Would there be any difficulty in finding men to work, and to do all that was required in the garden?—Not the slightest; there are many men who could do that.

6058. (*Sir R. Martin.*) There are plenty of gardeners and farm labourers?—Yes; in the hot season the men need not employ themselves during the heat of the day; a couple of natives could look after a very large garden in the heat of the day, and do anything that was required.

6059. (*Dr. Gibson.*) Would the men be inclined to work in a garden in addition to their usual duty?—I would not say that the generality of men, who profess to be gardeners, would like to take to it as an amusement.

6060. (*Dr. Farr.*) Would they require to be paid for their labour?—I think they would be allowed to be relieved from all other duties.

6061. (*Chairman.*) If a regiment has taken an interest in its garden, and put it in good order, and they are afterwards removed to another station, what becomes of the garden then?—It is left for the next regiment.

6062. In that case those who introduced the garden lose all their labour and trouble?—Yes.

6063. (*Dr. Farr.*) Do you think that any allowance should be made to them, if they left their garden behind them, for the vegetables in it?—Yes; and I have not the slightest doubt that an allowance would be made, but I have never heard it applied for.

6064. Would it not be an encouragement to them to cultivate it if a premium were given for a good garden?—Yes, if he got publicly praised by the authorities.

6065. The two combined you perhaps think would secure attention being given to the garden?—Yes, I think they would.

6066. (*Sir R. Martin.*) In every case you think that the soldier should understand that he is to have the full benefit of his own work?—Yes, I think so.

6067. (*Chairman.*) What proportion of the soldiers are now allowed to get married?—Twelve per cent., that is the allowance; we have eight.

6068. Do you think that there is any wish among the men that that number should be increased?—A great many men wish to get married, but the difficulty is to get a sample of women fit for soldiers' wives. Colonel Haines is adopting a most admirable plan, so that it is almost a matter of impossibility for any improper character to get into the ranks of our regiment; he is adopting a system by which a person who wishes to be married must bring forward very satisfactory references from a clergyman, of whatever persuasion they may be, before he will listen for one moment to the proposal, whether he keeps the regiment up to 12 per cent. of married men or not.

6069. Should you say, from what you have seen, that the married men are more comfortable than the unmarried men?—In India, yes; they are very comfortable indeed, far more so than they are in England. In England, no. There are many comforts for a married soldier in India that he cannot obtain in England, and a married soldier is therefore far better off in India than an unmarried soldier.

6070. (*Dr. Farr.*) In what respects?—He has quarters to himself in the first place, and he has the company of his wife, and there are many things of that description which make him better off than his unmarried comrades, and his wife is allowed (I do not know whether it is altered now) 10s. a month by the Government, and each child 5s.

6071. (*Sir P. Cautley.*) Shillings or rupees; it used to be eight rupees?—It is 5s. and 10s.; two rupees and a half for a child.

6072. (*Dr. Farr.*) Have they a detached hut?—Yes; they do not as in England live amongst the

men; the married soldier has a place to himself in what is called the patchery.

6073. Has the woman any means of getting employment so as to support herself?—No; they have their own household duties to perform, or they may be servant to one of the officers' ladies, or anything of that sort, but native servants are generally preferred.

6074. Then the married soldier can live upon his pay?—He can live comfortably, and save money if he is a saving man and has a careful wife.

6075. Does he dine with his wife?—Yes; he has his food served out from the commissariat; he can get it or he can get six rupees and a half a month in lieu of his commissariat food, and provide his own food; he can get his pound of meat and pound of bread, his tea, coffee, and sugar every day, and his wife can cook it at the fire at home; or he can get six rupees and a half, if he chooses, in place of that. Some prefer that, as they can get meat so very cheap, except upon active service.

6076. What takes place then?—Then a soldier is separated from his wife, and he has to contribute a certain proportion of his pay through the officer commanding his company, from whom it goes to the paymaster, and to the officer in charge of the dépôt, for her support.

6077. His wife does not accompany him?—No; no females are allowed on service, and a man's wife has her five rupees a month, and free ration for herself and half ration for each child, and her husband, if he is a private soldier, generally sends her five more out of his pay.

6078. (*Sir R. Martin.*) You would say that a married soldier is more comfortable in India than in any country in which you have served?—Yes.

6079. (*Dr. Farr.*) Have you observed that the married soldiers are healthier than the unmarried men?—Yes, I have always noticed that they are less liable to many diseases which are very prevalent in India.

6080. They are not so frequently in hospital?—No.

6081. I mean not merely from the venereal disease, but from other diseases?—Yes; there are fewer on the average who go into the hospital than of the single men.

6082. (*Chairman.*) They are more steady in their general conduct?—Yes, and more temperate.

6083. (*Dr. Farr.*) And their minds are more contented, are they not?—Yes, a great deal more so, especially those who have a family.

6084. Do you think that a greater proportion of the soldiers should be allowed to marry in India?—Yes, I should say so.

6085. More than eight in 100?—Yes, if they could manage to have the troops stationed in the hills in India, then they might have an increase in the number of married soldiers. The children of the soldiers born in India are not at all, in comparison, the same as the children that are born in England; they are generally delicate, and they never seem to thrive in the same way as children do at home.

6086. Not even those that are sent to the hills?—They seem quite different altogether; they are fine rosy cheeked children; but before they have been long down upon the plains, they dwindle away, and you see a difference in a very short time.

6087. (*Sir R. Martin.*) Have you seen any of the children from the Lawrence asylum in the hills?—I never saw one.

6088. (*Chairman.*) If a soldier is killed in action, or he should die, there is not much provision made for his widow, is there?—By a late regulation, I can only answer that whatever the rank of the soldier was, either non-commissioned officer or private, his wife, for six months, received the pay allowed to women, and also the children's allowance, and then she was sent, if she did not get married again, at the expense of the Government, to her friends.

6089. (*Dr. Farr.*) You are aware that a great deal of sickness in the army arises from the venereal disease among the single men?—Yes, that is very prevalent in India and very dangerous, a great number of men are destroyed by it.

6090. Have you seen their health injured, and is a great number of them out of the ranks in the hospitals in consequence?—More so than from any other complaint, except fever.

6091. Although it does not kill them it disables them?—It disables a great many, and in many instances it kills them.

6092. Have you any suggestion to offer by which you think the ravages of that disease might be diminished?—I think it might be diminished by vigilant superintendence on the part of the authorities in charge of the different bazaars and places of that description.

6093. What do you mean by superintendence?—There are native hospitals where these females reside for the purpose of their being received in, and there are native doctors.

6094. Under the superintendence of the Government?—They are paid by the Government; in all the cantonments occupied by the military those places are a part of the cantonment equally the same as soldiers' barracks.

6095. (*Sir P. Cautley.*) Are the names of the women registered?—I do not know.

6096. (*Dr. Farr.*) What stations do you refer to?—To Poona, to Agra, and Jullundur, those I am aware of; there is a place set apart for those people to live in.

6097. Are they under the same control?—Yes, and they are supposed to be examined as to their state of health.

6098. By natives?—Yes, and a report made to the surgeon of the station, generally the staff doctor, as to the state of the women.

6099. Are the women who are ill sent away?—They are supposed to be sent away immediately to the native hospital.

6100. Do you think that does any good?—Yes, I am certain that it does if it is carried out, but the thing is this, that a great deal of the fault as to everything in India is in not having the orders carried out correctly.

6101. An order is given, but it is not always carried out?—Just so, and I know that if it was there would be less sickness; the intentions of the Government are all very good, and if their orders were carried out properly by subordinates there would be fewer complaints and less bother than there is.

6102. There is no lock hospital in the neighbourhood of these cantonments, I believe, for the treatment of these women under European surgeons?—No, nothing of that kind; although they are allowed to accompany the army into the field they have nothing of that kind. Colonel Greathed sent them away from his army, and would not allow one, and the men were all very healthy, and it caused a vast improvement, but that was only for a short time.

6103. Upon the whole do you think that could be done generally?—No, I am sure that it could not, except for a short time, say a few months.

6104. What is your impression with regard to the climate of India as to its healthiness or unhealthiness?—I think that the great cause of the sickness there is the bad drainage about the barracks, and the filth of the towns that the barracks are near.

6105. Is it the general opinion of the non-commissioned officers and men that India is a very healthy climate to live in?—It is the impression of almost all soldiers until they try it, of those who have been there three-fourths would rather go back again.

6106. A regiment that had not been there at all would not object to go there?—No, it is just the contrary, they would sooner go to India than to the West Indies. I know that the West Indies are dreaded by the soldier.

6107. They would as willingly go to India as to Canada, would they not?—Yes.

6108. (*Sir R. Martin.*) Those who have served in India generally, like to go back again, do they not?—Yes, I am convinced that three-fourths of them do.

6109. (*Dr. Farr.*) They are aware that it is unhealthy, but they are not afraid to encounter the dangers of the climate?—It is so.

6110. (*Sir P. Cautley.*) When a regiment is

ordered home, a great number of the men generally remain in the country, do they not?—Yes, 200 or 300 out of a regiment.

6111. (*Dr. Farr.*) You are aware that a large portion of the army will be sent in future to India, and remain there for some years; do you think that will be acceptable or not to the men in the army?—I do not suppose that the men will at first like it, but I am convinced that the men, when they have had a specimen of the duties of the soldier in India, and especially if they have many old soldiers with them who have been in India, they will become satisfied; it is those who have never been in India who complain so loudly about it.

6112. Do you think that young men are not deterred from joining the ranks of the army by expecting that they will be sent to unhealthy places?—I think that they are.

6113. If you were endeavouring to obtain recruits in any part of England, do you think that would at all influence the young men?—I should be so much afraid that it would, that I would not venture to say that they were likely to be sent to India. I do not think that I should be conferring a benefit upon the service if I did.

6114. You have seen a good deal of sickness in India at various times?—Yes, I have had the cholera myself twice; I had it at Delhi, and I was one of the few that did recover, but we lost thousands of men altogether from cholera; very few of them survived who were attacked; I was one of the few that did by taking proper remedies in time.

6115. Fever is another disease from which the men suffer, is it not?—Fever is the more prevalent disease in India.

6116. The men suffer more from that, do they not; cholera kills them off, but they suffer from fever for many days and weeks, and even months?—Yes, except the remittent fever, I think it is called; that is a dangerous fever, and men die sometimes in a very short time from that.

6117. Dysentery is also another disease, and a very painful disease?—Yes.

6118. What effects have you observed these diseases have on the physical condition of a regiment, does it make the men weaker, or less able to fight, or to do their duty after they have been in India some time and have suffered from these diseases?—I think that troops fresh from home always stand disease better; they always seem stronger and better able to withstand those sort of things; the longer a soldier has been in India, the less he is able to stand attacks of sickness.

6119. You think that an injurious effect is produced upon men resident in India?—Yes, more so than upon strong fresh men just from home; I observed that in the 93rd Highlanders who were just from home; they used to bear the heat and work in the heat and sun better than our old hands that had been for 18 or 19 years in the country.

6120. Did you bring many men home with you from India who had served there for any length of time on the return of the regiment?—I dare say that we brought home 200 old soldiers.

6121. What was their condition?—Several of them died, and almost all of them from one complaint after we came home, a complaint something like consumption.

6122. (*Sir R. Martin.*) A good many of them wasted away, did they not, from bowel complaint?—It was some internal complaint; they complained not so much of the bowels as about the chest.

6123. (*Dr. Farr.*) Some of them, I suppose, completely recovered, but a great number were permanently disabled?—Yes; I should say that the same results might have been expected had they remained in India; they were old soldiers.

6124. Had they served 20 years in India?—A great portion of them had served in the first battalion of the 17th regiment before volunteering into the first battalion of the 8th regiment.

6125. What was the strength of the 8th regiment when it went out?—I cannot say.

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6126. (*Sir R. Martin.*) Do not men who have served many years in India dislike the climate of England?—Yes; they cannot stand the cold.

6127. (*Dr. Farr.*) I suppose that the duties in India are generally not so heavy as they are in England?—No.

6128. The only thing which they have to complain of is the diseases to which they are liable?—Yes, and which are incidental to the climate.

6129. Have you any notion yourself as to the causes of those diseases?—I do not think that in many instances the barracks are sufficiently high and ventilated for the number of men that they contain in some of the stations that I have been in; in others, and, indeed, in almost all the stations, there is no such thing as proper drainage, no sewers. At the corner of each barrack-room there is what they call a cesspool, where all the filthy water, soap suds, and all sorts of dirty water runs in; it is ladled out by the natives at certain hours in the day or night when full, and sometimes there is a fearful smell from it in the hot weather, the sun being upon it; it almost stifles you.

6130. Do you think that is injurious?—I am certain of it; there is a bad smell even in the wash-houses, although they are kept clean.

6131. What is the state of the sleeping-rooms in the barracks at night during the hot weather?—They are very close, and there is a very bad smell, which any one can perceive that comes in from the air. If you go into a barrack room, there is a very bad smell.

6132. Particularly, if there is any prevalent disease, such as dysentery, or is there any difference?—No.

6133. Have you any complaint to make of the water in India?—The worst water that a soldier has in India is in Calcutta; it is not fit to use; indeed, it is dangerous. I am sure that there are more soldiers die in Calcutta than in any other station in Bengal; and I am certain that most of them die from the frightfully bad water that they get there; men who do not take the trouble to purify it with alum and charcoal frequently become sick.

6134. (*Dr. Gibson.*) Is it obtained from tanks or wells?—From wells, I think.

6135. (*Dr. Farr.*) Have you any complaint to make against the water supplied to the men at the other stations?—No; the water is generally very good in India.

6136. (*Sir P. Cautley.*) The natives drink the same water, do they not, at Calcutta?—I should say so; but I am not sure of that.

6137. What is the state of the closets and urinals; is that satisfactory in India?—They are very well kept.

6138. Are they emptied frequently?—They are emptied every night; they are supposed to be emptied before gun-fire in the morning; before the soldier wakes, everything is supposed to be cleared away, and that is almost always the case; sometimes it may be neglected, and in such instances the people who ought to have done it are punished by the quartermaster.

6139. (*Dr. Gibson.*) Are these places close to the barracks, or at some distance off?—The distance varies; they are never more than 40 or 60 yards from the barracks.

6140. Is there a covered way to them?—In very few instances. There is a covered way at Agra, and there is also in a barrack at Colaba in Bombay. Those are the only instances in which I have seen a covered way leading to those places.

6141. (*Dr. Farr.*) In the hospitals are the soldiers, according to your experience, properly attended to?—Yes; I think that that could not be better.

6142. Do you think there is no ground of complaint?—None; every care and attention are shown to the soldiers who are sick.

6143. (*Dr. Gibson.*) Do the men like the native nurses?—They are not so attentive as the European

orderlies; but the only thing that a soldier has to do, if he has any complaint to make, is to mention it to the medical officer, and these people are severely punished if there is the slightest neglect on their part, but they are hardly worked on service; and with regard to the wounded, the soldiers have almost all comrades for that purpose, they send for them from the regiment; but they do not let the natives meddle with them, except to bring them their food.

6144. If a man is very ill is he attended by a native?—No; there is always a man belonging to his company who is sent to the hospital to superintend the natives in what they have to do. The soldier is well treated in hospital.

6145. The men have not confidence in the natives? Yes, they have confidence in them, but, perhaps, sometimes a man cannot talk to them; they therefore do not understand each other, and a man may want things that the natives do not understand anything about, and sometimes they will not understand. They do not take the same interest in an European that his own comrade does; they are merely working there for four rupees a month (sometimes four, and sometimes five, or whatever they may get), and they do not care who a man is, or what he is; they think that the easiest way they can get their wages the better for themselves, but by having a orderly there to look after these people, they are made to attend more on the soldier than they would do at other times. If any soldier has any complaint to make, if he is not properly treated by the orderlies, and speaks to the medical officer, the complaint is instantly attended to, and every satisfaction is given to him.

6146. Have the men ample means of washing in a hospital?—Yes.

6147. Do they do that in the verandahs?—For those who are able to wash themselves there is a wash-house for them, for those who are not able to go outside they generally wash near the cot, and there are proper chatties, as they call them, to wash in, and the natives carry them away, and throw the water away into the cesspool. But drainage is the principal thing that I am certain is wanted. I am certain that the barracks in India, even in the plains of Bengal, could be made a great deal more healthy, provided they were properly drained, for after the rains there will be a pool of water standing in the lines for five or six days; that gradually dries up by the heat of the sun, but there is much smell from it, and I am certain that it must cause fever; these things are often reported by the men and by the officers.

6148. (*Chairman.*) Have you noticed that the men were more unhealthy than usual at the time this bad smell prevailed, or just after it?—I have always noticed that the sick list takes one particular barrack room more than another, or one particular side of a barrack more so than it does another; from what cause I cannot say, but there is always more sickness in the rains than during any other period of the year in India.

6149. (*Dr. Gibson.*) What kind of barrack floor is most easily kept clean and dry?—The best floors for a barrack are a kind of freestone in large slabs; the floors in the Bombay presidency are chiefly of earth, with cow dung put over once a week by the hands of the natives, and left to dry.

6150. Do the men consider them good floors?—They do not like them.

6151. On what account?—I think the principal reason is the dirt that is occasioned, and the trouble that it gives them, for the soldier cannot move about in his barrack room until it gets dry, and it takes a considerable time to get the cow dung dry.

6152. Does it smell?—Yes, of course.

6153. (*Chairman.*) What is the use of the cow dung?—I do not know; it is the Indian custom; it is what the natives use in their own huts.

The witness withdrew.

OBSERVATIONS by MISS NIGHTINGALE on the EVIDENCE contained in Stational Returns sent to her by the ROYAL COMMISSION on the SANITARY STATE of the ARMY in INDIA.

MY LORD,

IN compliance with the request sent to me by the Royal Commission on the Sanitary State of the Army in India, in Mr. Baker's letter of 11th October 1861, that I would make on the contents of certain MS. replies to queries addressed to all Indian military stations any observations which might occur to me as bearing on the sanitary condition of cantonments and hospitals, I beg to transmit the following. In doing this, the difficulty of giving what every one might consider a fair representation of questions of such extent, by stating specific cases, has been great. Some will see no importance to health in the facts. Some will think the facts given the exception and not the rule. If there be an exception, *i.e.*, if there be a single station in India with a good system of drainage, water supply, and cleansing for itself and its bazaars, with properly planned and constructed barracks and hospitals, provided with what is necessary for occupation and health—a station where the men are not encouraged to drink, and where they are provided with rational means for employing their time—to such a station these remarks do not apply. But I have not found it. Everywhere there are grievous sanitary defects, which, wherever they exist, can lead only to sickness and loss of life to the degree in which they exist. And let those who doubt whether this representation is true, taken as a whole, look at the stational reports for themselves.

In the papers sent me I find an amount of evidence showing the causes of disease in the Indian army, such as perhaps was never before brought together on any similar subject. It is shown in these papers that:—

I. INDIAN STATIONS ARE SUBJECT TO THE DISEASES OF CAMPS.

1. The prevailing diseases at Indian stations are zymotic diseases, connected with camps,—such as I myself have seen,—all of them, cholera, fevers, diarrhoea, dysentery; together with hepatic disease.

The main point of the Indian sanitary question is, indeed, camp disease, the causes of which are rendered more intense by climate; and liver disease, occasioned to a great extent by over eating and over drinking, and sedentary habits, the result of these habits being, as in the former case, intensified by climate.

Stations have been chosen with as little regard to health as camps often have been. Many are in positions which the mere verbal description proves to be unsuitable. Or, at all events, little or nothing appears to have been done to render them suitable. They are low, damp, or even wet, often mixed up with unhealthy native towns and bazaars abounding with nuisances.

II. INDIAN STATIONS PRESENT THE SAME SANITARY DEFECTS AS CAMPS.

2. At all or nearly all the stations the usual causes of camp disease appear to exist. I will give examples of the more important of these as shortly as I can, as they exist at the larger British stations. These are:—

- (1.) Bad water.
- (2.) Bad drainage.
- (3.) Filthy bazaars.
- (4.) Want of ventilation.
- (5.) Surface overcrowding in barrack huts and sick wards.

(1.) *Bad Water.*

Hyderabad (in Sind) says “No doubt it (the water) swarms with animal life.”

Where tests have been used, the composition of the water reads like a very intricate prescription, containing nearly all the chlorides, sulphates, nitrates, and carbonates in the pharmacopoeia, besides silica and large quantities of organic matter (animal and vegetable), which the reports apparently consider nutritive, for few of them but “consider” the water “good” and “wholesome;” *e.g.*, Fort William, Calcutta, says that the water for cooking, drinking, &c., is carried from a tank *filled by surface drainage*, which tank is kept “perfectly clean,” and is “generally free” from “surface impurities.” Many “city tanks are in a most filthy condition, producing malaria.” Sealkote calls its water “decidedly good,” while containing a considerable portion of sulphate of lime. Ghazeepore calls its water “good and sweet,” and says that it “does not seem contaminated by the amount of leaves that necessarily fall into open structures.” Chunar says that its water is clear, sweet, and inodorous “if allowed to settle before it is drunk.” Agra's water is “laxative,” and “apt to disagree *at first*.” Dinapore admits that its wells have been poisoned by infiltration from barrack privies. Nussereabad says, “The flavour (of the water) varies according to the quantity of the salts.” At Murree the quality is “considered inferior by native visitors, and to cause colic.” “Boiling” and filtration through sand and charcoal are necessary to “render it wholesome.” At Hazareebaugh tank water, “on standing, copiously deposits” and contains “organic matter in considerable quantity.” Its well water for domestic use contains silicic, phosphoric, hydrochloric, and carbonic acids. But it is satisfactory to know that “persons *particular* about the quality of their drinking water” can “obtain their supply” from “several good wells.”

At Bangalore, the Ulsoor tank, used for drinking, is the outlet for the whole drainage of a most filthy bazaar, (125,000 inhabitants) for that of our cavalry, infantry, and horse artillery barracks, and of the greater proportion of the station. The commander-in-chief says, “the disgustingly filthy nature of the source from which the water used at Bangalore is taken, has been brought to notice scores of times by me within the last 4½ years; but, as usual, nothing has been done to remedy this most crying evil.” Even the wells from which drinking water is taken are impure from sewage. They are open; and “when they get dirty are cleaned.”

At Secunderabad, as much as 119 grs. of solid matter, and, as it would appear, 30 grs. of organic matter per gallon, are found in some of the well and tank water. [Secunderabad and Poona are almost the only stations which give a chemical analysis.]

At Surat "no one thinks of drinking the camp water."

At Asseerghur the same tank is used for drinking and bathing. "For the former the natives slightly clear away the surface." Asseerghur thinks that its water "*smells good*."

The application of chemical science to water supply appears hardly to be in its infancy in India.

The arrangements for raising and distributing water are everywhere, as Bombay Presidency remarks, the same as what they might have been "1,000 years or more ago." Belgaum has attained the maximum of civilization under this antique system. The water is there "raised in leather skins by bullocks, emptied into troughs, and thence conveyed by water-carriers."

At Kirkee "no such a thing as a pump is known;" Government pays 617 rupees per (hot) month to water-carriers.

Everywhere "each individual has his bheestie, and each regiment its set of bheesties."

BEGINNING OF WATER PIPE.*



END OF WATER PIPE.



These water-pipes with a will are not always found to answer, for Fort William (which pays them 134*l.* per annum) admits that they sometimes take the water from "nearer and impurer sources." Would it not be better to try water-pipes without a will?†

It is singular that, while describing water sources, qualities, and modes of distribution which civilized cities have ceased to use, most of the reporters consider the water as good and fit for use. The practical result of this part of the evidence is that safe water supplies are yet to be found both for Indian cities and for British cantonments; and that many sources, as described in the returns, would in England be scouted as infallible causes of cholera in epidemic seasons.

Lavatories.

As for all means of cleanliness, bathing, except in a few cases where there are plunge baths, seems to mean washing the face; or throwing water over the body, for where there are lavatories there are no or few fittings, where there are fittings there is no water.

At Lucknow a small canal runs along the bath room, from which the bathers draw the water and throw it over themselves, being prevented by iron bars across from "lying at full length in it and soiling the whole supply." The bath at Mean Meer is a long shallow tank, "in which the man can lie down and bathe."

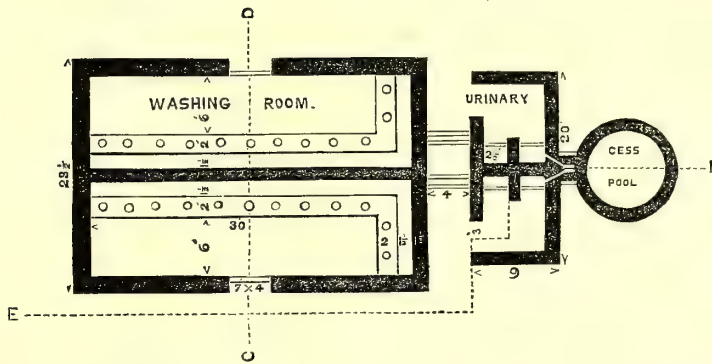
Madras and Wellington are literally the only stations where anything like lavatories and baths, with proper laying on of water and proper draining it off is known, either in barrack or hospital. But at St. Thomas' Mount, and at many other stations, each lavatory is a tub filled by a bheestie, in which all the men wash, there being no basins.

Fig. 1. gives a plan, elevation, and section of a lavatory at Aden, which affords rather a favourable specimen of the kind of accommodation provided. It will be observed that all the refuse water is conveyed into a built cesspit, 8 feet deep, from which it is expected to "make away with itself," as it best can. Why cannot civilized basins be provided for men to wash in and the foul water be properly drained away?

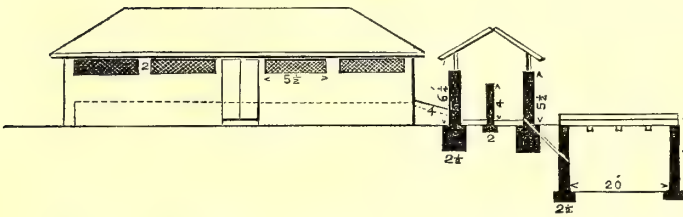
* Words convey such an imperfect idea of the actual state of things, that I obtained, by the great kindness of an Indian friend, illustrations taken from the life, which I have had cut in wood and transmit with this paper. I have also had woodcuts prepared of barrack and hospital plans, from drawings contained in the papers sent me.

† The reason usually assigned for employing these human water-pipes in barracks is, that they are indispensable on field service. But so are tents; and yet nobody proposes to barrack men in tents in time of peace. Barracks are built for peace, and ought to be supplied with reasonable and decent conveniences. Why should the bheestie and waterskin be preserved, when the tent is abandoned? Let the bheestie be for field service, if no better device can be discovered; but let some civilized method be adopted of supplying barracks, garrisons, and towns with this prime element of health and cleanliness. Besides, human labour is daily becoming of higher value in India, and it may be actually more expensive to use men as beasts of burthen now than to use the appliances of civilization.

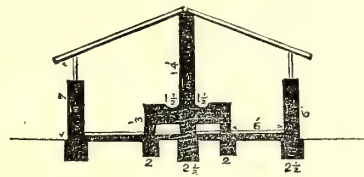
Fig. 1.

LAVATORY. ADEN.
Plan.

Longitudinal Section.



Section on C.D.



Washing and bathing in barracks and hospitals will have to be conducted on quite a different scale from the present in India, if health and cleanliness are aimed at. If the facilities for washing were as great as those for drink, our Indian army would be the cleanest body of men in the world.

(2.) *Bad Drainage.*

This may be rendered no drainage whatever, in any sense in which we understand drainage. The reports speak of cesspits as if they were dressing rooms. As at Nusseerabad and Kolapore, "a small cesspit is attached to each bathing room, urinal, or privy," and "to each married man's quarter there is a bathing room with cesspit."

At the capital of the Bombay Presidency, where civilization has introduced a "main drain" 2 feet square, with a "flat bottom," this "main drain" is a "great nuisance," and the "stench at times scarcely to be endured." At Fort George, in Bombay, the "latrines are not drained except into an open ditch, which is always in a foul state."

Indeed, Bombay would gladly say, as the London woman said when asked to point out the drains, in the days when London drainage was in a similar state, "No, thank God, sir, we have none of them foul stinking things here."

* At Madras (Fort St. George) the drainage hitherto is stated to be worse than useless. The main drain of the town is 80 yards distant from the European fort; the effluvia from it very offensive. The arrangements at the native lines, as described in the reports, are simply abominable. The old privies in Fort St. George are "as bad as they well could be."

At Bellary, a large station, there is no drainage except the fall of the ground.

At Secunderabad (Trimulgherry) there is no drainage of any kind. The fluid refuse evaporates or sinks into the subsoil. A nullah which intersects the cantonment stinks. The extent of the cantonment is so enormous, that it is said "to preclude any general surface draining," a statement which, if true, would amount to this, that the occupation of ground by human beings must inevitably lead to disease, a statement as applicable, or rather much more applicable to the area of London than to that of Secunderabad, and yet London is drained both on the surface and below it.

Everywhere the system of "drainage" is that "cess-pits" are "emptied" when "filled," or "when necessary," and their contents carried away by hand, as at Deesa and Belgaum. Generally they are close to the buildings.

At Hyderabad, in Sinde, in the native lines, the contents of the cesspits are "thrown about in close vicinity to the cesspits." "Anything edible is immediately picked up by birds or dogs." There is "great room for reform" in the native latrines, the cleansing of which consists mainly in the liquid "sinking into the subsoil, so that the earth is thoroughly saturated, and a noisome odour pervades the atmosphere." And yet it is added that the sanitary condition of the station is, "in every respect, satisfactory."

At Neemuch the "drainage of privies and urinals is only on the surface."

Often, as at Aden, it is expressly stated that it (viz., "all drainage") is "allowed to sink into the subsoil," which (at Aden) we are told is so useful as to "absorb the contents." The arrangement for enabling it to do this is shown in Fig. 1. Figs. 2 and 3 represent the usual construction of latrines. In Fig. 2 the contents are intended to be swept up and removed daily by hand,—a noisome and dangerous process, especially during epidemics. Fig. 3 shows the cesspool system of "cleansing," which means saturating the subsoil with filth, and endangering all the wells in the neighbourhood.

At Neemuch, which has attained the high pitch of civilization of building latrines for its bazaar, the "latrines are too close to the houses, and are not used at present for lack of a proper establishment to keep them clean." Therefore the people at Neemuch do like their neighbours in this respect, a proceeding which it is impossible to describe farther. At Asseerghur a similar abomination appears to be practised on an "open space of ground near the main guard and parade," which is "always offensive," and "ready to nurture epidemic disease."

Fig. 2.

LATRINE. POONA.

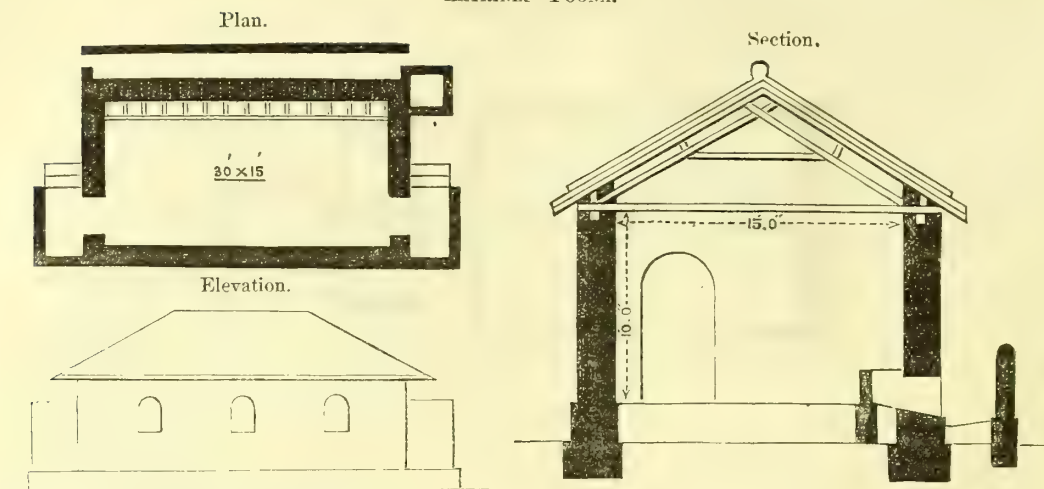
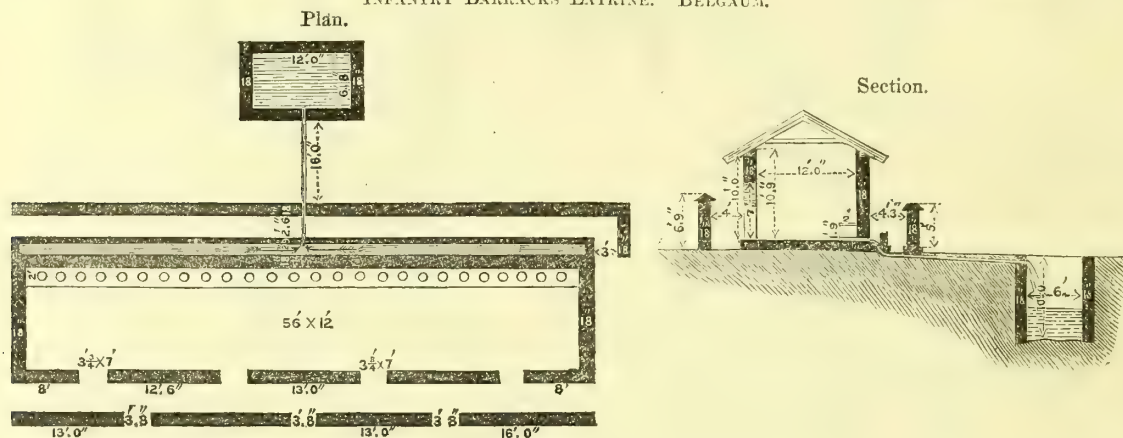


Fig. 3.

INFANTRY BARRACKS LATRINE. BELGAUM.



At Asseerghur the "construction of sewers and drains has not as yet been considered." They "consider," on the contrary, that the sewage "will probably be removed by hand." "The refuse, in all cases, is thrown "over the fort wall." "One of the tanks" is called "unsavoury."

Almost everywhere it is said, as at Nusseerabad, Kirkee and Poona, and Dinapore, all of them large and important stations, "barracks and hospitals" are "only wet" or "damp" during the "rainy months," as if it were a proof of great and unusual precaution in construction which builds buildings to be dry in dry weather.

At Fort William it is stated that the fluid refuse is swept away by garrison sweepers and water carriers, with the aid of a fire engine; that much of it evaporates; that the outlet is a foul ditch.

Dinapore also boasts of a foul ditch, often very offensive. At Poonamallee the "foul ditch" surrounds the fort and encloses the hospital; and "all fluid refuse sinks into the subsoil where it falls."

At Cawnpore is the singular statement, that the drains are "not intended" for draining cookhouses, privies, &c. Here, as elsewhere, the drainage is effected by hand; that is, everything that will not evaporate or sink into the ground is carried away to a distance in pails, skins, or carts, and emptied out.

INDIAN DRAINAGE SYSTEM.



At Meerut the cesspools are cleansed "by opening the tops and drawing out the fluid in buckets." It is said "they seldom require cleansing." We may infer from this what a condition of saturation the subsoil must be in!

Agra employs all the powers of nature, and none of its own, to get rid of its "fluid refuse;" evaporation, sinking into subsoil, &c. Nature, however, is dilatory, which renders "raised paths necessary between the barracks." The water from the lavatories is collected in an open cesspool, from which it is *spread over the ground*. The hospital cess-pits are deep wells, *never cleaned*. It is "tried to keep them sweet by lime, but *in vain*." (Probably.)

At Umballa the surface water "disappears with tolerable rapidity."

Mean Meer, the new station for Lahore, has no drains about the barracks. The water lies for hours. The lavatory cesspools sometimes overflow, saturate the ground, and taint the atmosphere.

These cesspools, as in Fig. 3, were intended for saturating the ground with foul matter, and out of the same ground the well water is taken.

Is not the whole history here of the late frightful cholera at Lahore?

And why cannot the refuse which does so much mischief by remaining be used to do good, and raise any amount of vegetables in soldiers' gardens?

Ferozepore tells the same story of no sewerage or drainage. Also at Ferozepore the lavatories are brick and mortar floors, "adapted for receiving and draining off the water into the subsoil outside, so that the men may freely bathe themselves!" There is no bath except the aforesaid floor. So at Peshawur and Sealkote is the same want of all sewerage or drainage.

At Berhampore, with its square mile of cantonment, only one cart is allowed to remove the contents of the privies to "holes a mile from barracks." The vicinity abounds in jheels and foul ditches, with putrid water.

Allahabad, one of our largest and most important stations, in one of the worst positions, as if that position were not unhealthy enough by itself, trusts to nature again, has no drainage nor sewerage, and leaves its surface water to "evaporate," "percolate," and "run off."

Benares follows in the train. At Rangoon the drainage is supposed to run up-hill. For we are told that all sewerage and drainage are merely "trenches made without reference to slope."

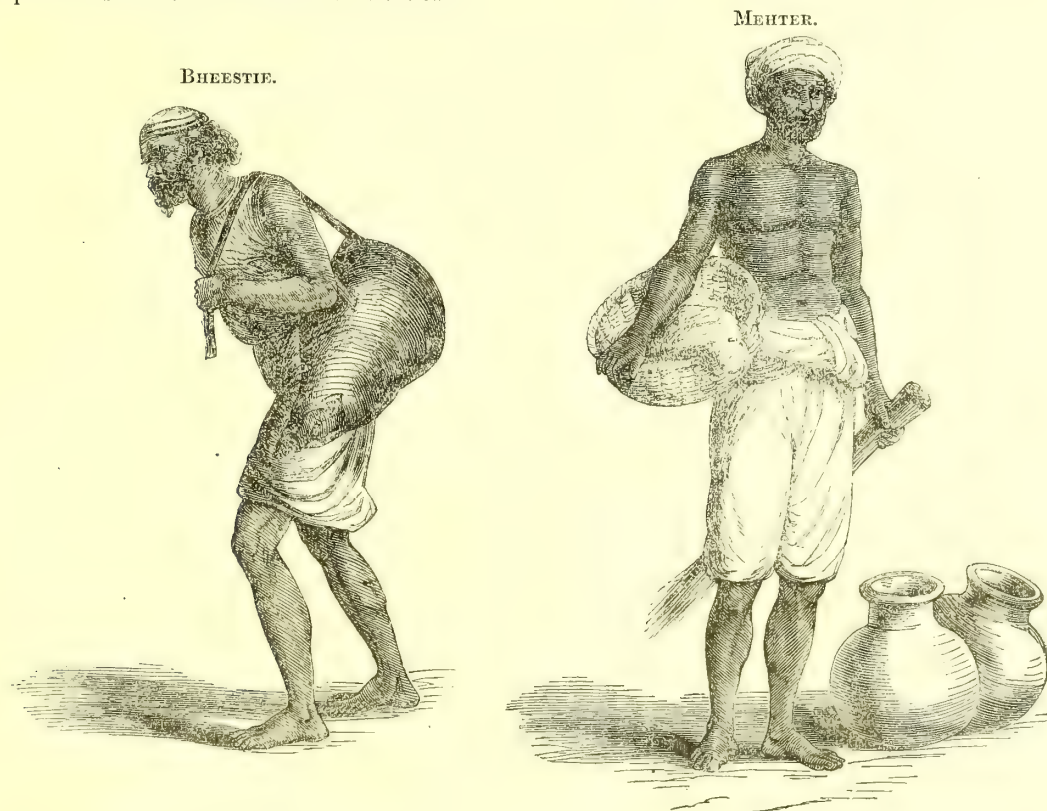
Landour, which is a hill station, has every house damp for three months in the year. Yet their "spacious lavatory, with brass basins," is not much used, "from the scanty supply of water in the dry season."

It is evidently quite possible to locate the whole army on hill stations and leave it more unhealthy than on the plains.

Nynce Täl, also a hill station, lets all its fluid refuse flow down to plains below.

It is impossible to pursue this subject further. There are such much worse things in the Stational Reports than what I have chosen to give, that I must say to those who call my "bonnet ugly," "There are much uglier bonnets to be had."

The system of water supply and drainage in India may be briefly defined as follows: they draw water from a well, not knowing whence it comes, and if there be any means to drain off water it is into a cesspit, or into long, open, pervious drains, not knowing whither it goes. Where this is not done, all the fluid refuse is collected in open cesspits, and carried away by hand labour or carts. Or else it is allowed to dispose of itself in the air or earth as best it can.



THESE TWO OFFICIALS REPRESENT THE SYSTEM OF WATER SUPPLY AND DRAINAGE IN INDIA FOR GARRISONS AND TOWNS.

Drainage, in the sense in which we have found it necessary for health in this colder climate, is by no means considered necessary for health in the hot climate of India; for, as in the case of the water supply, most of the reporters consider *no drainage* a sufficient guarantee for health.

(3.) *Filthy Bazaars.*

It is almost impossible to describe these. But one description will do for all. Except where the two Lawrences have been—there one can always recognize their traces—the bazaars are simply in the first savage stage of social savage life.

No regular system of drainage, no public latrines, or if there are any, no sufficient establishment to keep them clean, no regular laying out of houses, overcrowding, bad ventilation, bad water supply, filth, foul ditches, stagnant water, jungle and nuisances, this is the account of all. The country round some is stated to be "one immense privy."

At Neemuch, the Bazaar Superintendent maintains "strict supervision," and "punishes the inhabitants," although the latrines cannot be used. The native houses are all more or less dirty, with dung-heaps close to them. The "disagreeable emanations" from the bazaar are felt in barracks.

In Dinapore some streets were impassable dunghills "last year," "until cleared." The elephant sheds and all the south of the station in a state disgraceful to any cantonment. The drains, deep holes of festering mud. No latrines, although "the population is as thick as can be;" until lately, only one filth cart, now three. At a neighbouring village the dead are buried within the huts.

FEMALE SWEEPER.



At Agra it is a proof of "respectability" to have cesspools. The inhabitants (152,000) generally "resort to the fields."

English works, treating of sanitary improvement, insert sections of the bad drainage arrangements. But none contain such an illustration as this of how a woman is made to supply the place of a drain tile.

At Berhampore "nothing can be worse than the sanitary condition" of bazaars. The native houses are dirty in the extreme. Dung-heaps or deep holes full of stagnant water, the common cesspit of the houses, are close to them. The nuisance is felt even at barracks. The "Conservancy" establishment is quite unequal to its work.

At Muttra the bazaar is an accumulation of huts without order. "Drainage bad; ventilation worse; water supply execrable." "All the wells brackish, from nitre," the earth being contaminated with all sorts of impurities. Latrines "hardly known." "In short, the bazaar is a mass of filth."

At one hill station, Nynce Täl, where *men are sent for their health (!)* the stench is at times overpowering, from both bazaars being in a filthy and crowded state, no proper drainage or latrines, no means of preserving cleanliness, which causes nuisance even in the barracks. At another, Darjeeling, among other defects, the native villages, writes the medical officer, "are the most filthy" he has "ever entered, and" it is quite sickening to walk through them."

At Jubulpore, where every hut is crowded, where there are no latrines, where cleanliness is almost impossible, the same causes produce the same results.

At Cannanore the native houses have dungheaps and cesspits within the compounds. Owing to the want of latrines, the "filth and indecency" are described to be what it is impossible to repeat. The dead are buried within the compounds of houses.

At Trichinopoly the water supply is bad, scanty and brackish. The bazaar is said to be "clean," while the open cesspits are described as an "intolerable nuisance," when the wind blows over them. The native houses are ruinous and not ventilated. Levelling, filling up, pulling down deserted huts, &c., is urgently required, but not done.

Those who think I have given anecdotes and not fair illustrations, I refer again to the Stational Reports for further and fouler evidence.

These instances are enough to illustrate the subject. Bazaars are the real hot-beds of disease, and require sweeping reforms as much as or even more than the stations.

Native regimental bazaars, from which the soldiers procure supplies, are within military limits, and as much under military control as the ground on which the barracks stand, and ought to be kept in as good a sanitary state as the barracks will be when thoroughly improved.

(4.) *Want of Ventilation.*

The reports generally say, ventilation good, if barracks not overcrowded. But as the barracks are almost always overcrowded, we must conclude ventilation is bad.

Or they say, ventilation sufficient, because doors are kept open during day, which is as much as to say, ventilation is sufficient, because it is not.

At Kirkee, there can scarcely be said to be *any* ventilation in barracks. There are pigeon holes in the roof, but during the rains, when ventilation is most wanted, these have to be covered with tarpauling. At Poona the weather side has to be "dammed up" during the monsoon. At Bombay it is said that ventilation is generally sufficient; "at least there are no complaints," although "improvement is imperative."

At Kamptee the ventilation is described as "most faulty and deficient," although there are three openings in the roof of each barrack. The windows are unglazed. At Ramandroog, a hill station, the doors are venetian in the upper half, "a great disadvantage in wet weather." Half glass doors are required. At Bellary there are no windows. The doors are half venetian, half panel. At Trichinopoly, one of the very hot stations, the old artillery barrack is stifled by having only doors.

At Dinapore, where the ventilation is entirely by doors and skylights, "which latter, however, do not" open," one may safely say, ventilation not sufficient when doors are shut (at night). In the "permanent Hospital" at Dinapore, placed so that the "wind does not blow across" it, the ventilation is only "sufficient" when the doors are open.

At Allahabad the doors have to be closed in high winds, dust storms, &c.; and the ventilation, although there are roof ventilators and small windows over the doors, is generally insufficient. The hospitals of Allahabad, although they "face the wind," have "in most instances no windows, except openings over the doors, and in the roof." And the ventilation is pronounced to be "very defective," especially when the doors have to be closed.

So at Dumdum.

At Agra ventilation is said to be sufficient, provided the verandahs are not occupied for sleeping.

But the verandahs are occupied for sleeping.

At Landour, where sick men are sent to get well, there is both overcrowding and bad ventilation. There is no roof ventilation.

At Nynce Täl the air is said to be "pure" inside the huts, which means that they are always full of "smoke."

The cooling by tatties, *i. e.*, air passing through damp vegetable matter, often tends to produce ague.

External ventilation is often also bad, not giving the barracks the benefit of the prevailing winds, as at Dinapore, Allahabad, and Berhampore. This is a point of primary importance in India. At Muttra, although there is abundant ridge ventilation, the entire length, it is insufficient at night, simply because the barrack is in a position which the wind cannot reach.

At Allahabad one-third of the station is below the level of the river.

Generally, very little attention appears to have been paid to independent ventilation as a cardinal point of barrack construction. Doors and windows have been trusted to; yet they are so placed that men are often exposed in bed to hurtful draughts, and if shut, the fresh air is also shut out. Sometimes there is no glass in the windows, and when these are shut there is darkness as well as foul air.

A knowledge of the proper application of sanitary appliances to building in India appears to be as yet in its infancy.

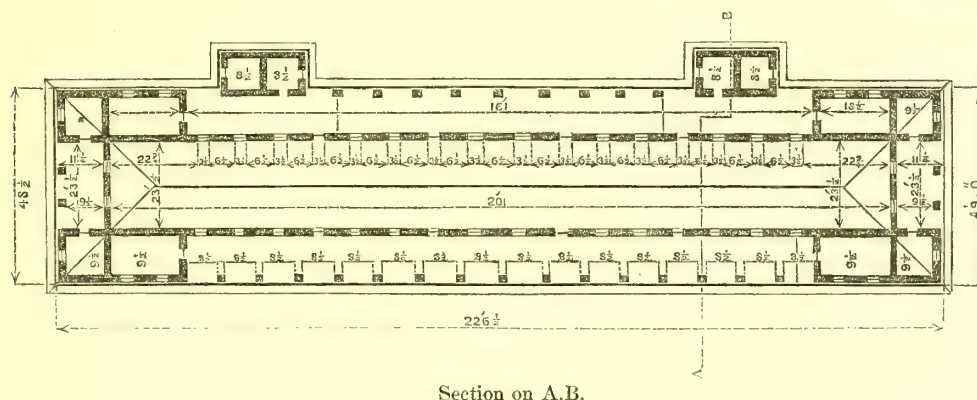
(5.) Surface Overcrowding.

The structure of Indian barracks varies much. But in one thing they almost all agree, *viz.*, in crowding the men upon the floor.

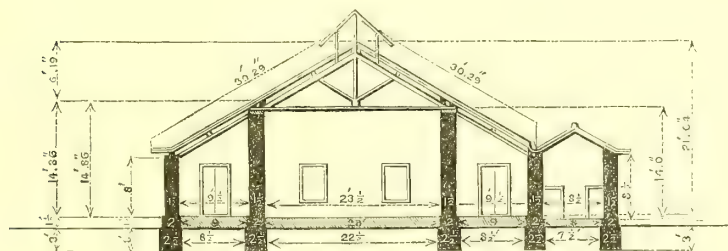
Fig. 4 represents a plan and section of a hut room at Deesa, no less than 200 feet long, intended for 80 men, at 1,116 cubic feet per man. It is well constructed for ventilation, and is altogether one of the best plans in India. But for its 80 men, which is just four times too many for any room, it allows less than 59 square feet per man.

Fig. 4.

EUROPEAN BARRACK. DEESA.
Plan.



Section on A.B.



Even in the most recent barrack plans there is the same defect.

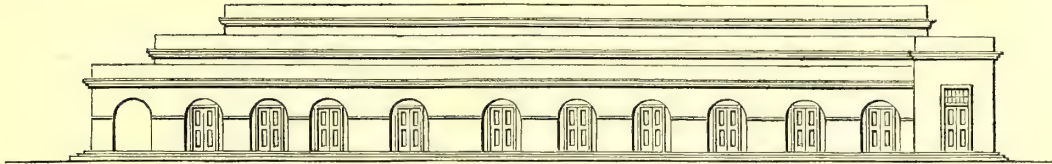
Fig. 5 gives a plan, elevation, and section of the new barrack, either erected or about to be erected, at Mhow. The elevation shows a magnificent and costly structure. But it is on two floors; it has double verandahs, the inner ones occupied by beds, so that there are four rows of beds, and 53 feet between the opposite windows; the ventilation of the whole interior is interrupted in rather an ingenious way by cross walls, and the men have 65 square feet of space each.

But even this is not the worst.

At Fort William, the Dalhousie barracks, which are said to be "perfect," have *six* rows of beds between the opposite windows, 216 beds by regulation in each room, and three floors of such rooms. While it is added "900 men" (300 men per room) "are generally accommodated in the barrack without inconvenient "overcrowding." What is *convenient* "overcrowding?"

The cubic space generally looks large in India, but the height of the rooms being enormous, often greater than their width, the superficial area is comparatively small. At Cawnpore the barrack rooms are from 25

Elevation.



besides. The elevation looks promising enough; but the inside, with its double defences of windows and doors against the outer air, is about the last place to put 70 men in. The distance between the opposite windows is 86 feet. The superficial area in this case (better than in the other instances, but more than counterbalanced by the extraordinary construction) appears to be about 85 square feet per man.

The men are far too crowded in their Indian barracks. In almost every case there are too many men in the rooms for health.

The floors in most barracks are merely the ground bricked over, or they are of stone or of a kind of plaster.

At some stations the floors are of earth, varnished over periodically with *cow dung*! a practice borrowed from the natives. Like Mahomet and the mountain, if men won't go to the dunghill the dunghill, it appears, comes to them.

To sum up: it is not economical for Government to make the soldiers as uncivilized as possible. Nature sends in her bill—a bill which always has to be paid—and at a pretty high rate of interest too.

III. INTEMPERANCE.

There is a good deal of intemperance among soldiers everywhere, but I very much doubt whether the same amount of tipping ever goes on in the British army in this country as appears to be encouraged by the canteen system in India.

A soldier in India may buy at the canteen no less than a gallon of spirits in 20 days, or he may have a quart of strong beer every day *and* one or two drams of rum or arrack.

It is easy to see what must be the effect of this on health in such a climate.

The gist of the stational returns amounts to this:—

Men all “temperate.” The maximum daily allowance per man is three quarts porter, or two drams spirits *and* one quart porter, or one dram spirits and two quarts porter. This as at Mhow, the largest of our stations in the Bombay Presidency. Agra too issues to each man per diem, during the “cold season,” 2 drams of rum *and* one quart of beer. But “no more than” two drams spirits, or “one quart (32 ozs.) “porter and one dram (3 ozs.) spirits” per man per diem is the common allowance.

Sale of spirits “strictly forbidden” in bazaar to soldiers; every man can nevertheless get as much as he likes in bazaar, *besides* the above quantity. For, as might be expected, it is practically impossible to encourage and restrict an evil at the same time. Government sells the licence to sell drink in the bazaar, and orders the men not to profit by it. The present law is like lighting a fire and charging it not to burn anything.

“No confirmed drunkards;” cases admitted into hospital directly from intemperance, numerous; *indirectly*, innumerable.

Average of habitual drunkards in some European regiments not less than 15 per cent.

At Fort William seven trials for habitual drunkenness in 8th Regiment in three months; in the 5th Fusiliers admissions into hospital *indirectly* from intemperance, 17 in 100; *directly*, 2 in 100. Spirits, it is said by more than one report, are the curse of the European soldier in India; also, that the evil effect of spirit drinking was manifest during the last field service. In seven regiments in Madras in 1849 the percentage among different classes was (roughly) as follows:—

	<i>Punished.</i>	<i>Admitted.</i>	<i>Died.</i>
Tectotallers - - - -	23½	131	1·1
Temperate - - - -	58½	141½	2·3
Intemperate - - - -	171	215	4·5

Again, it is said (Hazareebaugh), “soldiers as a body temperate,” *and*

One-third of disease, and

One-half of crime,

produced directly or indirectly by drink.

The long-cherished idea as to the necessity of spirits for the British soldier is, it is stated, thoroughly exploded. A man who drinks tea or coffee will do more work than a dram drinker, though considered sober. And why? Because we now know that tea and coffee prevent waste of the system under exertion; while spirits afford no more than temporary stimulus followed by exhaustion or collapse, both of which conditions are powerful predisposing causes of disease, especially in an exhausting climate. It is an error to sell spirits in canteens to prevent men obtaining worse spirits in bazaars. It creates craving, to be satisfied elsewhere. Again and again it is said that selling rum in canteens is an unmitigated curse to a regiment, destructive alike to health and discipline; that it will be a “happy day” when nothing but beer, light wines, coffee, tea, lemonade, &c. are to be sold. Col. Greathed, than whom we have no better authority, says that he “should wish beyond everything to see the practice of supplying spirits in canteens abolished.”

In one year (1859), at Allahabad, there were 36 cases of delirium tremens, of which 5 were fatal.

At Umritsir one-sixth of the admissions are directly, and one-half indirectly, from drink. Its effect is “injurious to the last degree.”

At Chunar, though the men are "mostly temperate," yet, on a 10 years' average, *one man in three (!)* was admitted into hospital directly from drink, besides those indirectly, out of the admissions. The deaths were just twice, the crimes just 10 times as many among the intemperate as among the temperate.

It is a comfort to hear that at Secunderabad the "average number of confirmed drunkards varies." But 25 out of 26 cases admitted into hospital indirectly from drink (Secunderabad's statement) is really too bad. Though when it is added, that in this large station, occupied by nearly 3,000 men, there is so little for them to do that they "go out in search of liquor," it is the less surprising. And the immense amount of epidemic dysentery that sweeps over the place occasionally, under such a system, is still less surprising.

At Bangalore, one of the largest of our Madras stations, where numerous acute attacks of disease are brought on by the quantity of spirits drunk, notwithstanding its fine, healthy, temperate climate, 3,000 feet above the sea, it is stated that, probably, "not three men out of five go to bed perfectly sober," and when pay is issued not two in five. That, of one-year soldiers, 1 per cent. is a drunkard; after two years, two per cent.; and so the proportion increases with length of residence, owing to their "idle, listless, objectless lives." In India, temperance is the exception and intemperance the rule. "But Government is to blame." It "bids them drink freely," and when the habit is confirmed "denounces them as a disgrace to their country." "The habitual daily two drams ruin the health and habits of the soldier, who thinks that as long as he takes only what Government allow him, he cannot go wrong." The taste for spirits, it is said, is "not easily acquired by young soldiers." "The habit of spirits is maintained by their authorized use."

The temperate men, it is stated, all drink occasionally; impossible to say how much spirit is sold in the bazaars. At present the collectors encourage the sale as much as they can for the sake of the revenue. Under no circumstances, except extraordinary fatigue, almost all agree, should any drink but beer, tea, or coffee be allowed, and the loss of revenue should be otherwise compensated for. Acquiring a taste for spirits should be discouraged in men by every means. It should be absolutely interdicted on the passage out, and malt liquor given instead, with good food, good water, and good accommodation. For want of these, about 10 per cent. of the recruits arriving from England at Kurrachee have in certain years suffered from scurvy.

"All spirit drinking is injurious to health." "Nine tenths of all the crime is caused by it." "It is directly or indirectly the root of all evil in the army." Such is the testimony borne in these reports.

In Burmah, when malt liquor could be had, health always improved. A marked change for the worse took place when spirit was issued instead.

Where beer was introduced, the "tremulous, yellow-skinned, emaciated" spirit drinker was rarely met with.

Madras presidency says that "health, efficiency, and discipline would be materially improved by tea and coffee in preference to spirits and malt liquor," "as has been proved when neither spirits nor malt liquor could be had."

Barrackpore says that, if spirits were abolished, and dietary improved, the mortality among our men would be "extraordinarily diminished."

Fatal cases (in sickness) mostly occur among intemperate men.

There is hardly a difference of opinion as to the necessity of abolishing the use of spirits in the Indian army. Men would be blind, indeed, to the most glaring facts who would justify its continuance. The only plea on the other side in the reports is a very old one, which has been used to justify other vices besides dram drinking, viz., that, "if we do not give spirits in the canteen, which we all believe to be bad for health and discipline, the men will get worse spirits in the bazaar." Thus the men are killed by liver disease on canteen spirits to save them from being killed by liver disease on bazaar spirits, Government in either case benefiting pecuniarily, as is supposed, by the transaction. May there not be some middle course whereby the men may be killed by neither bazaar nor canteen spirits?

IV. DIET. *Excess of Food.*

4. It appears extraordinary to give the soldier the same amount and quality of diet in all seasons, in tropical as in temperate climates. And yet every day the soldier has 1 lb. animal food, 1 lb. bread, 1 lb. vegetables, 4 oz. rice, tea or coffee, and sugar, besides his spirits and beer, and any amount of extra animal food he may buy for breakfast and tea. Of all countries India is the one where men cannot be dieted the whole year round by the same rule without mischief. But only a few enlightened men appear to have any idea of what effect this extraordinary system of dietetics has on the soldier's health.

Surely we have sufficient knowledge of dietetics to be able now-a-days to vary our diet to suit climates and seasons, and to know that we cannot eat every thing every where. Sir John Lawrence says, in his evidence, that Government "might try to induce the men, by varying the ration with reference to hot or cold weather, to take more to vegetable diet."

The means of cooking are of the rudest order—a small square outhouse, sometimes without a chimney, often far from clean, is the regimental kitchen. As for boilers and ovens, considered indispensable at home, there are none. A few holes to put the fire in, and moveable utensils to hold over them, are all that India thinks it wants. There is of course no water laid on, and no drainage. Here as elsewhere is the inevitable cesspit, and sometimes there are two.

Fig. 7 is a plan of a double kitchen at Hazareebaugh. Fig. 8 is a by no means bad example at Belgaum. Both show the total want of civilized appliances. And although the cooking is not often complained of by the stations, there is very good authority for stating that the food is imperfectly cooked, or served up in a way which destroys the digestive organs, and leads to the use of stimulants to promote digestion.

Fig. 7.

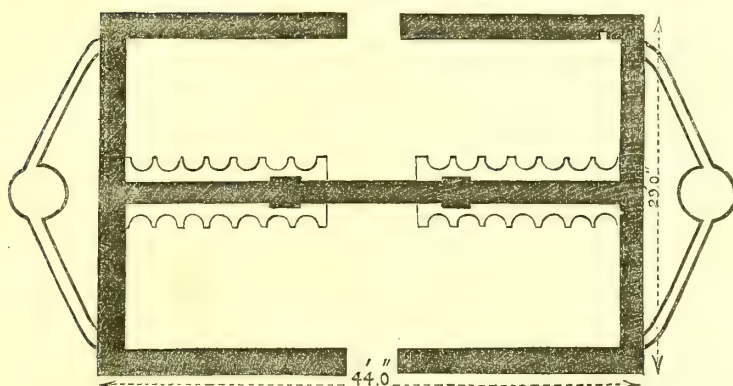
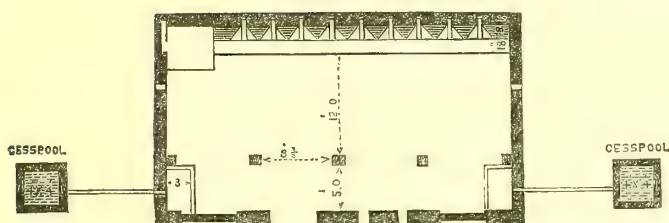
COOK-HOUSE. HAZAREEBAUGH.
Plan.

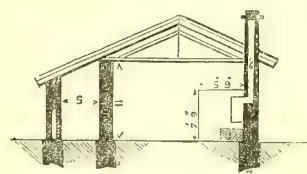
Fig. 8.

ARTILLERY COOK-HOUSE. BELGAUM.

Plan.



Elevation.



V. WANT OF OCCUPATION AND EXERCISE.

5. To understand the influence of this system of dieting and drinking, it must be remembered that, except morning and evening parades, and the man's turn on duty, he has nothing in the world to do. He can neither amuse himself, take exercise, nor turn his time to profit for himself, for there are no means of doing any of these things. All the spare time people usually give to active occupations he spends lounging in his hot barrack room, most of it on his bed.

The following graphic woodcut of the manner in which a soldier spends his day is from a drawing kindly sent me by an Indian officer of rank. (See page 12.)

India actually reverses the ordinary human day, for the men spend 18 hours of the 24 in or on their beds, and six hours only up or out. Indeed, Kamptee says that "for many months of the year the men are confined to barracks for 20 out of 24 hours." And your imagination must fancy 100 to 600 men or more packed into the same room for eating and sleeping away these 20 hours.

This is an account of a soldier's day :—

bed till daybreak ;
drill for an hour ;
breakfast, served to him by native servants ;
bed ;
dinner, served to him by native servants ;
bed ;
tea, served to him by native servants ;
drink ;
bed ;—and *da capo*.

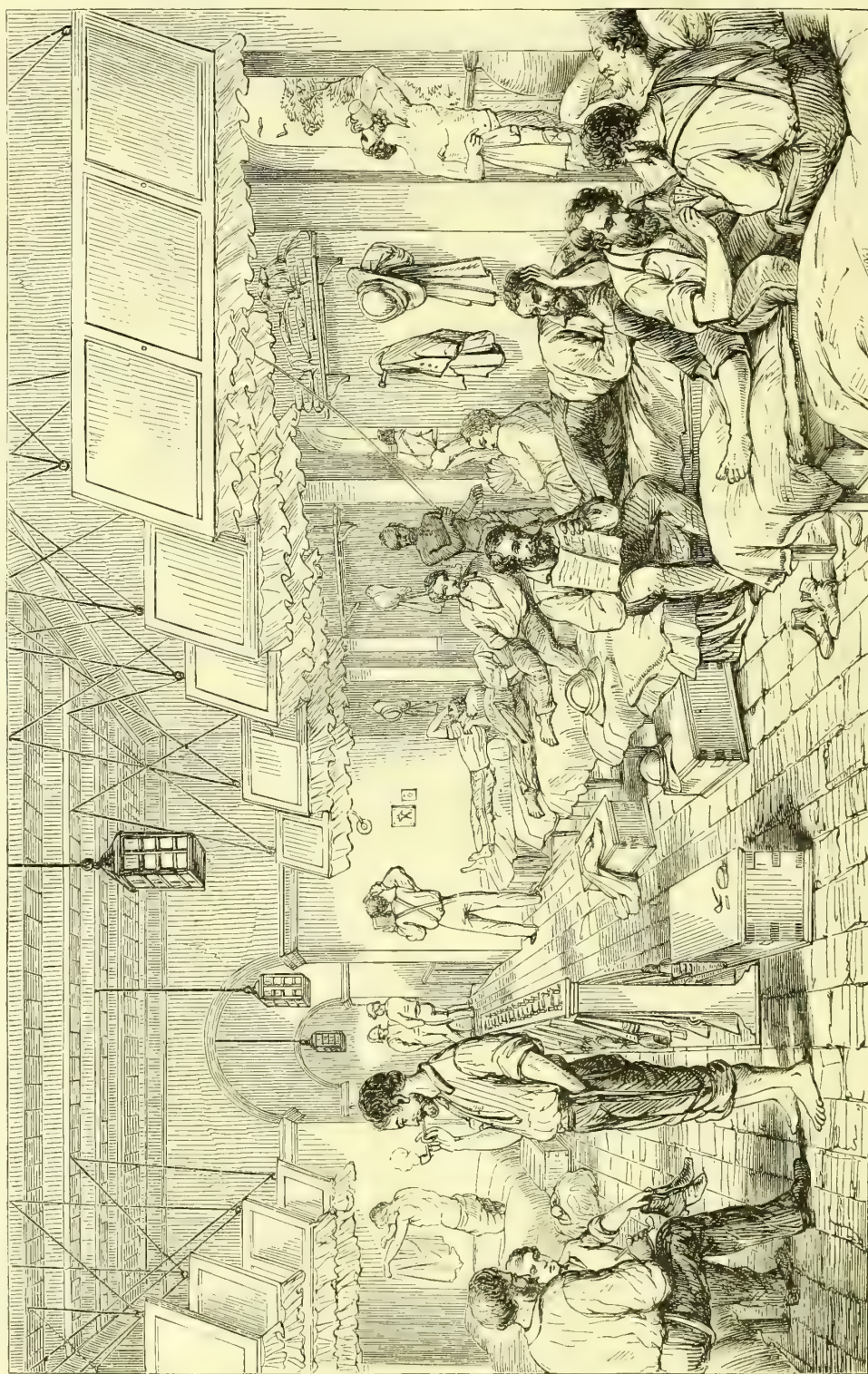
So that the Briton exactly spends his spare time between eating, drinking, lounging, or sleeping ; and he eats meat always twice and sometimes three times a day.

All his meals are condensed into the hot hours of the day. And just when he wants one most, viz., before he goes out to his early morning work, he does not get it. Why not give him hot coffee before morning parade, and beer, if he must have it, at dinner and at night ? Not one report except Tonghoo but prays for the abolition of all this dram drinking ; and it is said that the *abstinent* man is more enduring of fatigue and less obnoxious to disease than even the *temperate* man. Spirits, it is said, should never be offered for sale, as men are induced to take spirits who never would if they were not so "handy." Trichinopoly says that the sale of spirits should be abolished in canteens, bazaars, and within a circle of 10 miles round barracks.

If the men had employment, recreation, good tea, coffee, milk, more variety of food and of cooking, spirit drinking might be abolished. A good hot cup of coffee is the best stimulant for a soldier. As it is, the old soldiers often take a dram before morning parade, and nobody can prevent them.

The following piece of information is curious (the scene lies in the Madras presidency,) viz., that "the canteen funds" (the profits derived out of the soldiers' drunkenness) "are insufficient to provide amusements to keep the men from drinking." Also that where there is no library there are "plenty of books which can be read till 8 p.m., when all lights are put out." Berhampore has a library and reading-room, but "neither lighted at night."

That want of occupation, leading to drink, lays the seeds of disease among the troops, is acknowledged "Alcohol and unrefreshing day sleep," says Bangalore, "contribute to engender disease and accelerate mental and physical decay." Ahmednuggur says that, for one man occupied in a barrack there are six idle. Also, that when men are actively engaged in the field in hot weather, there is little sickness or epidemic



DAILY MEANS OF OCCUPATION AND AMUSEMENT. INDIA *passim*.

disease among them. So unaccustomed is the soldier to ordinary exertion that, as might be expected, the short parades are talked of as injurious, as if they were long harassing marches; while, curiously enough, it is admitted that the soldier is never better than when he is exposed to the harass and fatigue of field service.

Kolapore and Belgaum say that, the more varied and agreeable a soldier's occupations, the better his health; that the troops require means of occupation and amusement to keep them out of the bazaars.

All the sensible reporters say that too much stress cannot be laid on the importance of using the utmost exertion to provide legitimate amusement and occupation for the men—workshops, shelter for athletic games, &c. We must always remember that, in hot weather, the men, save those who can read, “have positively “nothing to do.” Employment on public works “would be a great boon;” “the work would be as cheaply “done as now; it would occupy the soldier, and he would feel he was doing good.” Savings banks would answer, “if workshops for trades were established.” The usual account from a station is, no library, nor reading nor day room, no club, no garden, no workshops, no theatre, no gymnasium, no means of instruction or recreation whatever, no skittle grounds, or if there are any, not covered, no sufficient shade for exercise. And the men are generally confined to barracks from 8 a.m. to 5 p.m. in hot weather.

Cawnpore actually orders the men to be confined to barracks for 10½ hours a day in hot weather; but the order “is often disobeyed.” At Chunar there is no restriction as to exposure to the sun. The “men “go about at all times, and, except when under the influence of liquor, do not appear to suffer from “exposure.” Yet Chunar's mean temperature is 65° in December and 92° in June, its sun temperature as high as 120° in June. And yet the men do not “suffer from exposure.”

Agra, Ferozepore, and Umballa say that a large covered building for gymnastics, workshops, games, with a library, reading and coffee room, a theatre and plunge baths, “would draw many men from their cots, where “they idle and sleep all day.” And Peshawur recommends that this building should be separate from barracks.

Dinapore recommends a farm yard to employ the men: an excellent idea.

Mean Meer (Lahore) suggests photography, modelling, and drawing as occupations for the men.

Sealkote (1,200 men), and Ghazepore (850 men) may be offered as examples of the two opposite types of rational occupation and idleness.

Sealkote, indeed, is the only station, except Rangoon, which has anything like completeness. It has ball courts and skittle grounds. It has schools and regimental libraries. It has a well-lighted reading room, with chess, backgammon, dominoes, and 16 newspapers, &c. It has a soldiers' garden, with seeds and tools provided by Government, who grant prizes for the best cultivation (soldiers' gardens, when they exist at all, are elsewhere worked by natives). It has armourers', saddlers', tailors', shoemakers', and one watchmaker's shops. It has theatres; it has cricket and regimental clubs; it has foot ball, and it is particularly fond of quoits. The savings bank of one of its regiments has 8,000*l*. It has sufficient shade for exercise. Yet Sealkote does not think it has done enough. And while other stations, whose men “lie in their cots all “day,” seem unaware that anything else is desirable, Sealkote wishes that “workshops for every trade” were instituted, as they might be, and “strongly recommends” a gymnasium.

It is noteworthy that the health of the troops at Sealkote seems to require but little amendment, and that no complaint is made of its climate.

Rangoon has a ball court and skittle grounds; schools, three libraries and dayrooms; soldiers' gardens; shops for trades; two theatres. But Rangoon says it requires lofty open sheds for gymnasium, and that Government should afford every aid in establishing good coffee rooms, *independent of canteens*, all amusements to be as near as possible, all canteens to be as far as possible, from the coffee rooms.

Now take Ghazepore. Its whole means of occupation, instruction, and recreation, are one ball court and two skittle grounds. Its whole shade consists of the verandahs, under water during the rains. “Almost “everything has yet to be done.”

The large station of Allahabad (with accommodation for upwards of 4,000 men) is almost as ill off. Tonghoo, the only station which considers the quantity of spirits drawn as “conducive to health,” and the amount of “sickness, mortality, and crime occasioned by intemperance” as “trifling,” has, as might be expected from this statement, absolutely no means of occupation and amusement for its men, and few of instruction. It appears to consider drinking and idleness the normal state of things. At Bangalore (1,700 men) “day rooms, soldiers' clubs, workshops, theatre, gymnasium and gardens, are things unheard of.” The “regimental library has no attraction for men who read with difficulty.” This is the place where, as soon as “the noonday gun announces that the canteen is open, a rush is made for the raw spirit dram;”—where “the canteen and the cot divide the hours unoccupied by the daily routine of petty duties.” What else can be expected? There is, of course, plenty of liver complaint here.

But amusements are not all that is required. In conformity with all reason and experience, Sir Charles Trevelyan observes, that, however necessary and useful chess and backgammon, ball courts, and skittle grounds, and even books and newspapers may be, they only furnish some present diversion, and do not supply any strong pervading motive, such as induces men to submit to sacrifices, and to make persistent exertions in other lines of life. This motive is to be found only in the hope of rising to a higher and better position. He advocates a system by which every soldier who conducts himself well and cultivates himself so as to acquire a knowledge of the native languages and other necessary attainments, should be able to look forward to promotion as a matter of course, either in the army or in the commissariat, ordnance, or other military departments, or in the department of public works or police. The British soldier in India would then feel himself engaged in the serious business of life, at least as much as any of his countrymen of the same class at home. The army would take its tone from the active influential portion of the men. The amusements of various kinds provided for the soldiers would be more appreciated and would have a more wholesome effect, because they would take their proper place in subordination to higher interests.

This is no theory. It was actually carried out by Sir C. Trevelyan at Madras. Men were first selected by competitive examination within the regiment. There was a second examination at Madras, and the result was the obtaining “of 20 men who were the pick of the whole army for the administrative service of “the Government in the civil and military departments.”

One element essential to placing soldiers in positions of civil usefulness is, of course, their learning the language of the country, necessarily part of that voluntary education which they must have for competitive examination. Teaching the native languages in regimental schools would at once provide the men with interesting occupation and the prospect of future advantage. The War Office has already sent to all European regiments in the Madras Presidency a cheap edition of the New Testament and Psalms with a Clavis in Hindostanee, in furtherance of this object.

Sir C. Trevelyan would also encourage trades and handicrafts to the full extent consistent with the means of profitably disposing of the produce. And this is the more necessary because all are not equal to the intellectual acquirements to which the previous remarks refer.

All officers who give an opinion on the subject concur in recommending workshops.

Dumdum, in the total absence of all means for occupying the men, opens a small museum, with lectures, to which the men crowd, showing "that soldiers are ready to avail themselves of any means of rational amusement in the evening in preference to spending all their time in the canteen."

Muttra again has no means of instruction, occupation, or amusement whatever, except a soldiers' garden, for which there are no tools, although indented for a year ago. Carpentry, saddlery, and coopers' work are in great demand, and would benefit the men, as regards health, morals, and finance.

Lucknow is building everything that is required, except workshops.

Rawul Pindi has nothing but schools.

Barrackpore petitions for fives courts, a theatre, gymnasias, swimming baths, public reading of good biographies, travels, and novels; for trades, such as clothing, accoutrements, barrack furniture, watch making, printing, paper making, baking. It says that savings banks should be connected with workshops.

Darjeeling has a hospital reading room, and reader: a very good plan. But for its men out of hospital, at a hill station, where the rains fall incessantly for five months, there are no means under cover provided and the men are pent up in barrack-rooms, to the great injury of their health. Darjeeling says, "there should be restaurants where men could get coffee, tea, newspapers, magazines, and mix with men of other regiments, instead of the discomfort of the everlasting barrack-room."

Hazareebaugh has a Government library, *not* lighted at night, a temperance reading room, well lighted, with upwards of 200 members (out of 1,080 men, for which number the station has accommodation), and, although it has armourers', shoemakers', and tailors' shops, it strongly recommends further means of occupation and amusement "as the long days of the Indian hot weather hang heavily on the soldiers' hands."

This part of the subject is by no means exhausted, but these examples and illustrations are quite sufficient to show the small amount, indeed, of physiological knowledge which has been practically applied to the British army in India.

Suppose any one wanted to try the effect of full diet, tippling, and want of exercise, in a hot climate, on the health of men in the prime of life, the Indian army method would be the process to adopt, in the certain expectation that every man exposed to it will be damaged in health.

While all this scientific "turkey stuffing" is practised, the men are carefully kept in barracks and not allowed to exercise themselves. And every body seems to believe that the way of making diseased livers in geese for Strasburg pies is the best way of keeping men's livers sound and of making efficient healthy soldiers for India. Wherever the régime is otherwise, as in the case of cavalry and artillery, who have some exercise, or where an enlightened officer allows his men to go shooting, there is, of course, improved health. But nobody learns the lesson.

People seem to consider that health is a natural production of India, instead of being the result of rational management. At the same time everybody says that India is "so unhealthy." Under this system of diet, regimen, drink, and idleness, it is indeed to be expected that cases sent to the hospital will be much more numerous, much more severe, and much less amenable to treatment and management than under a sensible system.

VI. HOSPITALS.

6. The Indian hospitals, though planned on simple principles, admitting of admirable details, are, as a rule, exceedingly bad as regards points considered essential to health and administration, even in this country. What would be, *e.g.*, thought in this country of a hospital without a watercloset, or bath, or means of personal cleanliness? Such a hospital would be considered as a mere makeshift, till accommodation fitter for recovery could be provided.

The "means of ablution" in Indian hospitals, are often "a tin pot, with which the sick pour the water over themselves." Or, as at Bombay, they "take water to bathe themselves from a trough." Elsewhere, they have "one tub, one basin, to 100 men." The means of washing, as at Ramandroog, a convalescent station, are "two shallow earthenware pie dishes," "on a form in a room" ("very chilly in damp" weather) "adjoining where the night stools are."

At Rangoon the "bathing accommodation" is "hitherto nothing but a tub of water, without basin, soap, or towel."

There may be a bath room. But "all apparatus is entirely wanting." The sick "can always, if they please, get a skinfull of water thrown over them by the water carriers," as at Hazareebaugh.

One may safely say that when the sick are able to bathe in India, it is a sufficient test of their being able to leave hospital, as has indeed been discovered to be the case at some home stations.

At Nynce Täl the sick bathe in the lake. Darjeeling says, "in fact the inducements to remain dirty are, especially in the case of sickly men, greater than those to be clean."

There does not appear to be a single well placed orderlies' or nurses' room in any of the hospitals, from which the sick can be seen at all times, and where the nurses themselves can be inspected. The surgeon's and "nurses'" quarters are sometimes three-quarters of a mile or a mile off, so that they (the medical and nursing attendants) are represented as spending their whole day in going backwards and forwards on the road.

The hospital is generally surrounded by a "high prison-like wall." At Ghazeeepore it is said "of course" "all the buildings generally are most unsuitable for hospital purposes." Proper ventilation is represented,

as at Baroda, as "next to impossible." At Kolapôre the rain beats in through the cowl, and "makes the wards so damp that charcoal has to be used to dry them." The water for drinking may be brought, as at Bangalore, from a tank which receives the whole sewage of the cantonment, and which "just now is not very clean," from which "hundreds of bullock loads of impure matter are removed year after year when the tank is low and the smell from it most offensive." Or the water may be brought (cholera also being brought with it) from wells into which the said tank drains. The drainage may be by an open ditch into the tank, whence the hospital derives its water. Or the water supply may, perhaps, have to be carried from half a mile off, or even from two miles off, as at Madras. But "no improvement is required in this respect." (!) The privies are everywhere either "highly offensive" or "not more offensive than the best of such places usually are in this country." Or the privies are "without seats," and are "kept pure by burning salt in them." "Arrangements admit of improvement."

Scarcely ever is there any provision of separate wards for convalescents; although, in a country whose scourge is dysentery, to leave men convalescent from dysentery in the same place and under the same circumstances as those suffering from dysentery is just to ensure as far as possible their *not* convalescing. The same may be said of fever and of bowel diseases generally. Convalescents pass their whole 24 hours in bed, except during their time of exercise (*where* they have means of exercise) on elephants, in sick carts, or doolies. They have not even a room to take their meals in, but eat their food upon their knees, sitting on their beds, "possibly with dying men around;" or they are sent to barracks and put on barrack rations, and "marched out under a non-commissioned officer morning and evening for exercise."

Where there is no guard house the "men on guard occupy a corner of the hospital verandah, where they eat, drink, and smoke at their discretion." No hospitals have dining rooms, although all ought to have them because of the pest of flies in India. Not one has a day room for men who can leave their beds.

The "sanitary state" is generally represented as "good," although at the same time we are told as in certain cases that the hospital is "unfit for accommodation of European patients;" or that "epidemic disease has appeared in it;" that "sores become erysipelatous;" that, as at Bangalore, "one of the flags" in the floor being removed, "the smell from the opening was so offensive that" the surgeon was "obliged to run;" that "gangrene and phagedæna have appeared, when the hospital was crowded;" that the "privy is a nuisance to one ward;" that the "cesspools are always more or less offensive;" or that the "out-houses are in a very dirty and unwashed condition." At Muttra the contents of the latrines are "carted away every morning for combustion in one of the many brick kilns which surround the station and help to poison the air." At Madras the "sanitary state" is called "good," and the commander-in-chief himself adds, "if the vile stinking river Cooum were not under the very noses of the patients." Both cholera and gangrene have appeared at times in the hospital. The latrines are placed to windward "unfortunately;" "tubs only are used." The privy is washed daily, and charcoal "burned in it." It is called "not offensive," the commander-in-chief again adding, "a year ago it was odiously offensive."

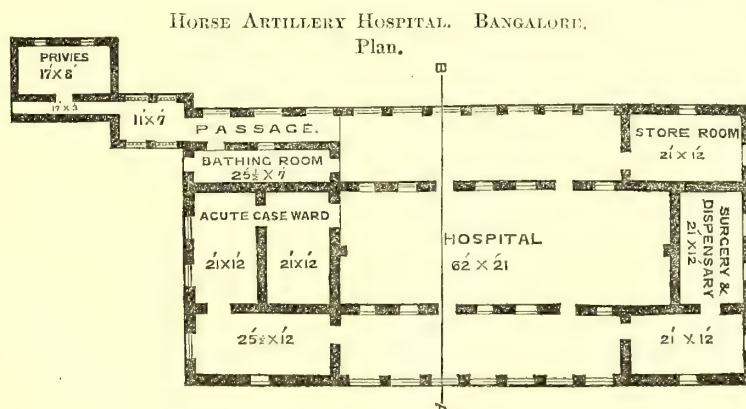
No wonder that it is stated, as at Bangalore, that "sick men are reluctant to come into hospital from barracks," and that the medical officer does not want "convalescent wards," because he finds it better to send his convalescents to barracks, where they recover faster.

From some hospitals the "impurities" are removed by hand carriage to 30 yards from the hospital. In another, the privy is said to be a "disgrace to the 19th century." One wonders to what century it would be a credit.

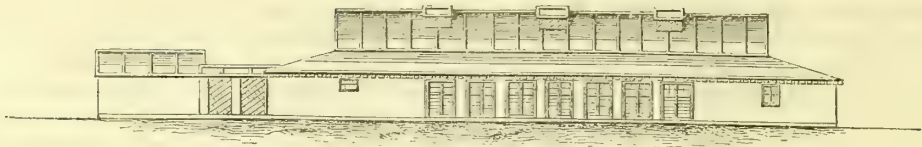
At most hospitals the bedsteads are of wood instead of iron, and the men break them to pieces in their "efforts to expel the vermin." As at Ramandroog, where men are sent for their health, "the building swarms with bugs." And so of every barrack and hospital where these wooden bedsteads are used. One surgeon complains of the serious injury to his sick occasioned by want of sleep from vermin. The bedding is of hemp or straw, instead of hair, which latter it ought always to be in hospitals, and which is now the regulation in all Queen's hospitals. It appears from several reports that sheets are not provided except for dysentery and fever: and certainly in no hospital deserving the name should the inspector-general feel himself called on to recommend that "a good mattress, a blanket, *sheets*, and pillow cases should be provided for every bed," as does the excellent inspector-general of the Madras Presidency.

Figs. 9, 11, are illustrations of the smaller class of regimental (British) hospitals. Fig. 9 shows the simpler form of construction, a single large ward, partially enclosed by other rooms for sick, all communicating and having a common ventilation, the arrangement good and simple up to a certain point, and then marred in the details. There are privies in place of water-closets, with covered passages, to conduct foul air to the sick in certain states of the wind. Bangalore gives a reason for "the covered way to the latrines," which we never should have thought of. It is a "covered place for exercise."

Fig. 9.



Elevation.



Section on A.B.



It will be seen that the hospital is entirely destitute of proper ward offices.
Fig. 10 shows the privy arrangements in plan and section. There is no drainage; the contents are carried away by hand.

Fig. 10.

EUROPEAN INFANTRY HOSPITAL PRIVY. BELGAUM.

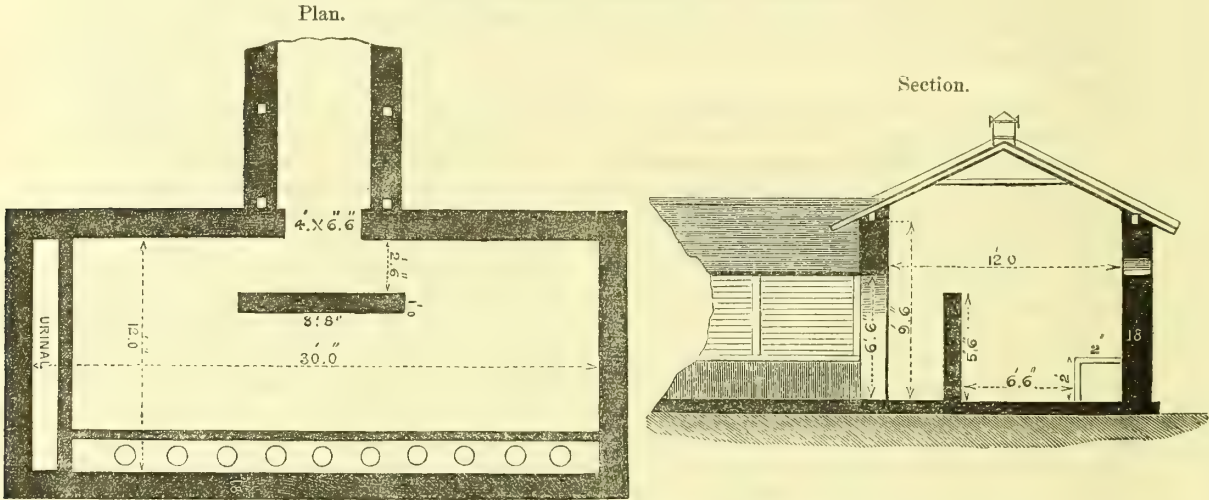
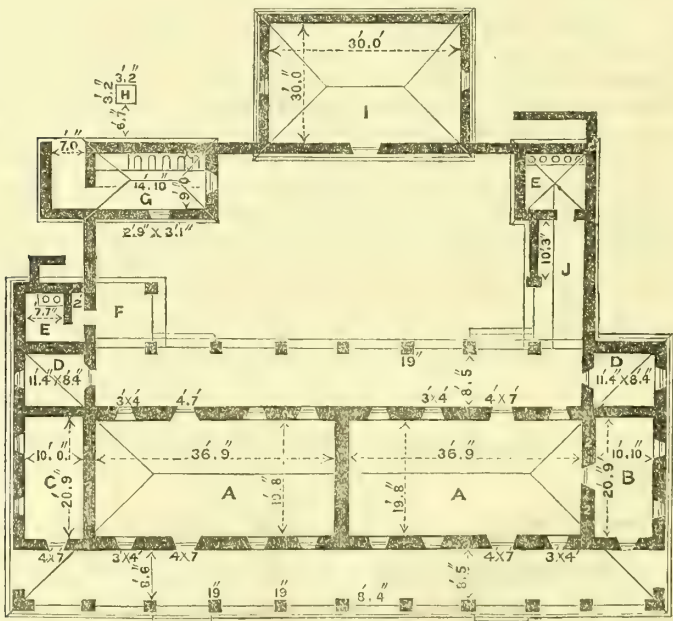


Fig. 11 shows a somewhat better construction of hospital, but there is the same defect in detail.

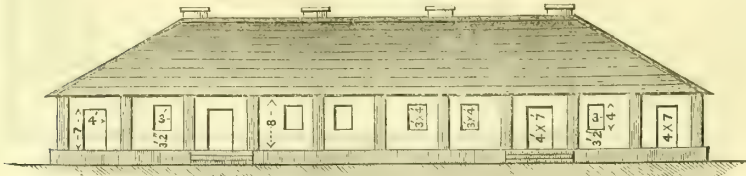
Fig. 11.

ARTILLERY HOSPITAL. BELGAUM.

Plan.



Elevation.



Either plan might answer for temporary camp purposes, in default of better, but that is all.

Indian hospitals generally, so far as all conveniences and comforts are concerned, appear to be simply camp hospitals; good, because the best possible for field service, but by no means good or the best possible for permanent stations.

There is no instance, except at Wellington, where the hospital, if on one floor, as is usual, is raised from the ground with any current of air beneath. These hospitals are stated, as at Bangalore, to be "always damp in wet weather." And often the floor is merely the ground bricked over. Rangoon and Tonghoo live like the beavers, and raise their barracks and hospitals on piles, with free passage for air underneath. The consequence is, that in those jungly swamps, they are more healthy than at most other Indian stations where the men sleep close to the ground.

As at Allahabad, Barrackpore, Dinapore, Meerut, Kurrachee, and Secunderabad, vast wards of from 100 to 150 beds, and even up to more than 200 beds, exactly the same as the barrack rooms, are in use.

The wards can never be said to be light or airy; "as a general rule, hospitals are badly lighted and gloomy;" doors are more common than windows. And these doors, when closed, leave the ward, if not absolutely dark, yet absolutely dismal and close. Indeed a dark ward must always be a close ward. Or "light enters from a couple of panes in the doors near the top, and when closed darkness is almost complete." There is in Indian hospitals hardly a room light enough to perform a surgical operation. And operations, it is stated, have to be performed in verandahs.

The inner verandahs are generally used for sick wherever more room is wanted: the outer ones sometimes cut up for lavatories, destroying what ventilation there is.

The superficial area per bed is almost invariably too small, and the wards almost as invariably too high; the result to the sick being that, with an apparently sufficient cubic space, the surface overcrowding is excessive. One of the worst examples of this is the recently constructed hospital at Trimulgherry (Secunderabad) which consists of three wards, two of which contain no fewer than 228 beds each; the wards are 42 ft. high, and afford 1,001 cubic feet per bed, but the surface area per bed is only 24 square feet. This surface overcrowding is greater than I have ever seen it in the smallest or the largest temporary war hospitals. Such facts strike one very forcibly in connexion with the high mortality among sick entering these and similar hospitals.

All the defects of barracks re-appear and with worse consequences in the hospitals: viz., bad water-supply, bad ventilation, no drainage, (Ferozepore says, "drainage not necessary,") offensive latrines, so offensive indeed that the patients have sometimes to leave a particular ward, no means of bathing, and hardly any of cleanliness.

There are besides, however, two grave defects not felt in barracks, but peculiar and fatal to hospitals.

These are the cooking and the attendance. It is in several reports complained that under the present system the cooks (natives or Portuguese), are nothing but "miserable pretenders," because the pay is so small; that the kitchens are no better than, but just the same as the barrack kitchens. They are often small open sheds, without chimneys, the smoke finding its way out as it can, and with but few utensils; sometimes the food is prepared on the ground. "But we are accustomed to this in India." It is added, that though common food is tolerably well prepared, there is nothing whatever that can be called sick cookery, nothing whatever to tempt the appetite or spare the digestion of the sick man, whom the hospital is for.

In hospitals at home, trained cooks of the army hospital corps are now in charge of the cooking, under the direction of the purveyor, who is responsible that the diets are properly cooked. In India the chief quality in native cooks appears to be the "pursuit of cooking under difficulties;" their ingenuity in bringing about an *apparently* good result, in a rude and often bad way, is frequently admired by the reporters, as if the end of cooking were "to make a pair of old boots look like a beefsteak."

In England where the grass-fed meat is so much better than in India, it is found necessary to put the purveying of meat for hospitals under the charge of the purveyor, for the sake of always obtaining the best quality.

There does not appear to be any provision of this kind in India, where all is under the commissariat.

As to the attendants, they are just the same as would be supplied to idle healthy men. Quantity, it would seem, is supposed to supply quality. In serious cases a "waiting man" is supplied "from the battalion who is relieved daily." That is, he goes on guard for 24 hours, as in the guard room, so in the sick room. It appears that mounting guard in the sick room is disliked, and the guard sometimes neglects his patient.

As to supposing that any nursing is required, the thing is totally out of the question. There are neither trained orderlies nor female nurses.

A matron is sometimes "sanctioned," but "only for a complete battalion." If there are fewer sick they must do without. Every severe case, as has been stated, is allowed to have its comrade to itself in from the ranks, i.e., the case which requires the best nursing is to have the worst nurse. Something more is needed to make a nurse, as well as a surgeon, than mere kindness. Wherever the above comrade-practice is found, we know beforehand that there can be no nursing, no discipline in that hospital, and any amount of drink.

There is generally one hospital serjeant and a "plentiful supply of ward coolies." The hospital serjeant is for discipline, and under him are 79 coolies and bheesties in cold weather, 240 in hot weather. This for an European corps. The general impression, as regards the native attendants,* is that they are in some

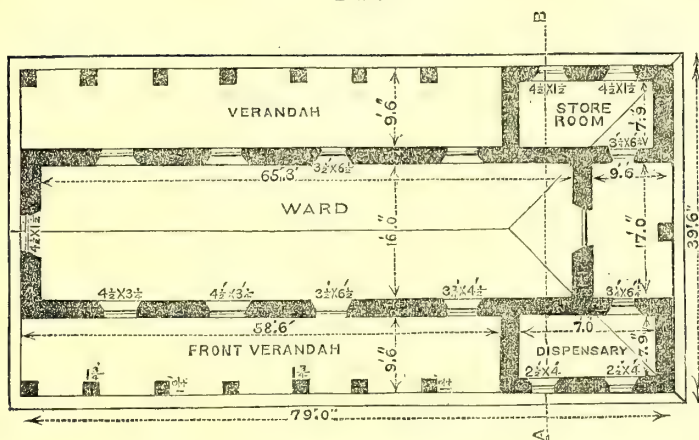
* And here comes in again the difficulty of difference in language. Our men dislike and despise the natives, and are regarded by them in return more as wild beasts than fellow creatures. The native, however, makes much more effort to learn the Briton's language than does the Briton to learn the native's. It is difficult to give an idea of the evil effects of the gross ignorance of all that relates to the country in the ranks of our army in India. The commonest attempt at conversation gives rise to feelings of impatience and irritation, too often followed by personal illtreatment. Where the Briton is sick, it is of course worse.

To enable our soldiers to hold ordinary intercourse with the people among whom their lot is cast, is the first element of an useful and happy life for them in India. Every soldier should be required to learn something of the native language. And a somewhat higher voluntary standard should be fixed, the inducement to attain which should be:—1. A specific pecuniary reward. 2. Eligibility for employment in the various departments of the public service.

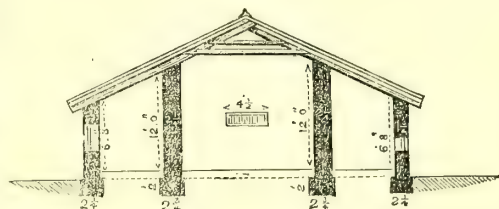
Fig. 13.

NATIVE INFANTRY HOSPITAL. KULLADGHEE.

Plan.



Section on A.B.



Elevation.



At Loodiana, one native doctor, one cooly, one water carrier, one sweeper, are the attendants "sufficient for the ordinary wants of the sick." The present arrangements for the female hospital are said to be "sufficient," (which means *none*) (Loodiana is now a native station).

VII. HILL STATIONS.

Sir Ranald Martin wisely and strongly urges that the whole subject of hill stations should undergo a thorough revision, for the purpose of deciding whether a portion of the army could not be always taking its turn as a reserve on the hills, thus to preserve its stamina.

Children too might be reared as well on the hills as at home. One of the native chiefs going over the Lawrence asylum (of 500 children) at Sunnawur, said to Sir John Lawrence that they looked like lion's cubs.

It strikes one, however, that it would not be safe to depend for improvement of the health of troops solely on occupying hill stations, with such an overwhelming amount of evidence as to the bad sanitary state of the stations on the plains, and even of not a few of the hill stations themselves, such as Darjeeling, Landour, Nynce Tal.

"At some hill stations there is malarious fever; others predispose to diarrhoea." The barracks and hospitals at Kussowlie and Subathoo are defective both in plan and in structure. At Mount Aboo they are "bad barracks," built in a "malarious gully," and the men return suffering from intermittent fever and from scorbutic disease, the result of want of vegetables. Will it be credited that, at one of the two hill stations of the Madras Presidency, the privies are built on the edge of the hill, in order that the natural slope may save us all the trouble of sewerage, the lavatories the same, which are emptied by "upsetting the tubs" down the hill; and that, at the other, with more than 900 men, the barrack square was an immense swamp for want of drainage. Low fever, from March to May, from which the men have suffered who were sent there for health, is attributed to this as if it were a meteorological observation. This refers to Wellington on the Neilgherries. Indeed the Neilgherry stations, the best in India, are in great danger of being permanently injured by sanitary neglects.

In fact, all that the hill station evidence proves is that healthy men, put under healthy conditions, will remain healthy, and *vice versa*.

Hill stations, it is said, are highly favourable to troops arriving *in health*, if lodged in good barracks; are unfavourable in some states of disease. Dry, spacious, well-ventilated barracks, in well-chosen positions, drained, supplied with wholesome water, and out of the way of nuisance and malaria, have been the great want of hill stations. And want of fresh vegetables and of pure water has produced much mischief. In the rains, the water is often loaded with "rotten vegetable matter causing diarrhoea." [Is this supposed to supplement the *want* of vegetables?]

High authorities advocate sending certain invalids to sea-side sanatoria.

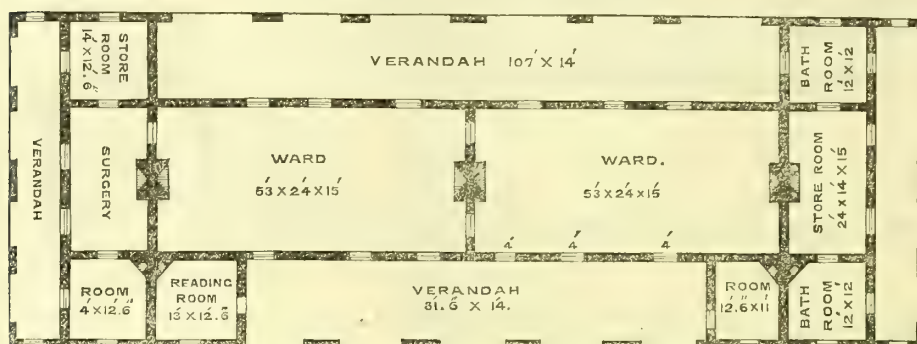
Hospitals at hill stations appear to be very much on a par with hospitals at plain stations, as far as can be learnt from Fig. 14, which represents the hospital at Darjeeling used for sick of the *dépôt*. The arrangement is much that of a field hospital, with fire-places to suit the climate. At this hospital an open privy was placed in one corner of the verandah, which compelled the sick to evacuate the ward, and it took five years' writing to get it removed.

Hill climates, judiciously used, would no doubt be of great value. But they are by no means all that is required for the salvation of the Indian army. This must be brought about by sanitary measures everywhere, of which hill stations, if kept in a good sanitary condition (but not if kept in a bad condition) are one. This is the unquestionable result of the evidence.

When our troops went into a notoriously unhealthy district in China, they were not placed on hill stations. They were properly managed, and their sanitary condition provided for; and they had no larger proportion of "constantly sick," than the troops at home.

Fig. 14.

JULLA PUHAR HOSPITAL. DARJEELING.



VIII. NATIVE LINES.

Native troops have no barrack accommodation, no doubt a most excellent thing for their health. They have hutting money (very little) and make their own huts, which are so badly built as to ensure thorough ventilation, being often indeed only open sheds in compartments. But little or no pains are taken to make them put up these huts in any regular order; they are crowded, or rather huddled, together and without drainage of any kind. They are always damp, and the men always sleep in malaria. When they have families the huts are too small because the hutting money is too small.

Native troops have no rations, and stint themselves of proper food in order to hoard their pay.

They are almost invariably temperate, and have little or no liver disease, whilst the British troops are decimated with it. So far as can be learned from disease statistics, native troops are far more moral than British.

Except schools, no means whatever of instruction, occupation, or amusement are provided for them.

They are, in fact, stipendiaries receiving a day's pay for a day's work, with their uniform, but they are not what we should understand by troops provided for by the State.

With regard to every appliance of civilized life the tale is even more absolutely *nil* than for British troops. There is absolutely no drainage or sewerage, no latrines. And the descriptions of what the surrounding country and bazaars are in consequence are absolutely impossible to repeat.

There are no lavatories nor baths.

There are no kitchens.

There is no sanitary police.

At Mangalore, one of the best of the native stations, "surface cleansing has hitherto been performed solely by the heavy rains." At Quilon, another, there is (as usual) no drainage, but ruinous buildings, harbouring the dead carcasses of animals, and "on one occasion, of an old woman."

The water supply is of course as bad as, or worse than at European stations.

At Kherwarrah, in Bengal, the water "has not unfrequently a filthy taste, and disagreeable organic smell."

The degree to which native troops almost everywhere suffer from guinea worm would alone tell us what the water is. At this same Kherwarrah, one in every six has suffered (for 17 years) from guinea worm.

There is no "conservancy" establishment for cleanliness. At this same large station of Kherwarrah, "this is left very much to the jackal, vulture, and carrion crow" (beyond the lines). There are patrols to prevent nuisances, "except in specified localities." The lines are kept clean, but the "sweepings are deposited 30 yards to windward."

The most ordinary sanitary precautions are not taken. "Every family has its own cesspool; dung heaps close to every hut," also holes for ordure. Animals are slaughtered to windward. The offal is thrown to dogs, jackals, and vultures. During the rains the stench from the offal, the increasing accumulation of years, is sometimes dreadful.

The native population is "decidedly unhealthy" from jungle, swampy ground, cramped, damp dwellings, (which shelter sheep, goats, and cattle, as well as men) bad food and water, neglected cesspools, middens, exuviae of men and animals, absence of drainage, opium eating, &c.

What wonder if native troops suffer from quotidian, tertian, quartan, remittent, and typhoid fevers (which alone constitute two fifths of the sickness and cause one-fourth of the deaths in some places) from acute and chronic dysentery, from sporadic and epidemic cholera, from simple and confluent small-pox, and from acute and chronic rheumatism.

The intelligent medical officer of Kherwarrah imparts a very important secret as to the unhealthiness of Indian stations when he says that none of them have had "fair play," (not even such large British stations as Dumdum, Barrackpore, and Dinapore,) owing to the "utter disregard of the commonest sanitary precautions."

At Cochin, in the Madras Presidency, the water is unfit for use from privy infiltration. Drinking water is brought daily 18 miles. One tank is used for bathing and drinking. The sanitary condition of the bazaar is "as bad as it can possibly be." "Cleanliness is unknown." There is "no drainage." The "streets are used as privies without hindrance." No regulation for cleanliness is attempted. The old rampart was converted into a ditch, now used as a public privy. Every odd corner is "in the most disgusting condition."

Rajeote, in the Bombay Presidency, might give similar instances of more or less neglect. But it is needless to follow this subject further. Everywhere there is the same ignoring of natural laws and the same penalties of disease and death.

The hospitals, again, combine all the disadvantages of civilization without any of its advantages. In one place the hospital was so overcrowded that for two years "gangrenous and spreading sores" were "frequent."* Another hospital was so much out of repair that "it would before long be a ruin," (the best thing that could happen to it). If there is a privy it is a "small room, with no place in which the excrement can go to be cleared away." If there is a lavatory or bath, it is "two tubs out of repair," (does that mean that they cannot hold water?) If there is a kitchen, as at Mercara, it is under the same shed as a privy, and cannot be used for the stench. Indeed the medical officer proposes that it should be turned into a privy. The sick generally cook under the nearest tree, and if unable to do so, a comrade cooks for them under the tree. Linen is washed and dried by caste comrades, or by the patients when not too ill. Each patient brings in his own bedding; generally his own bedstead. "Each patient defers bathing, according to custom, till he is cured when he retires to the nearest well, draws water, and undergoes the "bath of cure," i.e., when he no longer wants it. Every report begs for a bath room.

The general construction of native hospitals has been described under the head of "Hospitals."

IX. NATIVE TOWNS.

The description given of the native towns is astonishing.

Can it be possible that such a state of things exists after all these years of possession and unlimited authority?

So far as one can judge from the evidence, the sanitary state of entire large cities is as bad as, if not much worse than, was the state of the worst parts of our worst towns before there was any sanitary knowledge in the modern world at all.

What, for instance, is to be thought of the following?

At Bangalore, a station 3,000 feet above the sea, with the climate of a hill station indeed, and quite as healthy as any in Europe, where we have 1,700 men, we have allowed to grow up within our cantonment a native population of half a quarter of a million, without any of the arrangements of civilization whatever. Houses, tanneries, and slaughterhouses are crowded together without any plan. There are no public necessities. The natives resort to open spaces. The Ulsoor tank, which may be said to be the receptacle of the sewage of the whole place, including our barracks and hospitals, is used for drinking. In dry seasons, the tank itself is a great nuisance. Even the wells are poisoned, "owing to the amount of filth percolating into them from bad drainage." There is a dirt heap at almost every door. In the better houses, where latrines exist, they are wells sunk in the ground within the house, which are closed up when filled and others opened. The filth from the cow-houses flows into open drains. There are no arrangements for stabling the bazaar horses, which with other domestic animals are kept *in the houses*. This bazaar is all close to our own barracks; and it is said that now nothing short of removal of the one or the other will remedy the evil. There is nothing, therefore, to astonish us in the fact that, in this, one of the healthiest stations and climates in the world, the mortality of our European soldiers should have been 129 per 1,000† (including cholera) in one year.

In Hyderabad, not far from our largest Madras station (Secunderabad) all the promoters of zymotic diseases are at work, and cholera, small-pox, diarrhoea, and dysentery are, it is stated, the most common of these.

But the capital of the Madras Presidency is, perhaps, the most astounding. Its river Kooum is a Styx of most offensive effluvia. The air in Black Town and Triplecane is "loaded with mephitic effluvia at night." The atmosphere around Perambore and Vepery is "perfectly poisoned."

At Kamptee, with its 70,000 souls, "all filth is thrown into pits in the streets (!) of the cantonment." The poorer houses are huddled together without order, on ground intersected by nullahs, making the houses difficult of access. The cesspits "where accessible," are cleansed every 24 hours. The next information is curious. "Persons committing nuisances are closely watched and taken up daily." At Jaulnah there are no dung-heaps nor cesspits "outside at least."

The native population around Fort William, Calcutta, is peculiarly unhealthy; fevers of all kinds, cholera and fatal diarrhoea are "remarkably prevalent." The causes are "bad overcrowding," "bad drainage," foul drains, rank jungle, stagnant water, bad unwholesome drinking water, filth.

At Ahmednuggur it is acknowledged that almost every epidemic in the cantonment has its origin in the crowded, ill-ventilated, and dirty village of Bhingar (of 3,000 souls). The town itself of Ahmednuggur, with its 36,000 people and *no latrines*, uses "the very boundary of our camp" for this purpose, and "the smell of ordure is very perceptible." At Poona, where is a city of 80,000 people, three quarters of a mile off, a bazaar of 27,000, quite close, a village (Wanowrie) 100 yards from officers' lines, where cholera first arose, there is the same story about "no latrines," "conservancy" establishment far too small for the daily removal of filth, and nuisance experienced in barracks from this cause. Belgaum says of its bazaar that there is "no want of cleanliness," and "that the public privies and cesspools are at times very offensive." The town, with 18,000 people, is between the fort and the camp. It affects the general health of our station from its "bad conservancy." But, again, we are told there is "no want of cleanliness!"

At Kolapore, "one sweeper is maintained by Government" (for the bazaar), who collects the filth and throws it into a nullah, 400 yards from camp, which is also the public necessary; "two peons" prevent nuisance being committed in camp "from 4 to 10 a.m. daily." At Bombay, with a town of from 400,000 to 600,000 souls, there is a municipal commission, with sanitary powers, and the result of its practical labours is as follows:—Native houses generally in a filthy condition; much ordure within precincts of buildings, where it has been accumulating *for years*; native town proverbially unhealthy; nuisance, from wind blowing over it, experienced in Fort George and town barracks; washermen's tanks particularly obnoxious; site of slaughter-house as bad as can well be; sea breeze cut off by bazaars, &c. &c.

* Labuan says that its hospital is much larger than "the strength is entitled to," but that "frequently the number of patients far exceeds the number of beds," and the "extra" sick (60 in a strength of 161!) "have slept on the floor between each bed, and some in the verandahs."

† Dr. Macpherson's Report on Madras Presidency, Dec. 27, 1860.

Dung heaps are a "never failing condition of native life in India."

At Baroda, the military hospital is close to a nullah used as a "necessary" by the natives, and as a "receptacle for the filth of the whole station." When cholera occurred, the hospital had to be evacuated. And yet it is added, with great *naïveté*, "the sanitary recommendations of the medical officers are always attended to."

At Dinapore the native towns are "disgracefully filthy," with "holes near all native houses."

At Cawnpore there is overcrowding and want of ventilation, with all manner of filth.

At Peshawur the streets are dirty, the houses densely crowded and ill ventilated. The population suffers from a "severe and fatal" typhoid remittent fever, which rises to an "epidemic" in certain districts, also from epidemic small-pox, &c. &c.

At Ghazeepore, in the latter months of 1859, there was a "fearful" fatality from "fever," due to a total want of sanitary arrangements.

At Berhampore there seems to be scarcely any epidemic which the native population has *not*. Among the causes: "holes full of stagnant foul water, close to almost every house, forming the usual cesspool of the neighbourhood." Utter neglect of ventilation and of all sanitary measures."

At Hazareebaugh cholera and small-pox are the "most common and fatal epidemics."

Only the presentable flowers are here. The stational reports are a garden to which those who doubt the truth of this representation, taken as a whole, and think it merely true as to particular facts, are again referred.

The stational reports generally state the native populations to be "healthy," or "remarkably healthy," and then give a list of every disease that flesh, *under defective civilization*, is heir to, to which they are subject endemically or epidemically. What must be the state of health of the natives when "unhealthy?"

One remark, or rather inference, viz., native "caste" prejudices appear to have been made the excuse for European laziness, as far as regards our sanitary and hospital neglects of the natives. Recent railroad experience is a striking proof that "caste," in their minds, is no bar to inter-communication in arrangements tending to their benefit.

Sir C. Trevelyan justly says that a good sanitary state of the military force cannot be secured without making similar arrangements for the populations settled in and around the military cantonments; that sanitary reform must be generally introduced into India for the civil as well as the military portion of the community; that now is the time, for not only has the subject been worked out by actual experiment in England, but the improved financial state of India, the increased influx of Europeans, especially of engineers and mechanics, and the powers of local legislation lately conferred upon the subordinate governments, have given facilities which never existed before. The sanitary arrangements for towns will be conducted by municipal bodies, for the creation of which there is already a very good Act of the Government of India.

The mere passing of such an Act presupposes the impotence of "caste" prejudices; and nobody who understands the relation of bazaars and native towns to garrisons and cantonments can fail to see that the sanitary improvement of the Indian army involves the sanitary improvement and the advance of civilization in India, a work before which "caste" prejudices, and many other prejudices, will have to give way.

X. ABSOLUTE PERFECTION OF CAUSES OF DISEASE.

Our experience at home as to the results of sanitary improvement on the health of the army affords every reason to expect a very great improvement in the health of the Indian army, if proper sanitary measures be carried out. And it would require very strong evidence indeed to convince the people of this country that the epidemics which have devastated India arise from any other causes than those which the stational returns and the evidence prove to exist in what one may call a state of absolute perfection in the Indian towns, but which have been removed with entire success in this country.

XI. SOLDIERS' WIVES.

"Leave to marry" in the British army means that those only who marry with consent of the Commanding Officer have a claim to quarters in barracks. The proportion of quarters allowed by regulation at home is 6 married men per company of 100, in addition to married serjeants. When going to India, 12 married couples per 100 men, together with a proportionate increase of wives of serjeants, are allowed to go with the regiment, a number which high authorities consider too small. There is a general opinion that the proportion of married people allowed to go to India should be raised. The question is mainly one of sea transport and barrack accommodation, neither of which would be very costly as compared with the benefits to health and discipline which all agree would result from increasing the number of married men, always the steadiest, most temperate, and best behaved in the regiment.

Throughout India, however, there is better provision of "married quarters" generally than on home stations. At most places they are reported as "sufficient," at some "insufficient," at others "very bad," and at a few there are none. Where they are insufficient or non-existent, the "married quarters" are men's barrack-rooms or huts, divided off by curtains or partitions. Only at a few places are married people placed in barrack rooms with unmarried soldiers, still this practice does exist. One of the consequences of "allowing" marriage in the army is certainly that decent healthy quarters should be "allowed" too. No time should be lost, for this is especially necessary in India.

In the matter of soldiers' wives there are two instances of striking contrasts (each happened during the mutiny); one, the destruction by dysentery of 64 wives and 166 children of British soldiers at Dumdum; the other, a request made to and complied with by Sir John Lawrence from an officer of a native regiment of guides regarding the native wives. "Mind you look after these women carefully, and do not let them be in distress; several of their husbands, men of rank, have been killed." The request was loyally fulfilled and as loyally appreciated by the men.

At Dumdum 554 women and 770 children were crowded together without care or supervision, and the proportion which fell victims to intemperance, immorality, filth, and foul air was more than six times, in either case, the ordinary mortality of women and children in Bengal. The fathers and husbands were fighting or dead in our battles. This massacre killed as many as it is supposed fell by the hands of the mutineers.

It is singular that in no one part of the Dumdum report does the slightest allusion occur to this tragedy, making one think that it cannot be an isolated case. And it appears to have arisen solely from the absence

of any regulation as to the care of soldiers' wives and children in the husbands' and fathers' absence. Families go to India, and as long as the regiment remains fixed things may go on pretty well, provided there are decent separate quarters and a careful kindly commanding officer. But send the regiment on active service and there is no way of caring for the families. They take their chance under circumstances where they *cannot* help themselves. Or they are all huddled together, as at Dumdum, with this result, that while the husbands were punishing the murderers of English women and children in the upper provinces, their own wives and children were being destroyed in vast numbers, for want of care. Why?—Could it not be made a necessary part of army arrangements to appoint a "picked" married officer to act as guardian over these women and children, to see to their comfort and conduct, to their being properly lodged and cared for. The manner of providing for them out of their husbands' pay is a matter of detail easily settled. If only any one will take the trouble to do it the thing can be done. But more than this, it should be made matter of regulation throughout the whole service. There should be personal responsibility somewhere. At Dumdum nobody was held responsible and nobody was punished for the result. If one-tenth of the calamity had happened in England, there would have been coroners' inquests over and over again, and public opinion, if not law, would have punished some one. At Dumdum the enquiry took place after the destruction of human life had been going on for months.

Sir John Lawrence expresses forcibly his practical opinion that there should be a "system," treating the "men as so many children," in binding them to "remit" money for their families, but also providing guardianship for those families when the "regiment is going on service," and so averting the "terrible results" of "abandoning the wives."

Why cannot what was done for the Sikhs by Sir John Lawrence be done by regulation and on system for our own country people?

There are shocking illustrations of how soldiers' wives and children fare when the men are on foreign service, and how a man does not become a better soldier for knowing that his country does not care for his wife and children while he is risking his life for his country. To the extent to which marriage is allowed in the army should all its necessary consequences be acted out.

But so far from this being done, the principle everywhere has been the reverse. Even as regards illness, in some notorious instances soldiers' wives have expressed (and justly) the strongest indignation that Government took more care of prostitutes in illness than it did of honest wives; that Government will pay to cure the prostitute to go on with her horrid trade, which destroys their husbands, and will not pay to cure the wives and children, or to make the married quarters more comfortable; and it is true, although not so applicable to India, where there are female hospitals.

Some of these hospitals, as at Kurrachee and Deesa, Lucknow, Raneegunge and Ferozepore, appear to be very complete, with female attendants. In the Madras Presidency, they are too often, as at Bangalore, Trichinopoly, and Kamptee, merely men's wards appropriated to women, and justly stated to be "objectionable in every way." Elsewhere they are rather bare. Indeed, as at Baroda, Kirkee, Poona, Darjeeling, the sick women and children "have to be attended at their own quarters," either because "there is no matron," or because the "ward is too small," or &c., &c. Curiously enough, it is generally stated that the "present arrangement is conducive to comfort." What arrangement? Of having no matron? While it is added, that a lying-in ward and a matron are "much wanted." At Darjeeling the women and children are treated in their own quarters, which "would be satisfactory enough if the married quarters were not so dark and damp as they are." Sometimes it is said that "the arrangements are quite equal to those for the men."

The construction of these hospitals appears to be the same as that of small regimental hospitals.

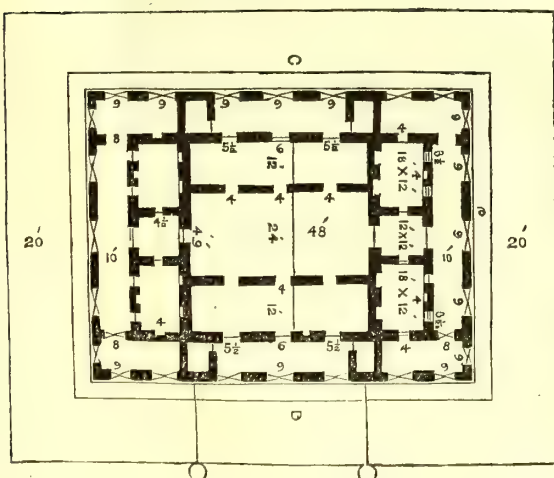
The following plan and section of a female hospital at Mean Meer (one of the most recently built in India) shows that they require quite as much structural improvement. It is a nest of rooms within rooms; and the same may be said of it that one of our engineers said of the Pacha's new fort on the Dardanelles, that "He would be much safer outside of it."

But, whatever defects there may be in the hospital accommodation for soldiers' wives and families in India, at least prostitution is not encouraged, and its immorality systematically palliated by lock hospitals on any large scale, although recent attempts have been made to extend them. Lock hospitals, alas! exist—I mean, and are advocated and supported on the principle of restoring the vicious to go on with their vice, the only institution I am aware of for this purpose. (Prisons and lock hospitals in England at least

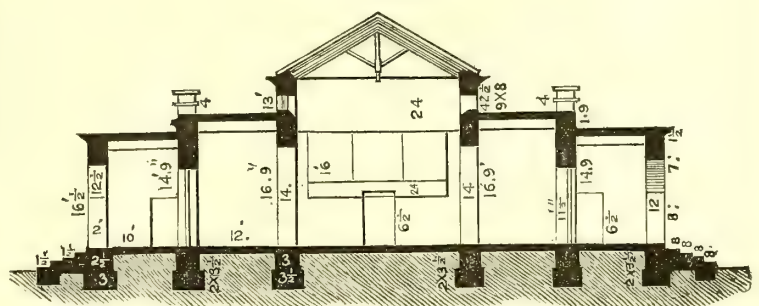
Fig. 15.

FEMALE HOSPITAL. MEAN MEER.

Plan.



Section on C.D.



aspire to reclaim the vicious.) And lock hospitals and police regulation are, alas ! sometimes recommended, just as if they could do any good. At Secunderabad, it is said, a lock hospital has been long in existence, with these "excellent results," viz., that 20 per cent. of admissions into (military) hospital are from the disease engendered by vice, which is five times as much as exists among the native troops. On the other hand, the enlightened medical officer at Kurrachee has entered a striking protest against the present lock hospitals, and has shown how utterly incompatible at once they are with morality, and how utterly useless in practice. Indeed common sense is the same as moral sense in these as in other things. As in the kindred vice of drunkenness, Government licenses in order to control vice, and the soldier is more drunken than before.

Lately, in one of our own largest seaport towns,—and I understand it is not the only place where such a measure is contemplated,—I was consulted as to the structure of a hospital where Government was going to pay for 15 and for 10 beds for fallen women for the army and for the navy. These are called the "War Office prostitutes" and the "Admiralty prostitutes." The title is just, and therefore the less agreeable. In this same town a hospital for soldiers' wives only lately exists, although it had been long corresponded about, although several women had been confined in barrack rooms, several had had fever in consequence, and one, at least, upon testimony of the army medical officer, had died from it, as well as children.

With two, or at most three, exceptions, there is no accommodation for sick women and children at any home station.

As regards army prostitution, there is, as I have said, the same helplessness as with army drunkenness.

It is apparently never considered that they are both parts of the same vice, and that, so far as human agency is concerned, they both spring from the same causes.

India has its licensed "lal bazaars," and its licensed spirit selling. And both are encouraged to the utmost by leaving the men utterly without rational employment for their time. The "lal bazaar" and the canteen both send men into hospital in abundance. While, instead of confronting both evils with the strong arm, and providing men with useful occupations and manly amusements, Government sets up lock hospitals under its authority, and makes ineffectual attempts to stop drunkenness by keeping the supply of drink, as far as it can, in its own hands, and so encouraging the evil by its own authority. The authority of Government is avouched for both evils. So long as this is the case, they will extend and flourish, and the tax payers in India and England will have to bear the cost.

XII. STATISTICS.

All that can be said under this head is that the statistical abstracts of sickness and mortality for the European troops of the Indian army afford no data of sufficient accuracy to enable us to judge of the sanitary state of the troops, while they are defective in some most important data required for estimating the exact sanitary condition of the stations. Practically, these statistics are very much in the same condition as were those for Queen's troops before recent improvements were introduced. The facts may be in existence, but there are no means of rendering them easily accessible. The question of mortality and efficiency is one of even greater importance now than it was formerly, seeing that the whole British army must pass through India in the course of its service.

The only way to keep a proper check over the sanitary condition of stations is to lay their sickness and mortality statistics annually before Parliament. This can be easily done by adopting the new statistical methods and forms at present in use for Queen's troops at home and on foreign service. These should be introduced over the whole of India, and the results published every year, together with those of the army at home.

XIII. SANITARY SERVICE.

In times past there has been no proper sanitary service in India. No doubt there has been more or less of cleanliness ; because wherever Englishmen go they attend to this in one way or other. Otherwise there is just the same neglect of civilized appliances, of water supply, drainage, &c., as used to exist in unimproved towns at home, notwithstanding repeated representations made by Sir Ranald Martin, and by other enlightened professional men. In India, as at home, no good will be done unless it be made some competent person's express business to look to these things.

Even with our habits of self-government, it has been found necessary for the central government to step in and assist local progress. It is certainly of far greater importance for the government of India to do so, seeing that there is no local self-government at all.

There is, it is true, a kind of local sanitary government by commissions at the seats of the three presidencies, the result of whose labours has hitherto been that no one of those three large and populous cities has as yet arrived at the degree of civilization in their sanitary arrangements at which the worst parts of our worst towns had arrived, before sanitary reform sprung up in England at all. Bombay, it is true, has a better water supply ; but it has no drainage. Calcutta is being drained ; but it has no water supply. Two of the seats of Government have thus each one half of a sanitary improvement, which halves ought never to be separated. Madras has neither. As to barracks and cantonments, it is quite evident that both sanitary medical officer and sanitary engineer need to "be abroad."

I am, my Lord,

Your faithful Servant,

FLORENCE NIGHTINGALE.

Right Hon. Lord Stanley, M.P.

President of the Royal Commission
on the Sanitary State of the Indian Army.

Nov. 21, 1862.

ABSTRACTS of RETURNS made to QUESTIONS ISSUED by the ROYAL COMMISSION on the SANITARY STATE of the INDIAN ARMY to COMMANDING, ENGINEERING, and MEDICAL OFFICERS of the ARMY in INDIA at STATIONS occupied by BRITISH and by NATIVE TROOPS.

(Prepared by Dr. Sutherland.)

WITH a view of obtaining the fullest local information regarding the sanitary state of the troops serving in India, a series of questions, reprinted in the Appendix, was prepared and addressed to the commanding, engineering, and medical officers at every station, whether occupied by British or native troops.

Special reports on the matters referred to in these questions were also called for from the principal medical officers of each presidency.

Questions were sent to 42 stations, three of which are exclusively native, in the Bengal presidency. To the Madras presidency there were sent copies of questions to 74 stations, of which 31 were native; and to the Bombay presidency were sent sets to 59 stations, of which 34 were native. Of these 175 series of questions, replies, more or less fully given, have been received from 117 stations; viz., from 35 British and three native stations in Bengal; from 29 British and 20 native stations in Madras; and from 18 British and 12 native stations in Bombay.

The returns do not afford the means of estimating the precise number of troops accommodated at each station; sometimes the accommodation is given numerically, at others, by regiments. Again, the stations had been occupied by the troops there, at the date the returns were made up, for very different periods of time, varying from a few months to several years.

But the questions were so framed as to draw out the largest amount of experience of the different classes of officers, not only as regards the stations they then were serving at, but also as regards those at which they had previously served. In this manner there has been collected together the Indian experience of nearly every regiment there at the time, on every point bearing on the soldiers' health, whether relating to climate, locality, barracks and hospitals, diet, habits, or duties.

These returns will be found to contain perhaps the largest amount of important sanitary information ever brought together, whether regarded simply as bearing on the health of the army, or in reference to the advancement of civilization and of public interests in India.

The nature of the questions, part of which were direct, part cross-questions, has necessarily led to the information being scattered throughout the replies. It has, therefore, been necessary to draw up a short abstract of the reports from each presidency, embodying the more important sanitary results of the inquiry. These abstracts by no means exhaust the information. Nearly every return, on the contrary, will repay careful consideration; and when perused by the light of our present knowledge, they are found to show very clearly the causes which have hitherto decimated the British army in India, together with the local conditions and personal habits which have favoured periodical outbreaks of pestilence among the native population. Although they do not expressly indicate the measures required for protecting health, the information they contain goes a long way towards this result by pointing out the causes of the evils.

PREVAILING DISEASES AMONG THE NATIVE POPULATION, AND THEIR CAUSES.

There are no statistical data whereby the annual ratio of sickness and mortality to the native population at the different stations can be ascertained.

India appears to possess no system of registration whereby the exact state of health of the population can be known. The information, therefore, on this subject, given in the stational returns, is of a very general nature, and is the result of inquiries made on the spot; and from nearly all the stations the information is of the same character. Everywhere the miasmatic class of diseases is the one which has attracted the notice of medical officers. Fevers, intermittent, remittent, and typhoid, cholera, dysentery, small-pox, spleen disease, diarrhoea, rheumatism; such is the account of station after station. Epidemics, the result of imperfect civilization and removable causes, prevail in India at the present day as epidemics used to prevail in Europe in the middle ages. The work of civilization and sanitary improvement has yet to be initiated in this great country. The prevailing causes are everywhere the same: filth, stagnant water, damp, foul ditches, want of drainage, bad drinking water, "utter neglect of ventilation and of all sanitary measures," overcrowding of houses, foul air.

There is not a local cause of these epidemic diseases cited by the reporters which does not admit of mitigation or removal.

At almost every station the sanitary condition of the native population is intimately connected with the sanitary condition of the troops. The two are bound up together so closely that the sanitary improvement of the army must involve one of two courses, either the removal of the troops away from the civil population, or the sanitary improvement of stations, as one part of the sanitary improvement of native cities and towns, and of the country.

DISEASES AMONG TROOPS.

The evidence on this subject shows that throughout the whole of India, malaria is the underlying condition of endemic and epidemic diseases. There is no station, either on plains or mountains, entirely free of it. It shows itself in the almost universal prevalence of fevers of the periodic type; generally intermittent in some form or remittent. Malaria is also concerned in the prevalence of dysentery and cholera; but there are other special predisposing causes of these diseases, quite sufficient to account for their existence even without attributing them to malaria.

Diseases of miasmatic origin occasion a very large proportion of admissions to hospital among British troops, and also of current mortality. The means of ascertaining the proportion for each station are

imperfect; and the discrepancies in the mortality returns for Queen's troops and for British troops of the Indian army serving at the same stations, are sufficient to show serious defects in the statistical methods employed. Only from Bombay Presidency are there detailed returns of sickness and mortality; and these show that the miasmatic deaths range from one half to about three-fourths of the entire mortality. The proportions in the other presidencies have been arrived at from other sources, and these afford equally startling facts. In Madras presidency the miasmatic mortality is from one half to three-fourths of the total mortality. In the Bengal presidency the proportions at some of the stations are even higher. At one station 14 out of every 16 deaths are occasioned by these diseases. It follows from the facts, that diseases produced by malaria and by mitigable or removable conditions, local and personal, are in reality the causes of the high death rate in the Indian army. *E.g.*, the mortality at Allahabad is 122·75 per 1,000 per annum; but to this death rate miasmatic diseases contribute to the extent of 82·34 per 1,000. The mortality at Fort William is 102·35 per 1,000, but of this 77·83 is due to miasmatic diseases.

Again, at Poonamallee, in Madras presidency, the total mortality is 89·55 per 1,000, but the deaths from miasmatic disease amount to 69·65 per 1,000.

At Fort St. George, Madras, the mortality is 34·69, and the deaths from miasmatic disease 16·21 per 1,000.

At Belgaum, in Bombay presidency, although the total death rate is as low as 18·33 per 1,000 (a little more than the mortality from miasmatic disease at Fort St. George), miasmatic diseases contribute no less than 10·15 per 1,000 of this proportion.

At Hyderabad (Sinde), miasmatic diseases occasion a mortality of 26·62 per 1,000 out of a total annual mortality of 35·85 per 1,000.

Generally, however, in the Bombay presidency, the miasmatic deaths bear a lower proportion to the total deaths than in the other presidencies.

At Baroda, an unhealthy station, they cause exactly one-third of the mortality.

For the whole of India, the highest total death rate, involving the greatest prevalence of miasmatic diseases, is to be found in Lower Bengal and at stations along the Ganges.

The most fatal of all diseases in India is dysentery. During the 16 years preceding 1845, the deaths among British troops serving in Bengal from this one disease amounted to no less than $15\frac{1}{2}$ per 1,000 per annum. The mortality from cholera during the same years amounted to 13 per 1,000; from remittent fever, 8 per 1,000; from liver disease, $4\frac{1}{2}$ per 1,000; the same mortality as from diarrhoea.

Fevers of the common continued, and typhoid types, generally considered the denizens of colder climates, afforded a mortality of $6\frac{1}{4}$ per 1,000, and ague a mortality of somewhat less than 3 per 1,000.

The deaths from apoplexy and sun-stroke are more than 17 times in proportion what they are at home; and the deaths from delirium tremens are 16 fold what they are among our home civil population. On the other hand, the mortality from consumption has been little more than one half in the Indian army of what it is in the civil home population, and about one-fourth of what it was in the home army in the 10 years 1837-46.

The stational returns afford data for the time only during which the regiments have been at the stations; but the facts are of the same nature. Everywhere there is a high prevalence of fever, chiefly intermittent and remittent, the particular type varying at different stations. Dysentery and cholera are much more frequent and severe at some stations than at others. At most of the stations liver disease prevails to a considerable extent, attributed generally to high temperature and variability of climate, combined with excess of eating, the abuse of stimulants, especially spirits, and want of exercise. Throughout India venereal disease is a most serious cause of inefficiency. At some stations upwards of half the sick in hospital are affected with it. Rheumatism is a common disease at many stations. It arises from variable temperature, but in many cases it is said to be the result of venereal disease. Small-pox occurs occasionally, but not to any great extent.

An analysis of the predisposing causes of this high sick and death rate brings out certain prominent facts of great importance, which may be classed under the following heads:—

SELECTION OF SITES FOR STATIONS.

Many of the stations occupy obviously unhealthy sites in low flat districts, having very limited facilities for natural drainage, and surrounded by undrained, badly cultivated, jungly land. Others are situated on river banks, often swampy, and liable to partial overflow of water, especially during the rains. Little complaint is made of the soils; but there is a concurrence of opinion in favour of porous soils, as being more conducive to health than retentive soils.

So far as can be gathered from the returns, mere elevation above the level of the sea appears to have less influence on health than might have been anticipated. Some low stations have a smaller death rate than others at a greater elevation. Elevation is nevertheless a very important element as regards health; but it is only one element out of many, and its advantages may be neutralized by neglecting other conditions. The returns show that many unhealthy stations may be improved by drainage, and by attention to other sanitary requirements. Often the atmosphere over considerable districts is rendered more or less impure by absence or inefficiency of sanitary police, especially as regards bazaars, native towns, and native habits.

Few, if any, of the sites at present occupied by troops appear to have had a fair chance in this respect; and although the evidence shows that abandoning some of the more unhealthy cantonments would be a very advisable measure, nevertheless the removable sanitary defects everywhere existing indicate how much may be done in the way of improving even the worst of them.

CLIMATES.

One of the most striking results of this inquiry is the absence of distinct allegations against the Indian climates as being special causes of disease. There is a general concurrence as to the fact that certain seasons are less healthy than others. Generally the most unhealthy seasons are the beginning and the end of the rains, at the periods when heat and moisture combine in producing more rapid decomposition and disengaging of malaria. There are complaints of heat, hot winds, damp, fogs, variability; and to these conditions, or to certain of them, a predisposing influence is in many cases attributed. But the more frequent defects in the climate are those of a merely local nature, connected with unfortunate selection of sites for cantonments, and which might, in all probability, be avoided by selecting other sites at no great distance.

The reporters consider the climates at certain stations more conducive to health than others; but, as already stated, so far as medical experience is concerned, there is an absence of general complaint of positive unhealthiness in the climates, *per se*, and apart from malaria and local causes of disease.

The evidence on the meteorological data is, with few exceptions, very incomplete.

Wherever there are Government observatories there are, of course, reliable data, but the other stations are very imperfectly supplied with means of observation, whether as regards instruments or observers.

The majority of the stations appear to have only thermometers, and the observations are not corrected. Only very general conclusions can, therefore, be deduced from them; but such as they are, these observations indicate heat, combined with moisture and heavy rain fall, considerable variability and high sun temperature. Certain of the stations have excessively dry climates, while some of the mountain climates approximate closely to those of southern Europe.

Generally, however, in the less healthy districts, the three elements of heat, moisture, and variability predominate.

The climates along the western coast and those along the outlying Himalayan ranges are marked by excessive rain fall. 100 inches of rain per annum is not an uncommon rain fall. In some districts it is half as much more; and at one station, Chirra Poonjee, it amounts to the enormous quantity of 51 feet. The greatest rain fall takes place where the monsoon strikes the mountain ranges; and a few miles to leeward the rain fall rapidly diminishes, and the climate becomes dry. Fogs are common at these elevations, alternating with high temperature and powerful solar radiation; but there appear to be districts close at hand where the air becomes dry and clear from its excessive moisture having been discharged upon the first mountain ranges.

The difference is remarkable between the eastern and western coast climates; the latter are very wet, the former dry, but close, warm, and sometimes foggy.

BARRACK CONSTRUCTION.

The great majority of barracks throughout India are constructed on one general principle. They consist of one long room, sometimes open from end to end, sometimes partially divided by arches and open to the roof. This room is protected from the sun's rays by verandahs from 8 to 12 feet wide, generally single, *i.e.*, one verandah surrounding the room, in the older class of buildings, but most frequently double, *i.e.*, two verandahs, one within the other, in the more recent constructions. This latter form has the general appearance of a long Gothic church, having a central nave from 200 to 300 feet in length, and from 18 to as much as 40 feet in height, with side aisles opening from the nave by numerous arches. In the double verandah barracks there are, of course, two of these aisles on each side the central nave.

With a few exceptional cases, all Indian barracks consist of one floor only. The foundations are raised from one to two or more feet above the ground level. There is generally a plinth of this height filled in with earth or rubbish, and the floor is laid on the top of the material, either of flags, brick, or composition.

No means are provided for cutting off the ground malaria by ventilation beneath the flooring; and as beds are about 18 inches high, the men generally sleep within 3 or 4 feet of the ground, enveloped in malarious exhalation.

Nearly every barrack room is too large, and contains too many men. In the majority of instances the rooms are made to hold from 40 or 50 to as many as 100 men, and even to a quarter or half a regiment. The new barracks at Fort William have 306 men in a single room. The infantry barracks at Dinapore consist of rooms no less than 826 feet long, with 308 men per room. At Fort St. George, Madras, there is one room 2,124 feet long, which contains above 600 men.

The usual breadth of the centre aisle of a barrack is 24 feet; the side aisles are from 12 to 15 feet, and the outer verandahs from 8 to 12 feet. So that in all, from outer air to outer air the distance is from 50 feet to nearly 80 feet; or, as in the large rooms at Fort William, with 306 men per room, no less than 103 feet.

The idea which lies at the root of this form of construction is a good and simple one, the error is in its mode of application. Wherever a large number of people are brought together under one roof there is always more or less risk to health. But in a country like India the risk becomes a positive danger. The great requirement during sleep is pure air, which it is practically impossible to obtain, where from 100 to 500 or 600 men sleep in the same room. Subdivision is hence absolutely necessary to efficient ventilation.

Barracks for a quarter of a company would be very much more healthy than any larger rooms.

It would therefore appear that subdivision of barracks, to lodge the men under quite separate roofs, is one of the most urgent sanitary improvements required.

It appears that all the barrack rooms are dark. Windows for admitting light in the sense in which we use windows in England scarcely exist. There are doors or windows on opposite sides under the verandahs and small cleristery windows in the centre aisle, but the form of construction renders them insufficient for lighting, and there appears to be a general idea that light and sun heat are synonymous terms. The subject is one, however, of such importance to health and comfort that it is worth while so to plan a building as to light it without heating it.

In the new barracks of Upper India there are glazed windows. But in many of the older barracks, the windows, such as they are, are unglazed and have merely solid shutters or jalousies, which, when shut, render the barrack dark.

A condition in all Indian barracks absolutely essential to health is that the sleeping rooms be raised above the influence of ground malaria. The safest construction would be to raise the whole block 3 or 4 feet with free ventilation below; to raise the barrack two floors above the basement, to devote the lower floor to dining rooms, day rooms, libraries, &c., and to permit men to sleep only on the upper floor, or at all events never to allow men to sleep within from 5 to 10 or 12 feet of the ground level, in proportion as the barrack is situated on an elevated healthy site or on a low unhealthy one.

Sleeping rooms should have only single open verandahs, and these should never be used to eke out the sleeping accommodation.

The external ventilation of many barracks is defective; partly from surrounding buildings, partly from local position, but more frequently from the arrangement adopted.

Sometimes the barrack blocks interfere with each other's ventilation; and there are instances in which the prevailing winds blow against the end of long barrack rooms, driving the foul air onwards among the men. At the best stations the barrack buildings are echeloned in such manner that the prevailing winds blow across the room. This arrangement is always the best for warm climates.

Internal ventilation is generally more or less provided for. Opposite doors and windows are often trusted to—one of the best methods, if properly managed. But we have already seen that the distance between the opposite doors and windows is from two to three times too great to admit of their being depended on. The wall space between the windows and doors is much too narrow, and the men while in bed are exposed to cold blasts passing over them. The arrangement of beds in many barracks renders it impossible to ventilate

efficiently with doors and windows. It can be done with two rows of beds in the breadth of the room, but this is a rare arrangement in India. Generally there are four rows, sometimes even six rows, of beds between the opposite windows.

In the newer barracks ventilation is in some degree provided for by the cleristery windows already mentioned, or by louvres in the roof. Apparently the most efficient of the Indian methods of ventilation is where part of the side wall is filled up to the depth of two or three feet from the slope of the roof by open work, with louvres along the roof to admit of the escape of foul air.

In many instances the ventilation is described as sufficient; in many, it is insufficient. In some barracks there cannot be said to be any ventilation except the casual opening of doors and windows, while in some cases it is described as sufficient if the barracks are not overcrowded.

The cubic space per man in the newer barracks is not often below 1,000 feet. There are instances however in which it is under 600 cubic feet, and at several stations it is between 600 and 1,000 feet. From 1,500 to 1,800 cubic feet is a not unfrequent allowance of space in the newer barracks, and there are individual rooms in which the cubic space is as high as 2,000 feet per man. Compared with the regulation allowance of space at home, the Indian amount is apparently magnificent. But the rooms of Indian barracks are generally so high that the cubic space is above the men's heads, and the surface overcrowding, a more important point, is often excessive. From 50 to 60 square feet of floor space is a not uncommon allowance for each man. In a number of instances it is from 60 to 80. In a few rooms it is about 100, but there are instances in which it is under 50. It sometimes does not exceed 40. The extent of superficial area usually allowed, in relation to the manner of arranging the beds, the occupation of the verandahs as sleeping accommodation, and the large number of men per room, result in what is really, as regards health, great overcrowding and impossibility of sufficient ventilation.

Lavatories.—Almost every barrack is provided with one or more ablution rooms. They are small square apartments detached from the barrack, often without fittings of any kind, never properly drained, sometimes connected with cesspits into which the waste water runs, to be absorbed by the soil or to be lifted out again and carried away by hand. Except in one or two recent barracks the ablution rooms are destitute of water supply unless carried by *bheesties*. Basins or tubs are usually supplied for washing. There is no proper bathing establishment anywhere, except at Fort St. George, Madras. At a number of stations plunge baths have been recently constructed, but at the majority of stations there are no means of bathing. Hence the appliances for personal cleanliness are almost everywhere deficient, especially when the nature of the climate is taken into account.

Cook-houses.—The cooking arrangements are quite peculiar to India. There is no cooking apparatus in the proper sense of the term. The kitchen is an out-building with a row of small fire-places, over which native cooks prepare the messes in copper pans. There is no water laid on, all has to be carried by hand. There is no drainage, the whole of the foul water either runs away on the surface or is led into open gutters or cesspits. The means of cooking are generally described as "sufficient," but it is satisfactory to know that at one or two stations improved apparatus has been constructed.

WATER SUPPLY.

Except at the new station at Wellington, and Fort St. George, Madras, there is no water supply for sanitary purposes in India, as it is understood in England; and Bombay is the only town to which water has been conveyed from a distance. Almost all the stations are supplied from shallow wells. At several, tank or river water is used. It seems rarely to be suspected that the water is unwholesome; but the sources of supply ought to excite grave suspicion as to the purity of the water. Wherever anything like an account of the quality is given, the water is unquestionably bad and dangerous.

Water sources have been very rarely submitted to chemical analysis; but where they have been analysed, there is hardly one of them that would not be rejected for sanitary purposes at home.

There is scarcely such a thing as a pump or a water pipe in India. Water is usually raised in skins or buckets, and carried by water carriers sometimes a considerable distance, in one case two miles, to the place where it is to be used. It is poured out of the skin into earthen or wooden vessels, from which it is again drawn for drinking, cooking, or washing.

The whole arrangements are those of an infant state of society, and the quantity of water delivered for use, even if the quality were unobjectionable, would never, under such a system, be sufficient either for health or cleanliness.

The water supply of towns is derived from similar sources, tanks, wells, or rivers. It is drawn for use and distributed in the same manner as at stations.

As there is no drainage, all the water carried into stations or towns must necessarily stay there; *i.e.*, in the subsoil, unless it be removed by hand labour.

Many of the wells are polluted with sewage, a natural result of the state of the water supply and drainage.

It is now known that water drawn from shallow wells, in undrained inhabited areas, is one of the most common causes of epidemic diseases, especially cholera and dysentery. And beyond a doubt the condition of the water supply of towns and of stations exerts a powerful influence on the origin and progress of these diseases. In India, as elsewhere, there can be no drainage without extended water supply, extended far beyond the possibilities of mere labour to afford. And it would be a very questionable measure, indeed, to bring in more water without a complete system of drainage to carry it away.

Water pipes and drain pipes are but the two extremities of one mechanism. One of them would be useless or injurious without the other.

The present system of water supply and drainage throughout India, for barracks, hospitals, cantonments, cities, and towns, is nothing more than that usually adopted in moveable camps, and which in the middle ages led to such disastrous loss of life from pestilence in Europe.

DRAINAGE.

In the sense in which drainage is used in this country, for protecting the public health by removing filth and subsoil water, there is none whatever in India. The most that is aimed at is surface guttering, always a very imperfect expedient, even for the removal of surface water; and unless very carefully executed and well attended to, always a dangerous expedient. At many stations the whole of the rainfall either evaporates, runs off on the surface, if there be fall enough, or sinks into the subsoil. It appears to be generally presumed that because a soil is porous, therefore it requires no drainage, whereas a porous subsoil is the one which stands most in need, while it most readily admits, of efficient drainage. Once allow a porous subsoil to become saturated with the filth of a population, the sooner the site is abandoned the better. Only by very careful drainage can the public health be protected from this contingency in such a climate as that of India.

There appears to be no paving, and without paving even surface drainage is impossible. In the vicinity of many stations there are large surfaces of what are called tanks, but which, in sanitary language, mean stagnant water. Many of these ponds become partially dry in summer, exposing large surfaces of putrescent mud, very often the result of filth and foul drainage thrown into them. Some stations are placed in the vicinity of unwholesome nullahs (watercourses which become partially or entirely dry when the rains are over), often used as public necessities by the native population. The surface is frequently excavated into hollows and water pits, producing malaria. Not a single barrack or hospital appears to be drained. The privies are either connected with cesspits or their contents are removed daily by sweepers. The refuse water from kitchens, lavatories, &c., is either received into cesspits or allowed to run away upon the surface. Usually these cesspits are shallow, and their contents are removed by hand labour, or they are simply soak wells to allow the foul water to saturate the subsoil. The smell from these arrangements sometimes pervades the air to a considerable distance, even into the barrack rooms. If such be the condition of the station drainage, what must be that of the native towns? In these the bad state of the drainage is simply an exaggeration of the state of things about the barracks. There are holes and gutters full of filth and foul water, close to the houses. No domestic conveniences; often cesspits within the houses and compounds; few public necessities, the mass of the population generally resorting to the fields and open spaces about the town.

Generally, as regards drainage, the description applicable to the condition of the drainage in districts in Europe where cholera and other epidemic diseases usually prevail, would apply to the state of the drainage in and around Indian stations, with this important difference, however, that the defects are far more serious in degree in India than ever they are in our colder climates, while defects much less serious in degree would have a much more fatal effect in the higher temperature and moisture of India.

INTEMPERANCE.

In England the canteen regulations forbid the sale of ardent spirits in canteens. But in India, as in other warm climates where there are stations of the British army, spirits are allowed to be sold to the extent of six ounces per man per day to all applicants. And the profit made on it goes to what is called the canteen fund, spent in providing the soldiers with certain conveniences and amusements, which there are at present no other means of supplying. Malt liquor is also very generally sold in the canteens. And there is a system of interchange, whereby a man may obtain all spirits or all malt liquor; or part one, part the other, in varying proportions.

On the voyage out to India spirits are issued to the soldier. So that, what with the habit thus acquired and the subsequent facilities and encouragements to the use of intoxicating liquors held out in India, the British army in that country presents the largest amount of drunkenness of, perhaps, any body of men in existence, as it certainly does of disease produced directly or indirectly by intemperance.

Take, *e.g.*, the single disease of delirium tremens. The Bengal mortality statistics show that for the same numbers the deaths from this disease have been 16 times more numerous among British soldiers serving in that Presidency than among their civilian countrymen at home.

The station returns from all parts of India show a large amount of disease constantly in hospital, the direct or indirect result of this system of dram drinking. The poisonous effects of ardent spirits appear to be more powerfully developed in India than in colder latitudes, producing in that country a marked predisposition to several diseases, popularly considered incident to the climate. Some medical officers indeed appear to consider that spirit tipping and drunkenness are the main causes of inefficiency and excessive mortality in the Indian army. Almost all attribute the marked prevalence of hepatic disease among British troops to this habit; and there is an all but unanimous concurrence of opinion, both among commanding and medical officers, that it would be a great public good to prevent the sale of spirituous liquors altogether.

The reporters consider that it would be difficult to carry out such a reform as the prohibition of the sale of spirits in canteens without incurring what they consider the greater risk of driving the soldier to the use of poisonous bazaar spirits to satisfy his craving. But on the other hand some of the reporters are of opinion that this very craving is the result of the systematic encouragement of dram drinking, held out by the Government.

The soldier considers that what the Government permits him to do cannot be wrong. And when his daily allowance of spirits from the canteen does not suffice him, he ekes it out by going to the bazaar. Whatever difference of opinion there may be on the practicability of the reform, the verdict is all but unanimous that the present system is ruinous to the soldier both morally and physically. And it is for the Government to find a way of making practicable that which all are agreed to be necessary.

DIET.

The diet of the European soldier in India consists of:—

- 1 lb. meat.
- 1 lb. bread.
- 1 lb. vegetables.
- 4 oz. rice.
- 2½ oz. sugar.
- ⅝ oz. tea or 1⅓ oz. coffee.

The vegetables usually consist of potatoes, carrots, onions, cabbages, turnips, cauliflower, pumpkins, according to season. There appears to be a very general deficiency of potatoes. This diet is issued to the soldier at all the stations in India, irrespective of climate, altitude, or season.

The men not unfrequently supplement this ration by additions of unwholesomely fed pork, &c., and they generally eat meat two or three times a day, taking their heaviest meal in the hottest period. Not only so, but they are allowed to draw porter with it and spirits after it. The regimen as a whole is what would be prescribed for healthy men, doing hard out-door work in a temperate climate. But there cannot be a doubt of the great risk to health likely to arise from it in such a country and climate as India, especially when we at the same time know that the soldier's life, at least in infantry regiments, is one not of hard work in the open air but of inaction and lounging in his hot close barrack room.

In short the men are not dieted in accordance with sound physiological principle. And as one result, liver engorgement and functional diseases of other organs ensue. Observation of native habits in warm climates would show that the bulk of their diet consists of farinaceous and vegetable food; and a change to this kind of food is no less necessary for Europeans living in tropical climates. In India, the soldier should be encouraged by all means to increase the proportion of vegetable material in his diet, and to diminish the amount of animal food in proportion to the requirements of the climate. And while this is done, work should at the same time be found for him to enable him to digest what he eats.

MEANS OF INSTRUCTION AND RECREATION.

In India there is no correspondence between the soldier's diet and drink and his means of exercise. The regimen usually adopted is as follows :—

After early drill the men return to barracks, where they are confined the whole day till evening in their hot, close, crowded rooms ; and during this period of confinement all or nearly all their food is eaten. At the great majority of stations they have nothing whatever to do in the heat of the day. There are no workshops in which they can employ themselves, and there are no sheds or other covered spaces in which they can play at games or take exercise. Such a thing as a covered gymnasium is unknown. There are ball courts and skittle alleys, more or less numerous ; but most of them useless in the heat of the day. Libraries and reading rooms have been generally provided ; but for the soldiers who cannot read, there is no corresponding resource to occupy their vacant time. At one station it is stated that as soon as the 12 o'clock gun fires the men rush out of their barrack rooms to get at the canteen to break the monotony of their day, adding the stimulus of drink to the other unhealthy conditions naturally resulting from the system of diet and confinement in use. It is important to remark that the most healthy arms of the service, the cavalry and artillery, have some exercise, and that where men have been allowed to go out shooting no injury to health has followed. The evidence all points in one direction, viz., that the Indian army must be managed more in accordance with sound physiological principle. The men must be dieted according to climate and season, and not on one general inflexible rule, as at present. They must be provided with rational means for occupying their time, by supplying them with workshops, gardens to cultivate vegetables, covered spaces for games and exercises, gymnastics, which ought to be made a parade, and soldiers' clubs, with coffee rooms, on the plan now being introduced at home stations. Complaints of the want of sufficient means of occupying the men are all but universal from every station in India.

DRESS.

The soldiers' dress in India has of late years undergone great improvement, and is now generally considered well adapted to the season, climate, and duties. There are suggestions from certain stations regarding improvements in head-dress, boots, &c. ; but these relate to points of detail. The opinion appears to be general that flannel worn next the skin would be preservative of health, especially in variable climates.

DUTIES.

Drills, parades, and marches take place in early morning, and are over for the day soon after sunrise. Sometimes there are short drills in the evening. Guards are mounted, as at home, for 24 hours. Except at one or two unhealthy stations, there is a concurrence of opinion that night guards are not prejudicial to health. All are agreed that young soldiers should not learn their drill in India (for this can only be done at a large sacrifice of health and life)—that drill should be perfected either at home, at some intermediate station, or on the hills.

PERIOD OF SERVICE.

The reporters state that from 20 to 25 years of age are the most suitable ages for young soldiers to proceed to India ; that they should arrive in India in the cool season (November till February). From 10 to 12 years is considered a sufficient period of efficient service ; but certain of the returns state that, under improved sanitary conditions, a soldier may serve as long in India as anywhere else.

HILL STATIONS.

Very few of the reporters have had experience of the effect of hill stations on the health of troops, and no satisfactory evidence of advantage having been derived from residence at them is adduced ; but at the same time the sanitary condition of hill stations, as described, is by no means such as to conduce to health anywhere. There is evidence as to improvement in health of certain classes of invalids by hill residence ; but other classes are not only not benefited, but their health is injured by it. The reporters, however, with few exceptions, are strongly in favour of selecting hill stations, either as head-quarters of regiments or as places to which detachments could be sent in rotation from the plains for recovering their stamina. The evidence, at the same time, proves the absolute necessity of placing all hill stations in the best possible sanitary condition.

HOSPITALS.

Every station has one or more hospitals, generally one for each arm of the service. The sites on which they are placed partake of the general characteristics of the locality ; but the best positions appear to have been selected for the hospital. With few exceptions, the hospital sites are described as being well exposed to prevailing winds, and as having sufficient fall for drainage, as far as the general levels admit of. At two or three stations the hospital sites are bad, but perhaps not more unfavourable than those of the barracks.

The general construction is similar to the barrack construction. Almost all the hospitals are on one floor, raised a few feet above the ground, without ventilation beneath. There is a foundation wall and plinth filled in solid, and on this the ward floor is formed. The older class of hospitals resemble huts, each hut containing a ward with two or three smaller rooms, surrounded outside by an open verandah to keep off the sun. The newer class of hospitals are built like the recent barracks, with a centre aisle and two side aisles, with verandahs outside. The materials used are burnt or sun-dried brick, wattle and daub, or stone. The floors are flagged, or of brick, or of a species of lime concrete (called *chunam*). The roofs in the older class of hospitals are sloped and constructed of thatch and tile. In the newer class the roofs are terraced and flat. In most instances the material is considered good, and the walls and the roofs, together with the verandahs, sufficient to keep the interior of the hospital cool.

The ward dimensions do not appear to have been laid down on any general principle, either as regards health or administration. They vary in length from 30 or 40 feet up to 200 feet and upwards. In one case, at Dinapore, the hospital ward is no less than 633 feet long. The central aisle is usually from 20 to 25 feet wide. If there be single verandahs, these are usually from 10 to 12 feet wide, making the whole width of the hospital, from outer air to outer air, including walls, between 40 and 50 feet. If the verandahs are double, this dimension will be increased by 25 feet, making the entire width of these double verandahed wards from 65 to 75 feet. The length of the building is sometimes divided by cross arches into what are called separate wards, which form, however, in reality only one ward, with the ventilation partially interrupted by cross walls. The height of the wards varies from 15 to 24 feet and upwards ; but there are wards, as at Trimulgherry, as

high as 42 feet. The practical result of this great height is not that the sick have the benefit of large cubic space, but that the beds are overcrowded on the surface. The Trimulgherry hospital contains 486 sick, with only 24 square feet per bed.

The number of beds per ward varies from 15 to 20, up to 80, 100, and in several cases to 150 and upwards. While in the Trimulgherry hospital there are two wards with 228 sick each : tenfold too many.

The cubic space per bed is large for a military hospital ; but it scarcely exceeds the amount allowed in some wards of the larger London hospitals. Sometimes it is under 1,000 cubic feet per bed, but more generally it is from 1,000 to 1,500 or 1,700 cubic feet, or even more per bed. But on the other hand the ward proportions are such that, in nearly every instance, there is considerable surface overcrowding for the climate. The superficial area is sometimes as low as 24 square feet. Generally it is from 40 to 60 or 70 square feet. In a few instances the area is 100 square feet or a little over.

But there is scarcely a ward which gives the superficial area required for the more serious cases of disease in such a climate as India.

So far as the evidence goes the ventilation provided would appear to be generally better in hospitals than in barracks. There are the usual opposite doors and windows, with ventilators in the ridge, openings in the walls, and cleristery windows in the double verandahed buildings.

The structural arrangements are the same as those for barracks. But the state of the hospital ventilation is less complained of, apparently because more attention is paid to it. But, considered in relation to the construction of the buildings, the size of the wards, and the number of sick in one room, it is very doubtful whether these hospitals are ever free of a "hospital atmosphere."

Their construction shows that the wards must be dark ; and we know that light is an element, second only in importance to air, in the course of disease.

The structural arrangements for administration are very deficient. There are no properly placed nurse's rooms or sculleries, without which there can be no ward discipline or real administration. The medical offices are also frequently defective ; and there do not appear to be any means of performing operations more than are found in field hospitals.

There is no hospital drainage in India. In many cases even the roof water is allowed to sink into the ground, close to the wards. Any attempt at drainage is merely by surface gutters, leading outside the hospital wall, or to a ditch or nullah. There are no water-closets, only open privies in the back yard of the building, the contents of which are removed by sweepers. Sometimes the privies are over cesspits. All the arrangements are offensive ; and during the prevalence of epidemic disease, especially of dysentery or cholera, they must be in the highest degree prejudicial.

There is no hospital water supply, except what is carried by hand labour, sometimes from a distance of one or two miles. Little or nothing appears to be known of the quality of the water, and the means of distribution ensure the supply being limited, instead of being unlimited, the only safe condition of all hospital water supply.

The means of cleanliness as described are very deficient. There are few properly fitted lavatories, and few or no suitable baths. Washing the hands and face in any way, sometimes (indeed not unfrequently) in a little damp square room, with nothing but earthenware basins on the floor, or tin pots with wooden tubs instead of baths, and vessels for storing water, out of which the sick can help themselves ; this appears to be considered sufficient for cleanliness in Indian hospitals. The improvements in these matters being introduced into civil and military hospitals in England appear to be unheard of in India.

The hospital kitchens are on the same plan as the barrack kitchens. They are in out-houses behind the hospital, and are provided with low fire-places, on which the diets are cooked in the native fashion. The cooking is generally stated to be sufficient, but occasionally complaints are made of the cooks, and opinions expressed in favour of the whole system of hospital cooking being improved.

In all cases hospital linen is washed (and torn) by native washermen (dhobies) away from the building.

The sanitary condition of the hospitals is generally described as satisfactory. In some instances it is the reverse ; and it is not a very favourable sign that the sick in hospital should suffer from epidemic diseases prevailing in the vicinity.

None of the hospitals contain convalescent wards. Convalescents appear generally to be sent to barracks, or they are kept in hospital with the sick until able to return to duty. Wherever there is serious disease there should be separate accommodation for convalescents. In a climate where dysentery, cholera, and fever are the prevailing diseases, it is a certain method of delaying recovery to associate convalescing and sick men in the same wards ; and Indian barracks with their dieting and facilities for obtaining drink, are not the best places to send convalescents for the purpose of avoiding this risk.

Attendance on sick is provided for in India by a subordinate medical department, and by ward coolies and by ward servants acting under the orders of the medical officers. There is a great subdivision of labour in the hospital duties, and consequently a very large number of attendants and servants in proportion to the sick. The hospital of an entire regiment has an ordinary establishment of 79 persons, increased in hot weather to no less than 240. In this are included water-carriers and mehters for removing hospital filth and refuse.

The sick are attended by native ward boys, and severe cases by comrades, obtained on requisition of the medical officer. There is a regimental hospital serjeant for discipline. No training appears to be given to the attendants for ward duties. At one station (Allahabad) there are female nurses in the general hospital, stated to be a great comfort and benefit to the sick.

Notwithstanding the large staff attached to these hospitals (larger at times than the number of sick) there is strong evidence that the hospital administration is not good, and requires much improvement.

Nearly every station has one or more female hospitals, many of which have been specially constructed. But at some stations the female hospital accommodation is under the same roof with the male hospital ; and sometimes it consists of a male ward misappropriated for the purpose. At a few stations the sick wives and children of soldiers have to be attended in their own quarters. The specially built female hospitals have the same general structural defects as the male hospitals ; but the accommodation generally is described as "sufficient."

NATIVE LINES.

The sanitary defects of native lines are the same as those in British cantonments ; but in a much more aggravated degree, from the general neglect of all sanitary precautions among natives.

Native troops generally receive hutting money, and hut themselves on the ground appropriated to them, without regard to order or regularity.

The ground is undrained, or it is merely trenched, and full of excavated holes, the receptacles of all sorts of filth.

The sanitary police is extremely imperfect.

A considerable extent of the surrounding ground is often covered with filth. The bazaars are very bad, the streets sometimes used as privies. Bad water, no drainage, overcrowding, dung-heaps and filth, appear to be their normal condition. No person can read these native returns without being convinced that the most virulent causes of local diseases and pestilences are in continual activity in and around the stations.

Although the system of hutting native troops could be so applied as to possess great sanitary advantages, these advantages are by no means realized.

The men are sometimes hutted separately in huts constructed of bamboo and matting. But sometimes the huts are merely long open sheds divided (pendals). Generally there is bare ground for the floor, and the men frequently sleep outside in hot weather. Native troops are always exposed to ground malaria in a concentrated form during sleep; and their huts can never be otherwise than damp, especially during the rainy season. When more permanent materials are employed, such as sun dried bricks, ventilation is effected by a door and an opening in the wall, instead of a window. The ventilation could be materially improved by roof openings.

With all their disadvantages, these native huts and barracks are possessed of sanitary advantages of a most important kind. There need be no overcrowding, either in cubic contents or in superficial area, except, perhaps, where the soldier is married, in which case his wife and family live with him, but in which case he does not always build a larger hut. There are abundant means of natural ventilation; and the huts are not exposed to the great evil of European barracks, viz., crowding perhaps a quarter of a regiment in the same room. The water supply is the same as for European barracks, viz., wells, tanks, and rivers. Natives are said to be generally more particular about the quality of the water than are Europeans; but the reports nevertheless furnish sufficient evidence of unwholesome water being extensively used. At many stations where there are native troops, tank water is used, always more or less polluted with surface drainage and filth washed in by the rains. Sometimes the same tank is used for drinking and bathing. The well water is often polluted by infiltration of putrid organic matter from a foul undrained subsoil. There are neither lavatories nor baths. There are no cook houses. Where there are privies, these are of the most offensive character, and sometimes they are cleansed by merely throwing the contents over the adjacent surface. But often there is no provision whatever made. The arrangements of a native station are those of an oriental camp, and entail great liability on the part of their occupants to periodic fevers and to any epidemics, especially those of bowel diseases, which may happen to prevail.

Native troops enjoy a remarkable exemption from liver disease, which is attributed to their temperate habits in eating and drinking. They suffer from venereal disease in a very low ratio, from a tenth to a twentieth part of the ratio of European troops. Rheumatism is frequent among them, arising apparently from damp, want of care in clothing, and rapid change of temperature. Intermittent fever is one of their most common diseases.

The condition of the air, over some of these native stations, in still, warm, moist weather, is extremely offensive and unwholesome, and nuisance from it is experienced to some distance. This is the result of filth and want of drainage.

Native troops are allowed to diet themselves, a system which is attended with serious disadvantage in cases where the men stint themselves of proper food to save money. Their cooking is frequently very imperfect and unwholesome.

At a number of stations there are native schools; but with these exceptions there are no means provided, either for instruction, recreation, or exercise. In this respect the men appear to be left wholly to themselves, without interference on the part of their officers.

Native hospitals are of more permanent construction than the barracks. They consist essentially of a single hut ward, with sometimes two or three smaller wards, built on the same general plan as British hospitals, but affording considerably less cubic space per man. This is generally from a third to a half of that allotted in British hospitals, and hence, as a rule, all native hospitals are overcrowded. The usual means of ventilation are doors and windows, often not glazed. It can never be enough, with so small a cubic space. Except this ward or wards, it cannot be said that the native sick accommodation has any other hospital characteristic. In all the other conveniences required for the treatment of sick there is entire deficiency. There are no suitable nurses' rooms, no ablution nor bath accommodation, patients being allowed to go home to wash or to bathe themselves in the nearest tank. There are no waterclosets or proper latrines. The substitutes for these are indescribable, offensive, and injurious to health. There are no hospital kitchens, and no cooks. The patient or a friend does the sick cooking. There are no hospital diets. The sick diet themselves according to their own fancy. The attendance consists generally of an officer of the subordinate medical department, a serjeant, and comrades from the ranks. A native station hospital is simply a very inferior form of European camp hospital, in which the sick can be more conveniently visited than in their own lines, and where the medical officer has the power of giving them medicine. So far as can be learned from these returns, the present native hospital system contemplates nothing more than this.

The sick wives and children of native soldiers present themselves to the medical officer for advice, or are attended in their own huts when too ill to come to him.

Considered as a whole, this native hospital system resembles nothing to which the name of hospital system can be applied.

BURIAL OF THE DEAD.

There are burial grounds at all stations occupied by British troops. These grounds are placed outside the cantonments, at a sufficient distance to prevent injury to health.

The surface area allowed, and the general method of conducting interments, is the same as in this country.

Native dead are disposed of according to religion and caste. Mohammedans bury their dead in separate grounds, often at a considerable distance from human dwellings. Their method of burial is objectionable, and would give rise to nuisance if close to towns.

In certain cases there are burial grounds within cities, which are complained of as being injurious, and a practice is mentioned of burying within compounds or in houses.

Hindoos burn their dead, often very imperfectly, and throw the remains into rivers.

There is no complaint of injury to the health of British troops from any of the existing practices, although occasionally nuisance arises from them.

BENGAL PRESIDENCY.

ABSTRACT OF SANITARY DETAILS IN RETURNS FROM PRINCIPAL STATIONS WHERE THERE IS ACCOMMODATION FOR BRITISH TROOPS.

Returns have been made from 35 stations in *Bengal* presidency, where there is accommodation for British troops. Of these stations 34 are included in the following abstract.

The stations least elevated above the sea level are *Fort William* and, farther up the river, *Dumdum*, which are only 18 feet above the sea. At these two stations there is accommodation for above 3,000 troops, in positions so low that the tide washes into all the neighbouring ditches, and more or less saturates the subsoil with water.

Along the valley of the *Ganges*, from *Fort William* as far as *Lucknow*, and close upon the river, there are upwards of 15,000 British troops located at elevations above the sea level varying from 80 feet to 368 feet. With scarcely an exception, these stations are on the same level as the surrounding country. *Allahabad* is partly 40 feet above the *Ganges*, but a third of the station is actually below the river. *Berhampore* is 3 feet below the level of the river *Bhagirutty*, which skirts the station.

The N.W. stations are on higher ground; *Ferozepore*, the lowest of them, is 720 feet above the sea level, and *Rawul Pindi* is 1,500 feet.

Between these two elevations there is accommodation for above 20,000 troops.

Hazareebaugh, one of the best stations of the Presidency, is situated on a table land in Lower Bengal, 1,900 feet above the sea. There are above 1,100 troops barracked at this station. The cantonment site has the advantage of being 200 feet above the level of the adjacent country.

Meerut and *Agra* are, one 100, the other 50 feet, above the surrounding levels; but with these exceptions the stations generally are little, if at all, raised above the adjacent country.

There are four returns from hill stations at elevations from 7,000 to 7,800 feet above the level of the sea, but the accommodation provided at these is for not more than 1,200 men. The highest of these stations is *Murree*. They are all situated in the Himalayas, and are at present used as sanitarium.

There are 11 considerable stations on the banks of the river *Ganges*.

The subsoil is chiefly alluvium and clay, more or less wet or marshy during the rains. The surrounding country is generally undulating or flat, and in several instances the means of natural drainage are deficient.

The majority of the N.W. stations are situated on flat sandy ground, with more or less alluvium mixed with limestone nodules or conglomerate. In some districts the underlying rock is sandstone. The country round several of these stations is imperfectly cultivated, and there is not much wood for shade. The hill stations rest on mountain masses of gneiss, sandstone, and limestone. They are generally on ridges, with steep slopes or ravines falling from them, and have ample means of natural drainage and water supply, but they are subject to very heavy rain-fall and great dampness at certain seasons.

I. TOPOGRAPHY.—MORTALITY.

Stations.	Elevation above		Accommodation for British Troops.	Actual Occupation.	Mortality per 1000 per annum (Queen's) British Infantry.*		Topographical Remarks.
	Sea. Feet.	Country. Feet.			Total.	Miasmatic Diseases.	
Fort William -	18	0	1,465		102·35	77·83	Plain; swampy; alluvial; sand; clay; numerous tanks.
Dinapore -	212	+	910		62·55	48·02	On bank of Ganges; flat; flooded during rain.
Cawnpore -		0	1,402		91·48	71·58	Flat; sandy; arid; no jungle; alluvium on kunkur; 60 feet above Ganges.
Meerut -	900	100	4,227		45·12	30·41	Sandy; flat; dry; loam on calcareous conglomerate.
Agra -	800	50	1,776	1,400	42·48	20·58	Flat; dry; sandy; ravines; unhealthy; alluvium; clay; sand; lime.
Umballa -	1,050	0	2,162	2,162	55·24	38·27	Flat; sandy; cultivated.
Loodiana -	900	0	—	—	—	—	Sandy plains, with clay; cultivated.
Ferozepore -	720	0	948	1,148	56·05	36·77	3½ miles from Sutlej; flat; sterile; sand and clay.
Jullundur -	937	12	—	1,200	36·62	21·33	Flat; sandy; hollows with water.
Lahore -	1,128	8	—	2,214	81·42	58·23	{ Flat; arid plain; alluvial clay; loam and sand; last on surface.
Mean Meer -							
Peshawur -	1,056	68	—	2,651	61·23	41·81	Flat; partially irrigated.
Sealkote -	900	0	1,200	—	26·79	13·17	Flat; alluvial; sandy subsoil.
Murree -	7,800	2,500	—	—	91·76	47·06	Mountainous; sandstone; indurated red clay, and black soil.
Ghazee pore -		0	830	848	47·03	42·08	On bank of Ganges; alluvium with calcareous conglomerate.
Berhampore -	76½	—3	1,196	—	—	—	Alluvial; many water holes; 3 feet below river level.
Hazareebaugh -	1,900	200	1,120	1,080	—	—	Undulating; dry; gravel and loam on clay.
Allahabad -	368	40	4,280	2,515	122·75	82·34	At junction of Ganges and Jumna; sandy; country under water from July to November; clay subsoil.
Dumdum -	18	0	1,649	—	76·57	64·79	Alluvium and clay; swampy during rains.
Benares -	270	0	1,377	876	—	—	Undulating; alluvial; resting on calcareous conglomerate.
Landour -	7,000	4,000	200	223	60·71	29·01	Mountainous.
Muttra -			424	400	37·26	23·45	Subsoil kunkur; flat; sandy; dry; close to Jumna; water lies on surface.
Raneegunge -	370	0	1,424	1,120	—	—	Undulating; sandy; swampy; gravel and sandstone.
Umritsir -	900	0	1,650	620	—	—	Flat; sandy, with clay; kunkur.
Nynee Täl -	7,609	1,200	840	740	—	—	Mountainous; limestone.
Rawul Pindi -	1,500	+	200	—	28·86	14·29	Alluvial plain; loam and clay resting on limestone conglomerate.
Lucknow -	360	+	124	—	169·29	148·73	Site open.
Chunar -	250	—	268	—	—	—	Close to Ganges; sandy; swampy from overflow; sandstone.
Roorkee -		+	630	487	—	—	Dry sandy plain.
Jhansi -	700		189	—	—	—	Rocky; hilly; barren; ravines; granite and quartz subsoil.
Barrackpore -	23	0	1,080	—	—	—	Flat, alluvial, marshy jungle, on bank of Hooghly; alluvium, with sand and clay.
Delhi -	800	0	—	959	—	—	Rocky; ravines; flat; dry; sandy; some swamp; jungle and wood.
Morar Gwalior -	800	0	1,594	—	—	—	On bank of river Morar; stony, barren hills; open, undulating country; argillaceous soil; kunkur subsoil.
Jubbulpore -	1,250	+	1,000	827	—	—	Hilly and flat; jungle and water in vicinity; cultivated in parts; sand; black cotton soil, with black trap or laterite.
Darjeeling -	7,000	6,000	120	—	38·95	23·37	Mountainous; gneiss rock; subsoil clay, covered by sand and vegetable soil; forest at a short distance.

* From the Statistics of Sickness and Mortality among Queen's Troops in the Appendix.

STATIONS.	REPLIES.
II. LOCAL CLIMATES.	
FORT WILLIAM.	1. Mean maximum varies from 71°·4 in December to 93°·8 in May; mean minimum varies from 59°·3 in December to 80°·8 in June; mean daily range varies from 7°·5 in August to 18°·1 in December; mean sun temperature from 124°·3 in December to 135°·9 in October. Mean rainfall 64 inches; temperature high; atmosphere generally moist, at times very offensive and impure from malaria and effluvia near Calcutta, less so in Fort William. Healthy months, November to March; unhealthy, April, May, September, October, when prevailing diseases are fevers, intermittent, remittent, cholera, small-pox, dysentery. Climate affects health and constitution of troops in garrison. Change from cold to heat, extreme humidity, drying of country after rain, precede or accompany miasmatic disease.
DINAPORE.	2. No meteorological observations; climate a medium between damp of Bengal and drought of N.W. Damp in rains; tolerably free of dust; morning fog November and December; bronchitis and bowel disease and dysentery caused by cold nights; warm clothing required in winter, flannel in all seasons; men allowed to go out in cloudy weather; December to March most healthy months. Prevailing diseases, heat, apoplexy, fevers, dysentery, bowel and hepatic diseases. Fever follows drying up of country after rains.
CAWNPORE.	3. Records destroyed during mutiny. Great fluctuations of temperature, humidity and pressure. Temperature extremely high during hot winds, and mortality occurs from heat apoplexy, sunstroke, &c.; most unhealthy months, April to September, when prevailing diseases are fevers, cholera, dysentery, rheumatism.
MEERUT.	4. Mean maximum temperature, 69° in December, 103° in May; mean minimum 49½° in January, 84½° in July; mean daily range, 9° in September, 31° in November; mean sun temperature 84° in December, 118° in May. Rainfall 17·89 inches. Climate good; dry a great part of year; not variable; fogs very rare; much dust in dry seasons; no bad influence on health; most healthy months, December till March; most unhealthy months, August to October, when fevers intermittent, remittent, and continued; catarrh, diarrhœa, dysentery, and hepatitis prevail. Fevers most prevalent at end of rainy season; small-pox in March and April. Great variation of temperature produces influenza, sometimes cholera.
AGRA.	5. Mean maximum temperature varies from 73°·3 in January to 112°·7 in June; mean minimum temperature varies from 42½° in January to 83°·3 in June; mean daily range 18°·4 in July to 38°·1 in April; mean daily temperature 66°·9 in January to 97°·1 in June. Rainfall about 10½ inches. Climate from end of October to beginning of April cool, clear, and healthy; very hot and dry, but not unhealthy till end of June; hot and moist till end of September, when fevers prevail; much dust in hot season; much animal food not required; exposure to sun to be avoided in hottest season; flannel belt required. Healthiest months, November to April; unhealthiest, August to October. Miasmatic fever, with dysentery, prevails; sunstroke frequent in May and June; liver complaints prevail in hot and rainy season; chest affections in cold season.
UMBALLA.	6. Mean maximum temperature varies from 76° in December to 113° in June; mean minimum temperature 37° in December and January to 76° in June; mean temperature 59°·8 in January to 96°·6 in June; maximum sun temperature 89° in December and January to 128° in October. Rainfall 26·3 inches. Climate generally healthy; dry and hot for three months; moist and hot for three months; temperate for two months; cold and bracing four months; neither variable nor foggy; more or less dusty from April till July; debilitating from April till October, during which less animal food and light clothing should be used; flannel required during rains. February most healthy, July most unhealthy month; prevailing diseases, fevers, rheumatism, bowel and liver complaints.
LOODIANA.	7. No meteorological instruments. Climate very dry; heat very great April to October. Rainfall very variable; nights cold in cold season, sometimes freezing; fogs rare; dust frequent in hot weather; healthiest months, November till April; unhealthiest, August to October. Prevailing diseases; fevers, intermittent and remittent; spleen; dysentery; diarrhœa.
FEROZEPORE.	8. Mean temperatures vary in different years; lowest mean maximum in 5 years, 62° in January; highest mean maximum 115° in June; lowest mean minimum 41° in January; highest mean minimum 96° in May. Mean daily range varies remarkably in different years, 7° to 44° in same month; highest observed mean daily range 46° in November 1856; highest mean sun temperature 130° in July. In five years total rainfall, in October, November, December, 0·2 inch (in December 1858). Monthly rainfall varies in different years, from ¼ to above 13 inches in same month. Climate dry, "free from any great variation" or miasma. Rainfall has been increased by tree planting; climate particularly favourable to health; most healthy, December to March; most unhealthy, August and September; prevailing diseases, intermittent fever, liver disease, "produced by exposure to heats and chills from sudden change of temperature."
JULLUNDUR.	9. No meteorological instruments. Climate said to be good. July, August, September rainy season. Other months dry, with occasional dust and thunderstorms. September, October most unhealthy months. Prevailing disease, intermittent fever. Climate most healthy. Zymotic disease connected with a hot sun and cold damp nights.
MEAN MEER.	10. No proper instruments. Mean temperature varies from 51° in January to 91° in August, the highest observed mean. Rainfall varies in different years; 9·1 to 21·4 inches. Climate dry. Wet bulb falls 19° in a room in hot weather; wet bulb falls 20° to 24° after rains. Fogs rare. Cold easterly winds in cold weather. Atmosphere dusty. Unhealthy, May to July. Fevers, hepatic, and bowel disease prevail. September, October also unhealthy. Malarial fevers prevail. Fever begins with hot weather. Heat brings hepatitis; extremes of temperature, dysentery.
PESHAWUR.	11. Mean maximum temperature varies from 54½° in January, 106° in June. Mean minimum, from 41½° in January, 89° in June. Mean daily range, from 4° to 38° in March. Mean sun temperature, from 68½° in January, 113½° in July. Rainfall varies from 7 to 14 inches. Climate exceedingly trying, great alternations from heat to cold, from dryness to moisture. Tree planting appears to have equalized the temperature. Variableness chief element affecting health. Healthy, December to April. Most unhealthy in September and October, when fevers and bowel complaints prevail.
SEALKOTE.	12. Mean maximum temperature, from 63° in January, 98° in June. Mean minimum, from 51° in February, to 81° in June. Mean sun temperature, 72° in January, 124½° in July. Climate remarkably healthy. Air generally dry, notwithstanding heavy rainfall. Climate variable. June to August very hot, Cold very great December to February. No dust or impurities.

STATIONS.	REPLIES.
GHAZEEPORE.	<p>A great coat or cloak should be ready at all times. Flannel particularly required. Unhealthy, August to beginning of October. Rest of year healthy.</p> <p>13. Mean maximum, varies from $73\frac{1}{2}^{\circ}$ in December, 105° in May. Mean minimum, 56° in December, $82\frac{3}{4}^{\circ}$ in July. Mean temperature, $64\frac{3}{4}^{\circ}$ in December, $93\frac{3}{4}^{\circ}$ in May. Mean daily range, 14° in July, $28\frac{1}{4}^{\circ}$ in March. Mean sun temperature, 90° in December, $125\frac{1}{2}^{\circ}$ in May. Rainfall, 47·32 inches. Climate not very variable. Cold season very bracing. Much dust in hot season. September, October, unhealthy from fevers of all kinds, dysentery, and chest affections. January to April most healthy. This applies to natives. No experience of European troops.</p>
BERHAMPORE.	<p>14. Mean maximum varies from 75° in December to 100° in June. Mean minimum, from 51° in January to 78° in December. Mean temperature, 64° in January to 87° in June. Mean daily range, from 13° in August and September, to 30° in March. Rainfall, 39·75 inches. Climate damp. Frequent fogs during cold weather, until 9 or 10 a.m. Heat very oppressive April to beginning of June. N.W. winds healthy. Healthy, December to February. Unhealthy, August to November. Fevers intermittent, remittent, spleen, diarrhoea, dysentery, liver and rheumatic affections then prevail. Endemic disease, with rapid prostration of strength, accompanies damp air and powerful sun acting on vegetable matter.</p>
HAZAREEBAUGH.	<p>15. No proper instruments; only a thermometer. Mean temperature, 64°·85 in December, 87°·3 in July. Rainfall, $72\frac{1}{2}$ inches. Climate, medium between Bengal and upper provinces. Air free of dust. Temperature, 8° or 10° cooler than most Indian stations. Climate variable, but excellently adapted for European troops, especially recruits. Flannel belts required in rainy season. Air cool, sun hot. September to November unhealthy; typhoid, remittent, and intermittent fevers, and bowel complaints then prevail. December to April healthy.</p>
ALLAHABAD.	<p>16. No records; all destroyed in mutiny. Climate dry, March to June; wet, July to November; cold, October to March. Rains regular. Dust storms in dry weather. Climate requires generous and varied diet, and clothing according to season. April to June, fever, dysentery, sunstroke, cholera. During rains, dysentery and cholera. In cold, fevers, chiefly intermittent. November to March, most healthy. East winds increase severity of cholera.</p>
DUMDUM.	<p>17. No proper instruments. No observations. Temperature, 1° or 2° lower than Calcutta. Climate very moist. Thick mist nearly every morning for a month before hot season. Climate not ordinarily unhealthy, with proper precautions; healthiest months, November to January; unhealthiest, June to August, when cholera, dysentery, and fevers prevail.</p>
BENARES.	<p>18. Mean maximum temperature, 68°·2 in December to 98°·8 in May. Mean minimum, $58\frac{1}{2}^{\circ}$ in December, to 87°·8 in May. Mean temperature, 65°·4 in February, 92°·2 in May. Mean daily range, 1°·6 in July, 13°·3 in January. Mean sun temperature, varies from 89°·9 in January, to 127°·5 in May. Rainfall, 37·35 inches. Climate, intermediate between Bengal and north-west provinces. Not subject to sudden change of temperature, but to considerable diurnal alternations. Atmosphere generally loaded with dust in hot winds. Climate on the whole salubrious. November to March healthiest; August to October unhealthiest; malarious fevers, dysentery, hepatitis then prevail. High temperature and moisture in rainy season. Great dry heat, with still atmosphere, accompany these diseases.</p>
LANDOUR.	<p>19. No instruments. Mean temperature varies from $44\frac{1}{2}^{\circ}$ in January, 73°·18 in June. Rainfall, 92·7 inches. Climate very moist for some months, due to elevation. Diarrhoea (obstinate), dysentery, chest affections of children prevalent.</p>
MUTTRA.	<p>20. No instruments or records. Climate produces heat apoplexy, hepatitis, continued fever. "Just now air over entire district a mass of dust, sometimes obscuring the sun." Diet of troops ought to be lighter; less meat, light puddings, plenty of fruit and vegetables. Healthiest months, October to March; sickliest, April and May, from continued fever and hepatitis.</p>
RANEENGUNGE.	<p>21. No proper instruments. No satisfactory observations. Highest mean maximum temperature, $96\frac{1}{2}^{\circ}$ in May. Highest mean temperature, 91° in May. Climate generally healthy, but subject to heavy dust storms.</p>
DELHI.	<p>22. No records. Mean temperature varies from 92° in June, to 56° in January. Rains continue with intermissions from end of June to end of September. Rainfall, 10 inches and upwards. Hot winds, dust storms, April to June. Climate unusually dry; favourable to Europeans. Unhealthy months, September, October; from low fever.</p>
UMRITSIR.	<p>23. No proper instruments. Mean temperature varies from 54° in January to 88° in August. Mean sun temperature, from 76° in January, to 109° in May and August. Rainfall, 44·36 inches. Climate, comparatively very healthy; very dry for many months. Rain, July to September. Heat from middle of April to October intense. In winter, thermometer falls to freezing point. Ice is formed in December and January, sufficient for six hot months. Fogs very rare. No damp, except after rain. Dust storms in hot weather render candles necessary to see with. Sickness increases after first rains. In hot months, animal food once a day only should be given; no spirits and no malt liquor in heat of day. Light clothing, with flannel next skin. December and January healthiest; September and October unhealthiest months, when intermittent fevers, diarrhoea, dysentery, liver disease, and occasionally Asiatic cholera prevail.</p>
NYNEE TAL.	<p>24. No proper instruments. Average temperature, from $48\frac{1}{4}^{\circ}$ in January, to 68° in June. Rainfall varies in different years from 68 to 144 inches. Climate excellent; damp in rains but dry and pure at other times. Too many trees. Residents have good health. Sun powerful in summer. Winter months most healthy, and best adapted for invalids. No endemic diarrhoea.</p>
LUCKNOW.	<p>25. No complete observations. Mean temperature from $58\frac{1}{2}^{\circ}$ in December, to 91° in April and June. Cold weather begins in October. Water freezes in December and January, sometimes in February. Often heavy dews and showers of rain in winter. Hot weather from end of April till June. Dust storms frequent. Climate of Oude better than south of Ganges. Cold and hot seasons healthiest; unhealthiest, breaking up of rains. Most fever in June; least in January. Bowel affections in heat and rain; catarrh in cold season. Heat apoplexy in May and June; 500 cases occurred in Lucknow field force in May 1858.</p>
RAWUL PINDI.	<p>26. No records. Climate decidedly finest in plains of India. Winter clothing, generous diet necessary for seven months; light clothing, less stimulating food necessary for other five, with plenty of vegetables.</p>
CHUNAR.	<p>27. Instruments imperfect. Mean temperature, from 65° in December and January, to 92° in June. Mean sun temperature, from 84° in January, to 120° in June. Rainfall, 47</p>

STATIONS.	REPLIES.
	inches. Climate hot and healthy; hot and dry in hot winds; hot and moist in rainy season; pleasantly cold in cold season; no great variation; little subject to fog and dust. October to half December unhealthiest. Intermittent fever.
ROORKEE.	28. Climate very healthy, quite equal to that of England. September, October unhealthiest, from fever intermittent and mild continued.
JHANSI.	29. Records destroyed during mutiny. Climate healthy and bracing, except in hot weather. Cold season healthiest. Intermittent fever in August and September.
BARRACKPORE.	30. No proper instruments. Temperature in hot season, 82° to 104° in shade; in rains, 80° to 96°; in cold season, 54° to 80°. Climate moist, warm, little variation; moderately healthy. Evenings in hot weather sultry and oppressive. Heavy dews in mornings in cold weather. August to October unhealthiest. Diarrhoea, dysentery, cholera, fevers, remittent and intermittent then prevail.
MORAR GWALIOR.	31. Mean maximum temperature, from 70½° in December to 106° in July. Mean minimum, from 56½ in December, to 86° in May. Mean temperature, 61½° in December, 96° in June. Mean daily range, from 3½° in September, to 18½° in February. Rain fall about 25 inches. Climate salubrious, dry and hot. Too many trees. Air often loaded with dust. Healthiest, at end of cold weather. Unhealthiest, at end of hot and wet weather. In May and June, head and bowel affections and fever prevail. After rains fever and bowel complaints.
JUBBULPORE.	32. No information. No instruments.
DARJEELING.	33. Mean maximum temperature, from 50°·39 January, to 64°·97 August. Mean minimum, 38°·68 January, 57°·97 July. Mean temperature, from 45° January, to 61°·35 August. Mean daily range, between 2°·9 July, and 5°·8 November. Mean sun temperature, between 90° in December, and 104° in July. Average annual rain fall in 7 years 124 inches. Climate, temperate and damp; beneficial in debility after fever, or in simple debility. Not beneficial for serious organic disease or rheumatism. Spring water percolating the decayed vegetable matter produces diarrhoea after first rains.

III. PREVAILING DISEASES AMONG NATIVE POPULATION, AND THEIR CAUSES.

FORT WILLIAM.	1. Native population comparatively unhealthy. Prevailing diseases, intermittent, remittent, typhoid fevers; cholera; dysentery; small-pox; enlarged spleen, and fatal diarrhoea, remarkably prevalent. <i>Causes</i> .—Rank jungle; filth; stagnant water; damp; foul drains; bad drainage; bad, unwholesome, brackish drinking water; bad overcrowding; dirt, and bad diet.
DINAPORE.	2. "Generally healthy, especially the natives." Prevailing diseases: fevers, small-pox, cholera, bowel complaints, palsy of the lower limbs. <i>Causes</i> .—Too much or too little rain; bad drainage; "holes near all native houses;" some native towns "disgracefully filthy."
CAWNPORE.	3. "Generally healthy." Cholera; small-pox; occasionally aggravated by overcrowding, want of ventilation &c. prevail.
MEERUT.	4. "Considered healthy." Diseases: fever, diarrhoea, dysentery, small-pox, spleen, cholera, not so frequent as elsewhere. Comparative healthiness attributable to porous soil, cultivation, and few sources of malaria, free ventilation.
UMBALLA.	5. "Generally healthy." Prevailing diseases: endemic fever, spleen disease; epidemics rare. District well drained by rivers; porous subsoil; few swamps.
FEROZEPORE.	6. "Particularly healthy." Prevailing diseases, venereal, giving rise to ulcers, cancers, diseased bones, leprosy, intermittent fevers; calculi. Healthiness attributable to dry atmosphere; absence of surface water and vegetation; pure drinking water; living much in open air.
JULLUNDUR.	7. "Native population most healthy." Prevailing diseases, fevers; intermittent; dysentery; spleen rare. Healthiness attributable to regularity of rains.
MEAN MEER.	8. Prevailing diseases, fevers, mostly intermittent; lung diseases; bowel complaints; dyspepsia; acute and chronic ophthalmia; ulcers and boils; rheumatism; venereal. Cheap food and fine climate favourable conditions. Dry seasons most healthy.
PESHAWUR.	9. Prevailing diseases, fevers, intermittent; bowel complaints; rheumatism; epidemic small-pox; typhoid remittent fever (severe and fatal) epidemic, in certain districts. Spleen disease not common. Streets dirty, houses densely crowded, ill ventilated.
SEALKOTE.	10. "Healthy." Prevailing disease, rheumatism. Except small-pox, epidemics unknown; spleen disease not common. Healthiness attributable to absence of malaria and open dry country.
GHAZEEPORE.	11. Prevailing diseases, fevers, intermittent, remittent; dysentery; diarrhoea; small-pox; lung disease; spleen; attributed to "malarious nature of climate;" want of sanitary arrangements; poverty of food. October to December 1859, "fearful" fatality from "fevers."
BERHAMPORE.	12. Unhealthy. Prevailing diseases, rheumatism; "fevers of all types;" diseases of bowels; liver; spleen; lungs; cholera; small-pox. <i>Causes</i> .—Damp climate; rank vegetation; "holes full of stagnant foul water, close to almost every house; forming the usual cess-pool of the neighbourhood." "Utter neglect of ventilation, and of all sanitary measures;" low level of country.
NYNEE TÄL.	13. Generally healthy. Prevailing diseases, fevers, intermittent with spleen, and small-pox. <i>Causes</i> .—Sudden variations of temperature; dense underwood; living in hollows; want of free ventilation.
HAZAREEBAUGH.	14. Natives, a poor puny race. General health, average. Prevalent diseases, fevers, intermittent; spleen. Cholera; small-pox; most common and fatal epidemics. <i>Causes</i> .—Jungle; malaria; rice cultivation; poverty; insufficient food.
ALLAHABAD.	15. On the whole healthy. Prevailing diseases, fever, intermittent, remittent; cholera; dysentery; paralysis of loins, caused by eating lathyrus sativus. "Comparative healthiness due to full occupation; abundant food and water."
RAWUL PINDI.	16. Generally healthy. Epidemic small-pox almost every year at beginning of hot season; measles common, and calculus. <i>Causes</i> .—Objection to vaccination; want of cleanliness in person, house and village, hard water.
DUMDUM.	17. Sickly in hot weather. Prevailing diseases, small-pox; cholera, in hot weather; fever with spleen disease, at end of rains; cholera endemic in the district. <i>Causes</i> .—"Defect of vaccination," lowness and dampness of native huts; bad food and vegetables; putrid fish.
BENARES.	18. Generally healthy. Prevailing diseases, malarious fevers; affections of spleen and bowels; "epidemics of small-pox, caused by inoculation, common in February and March." Healthiness attributable to dry climate; not much marshy ground; sufficient food and clothing, and efficient sanitary regulations enforced by city magistrate.

STATIONS.	REPLIES.
LANDOUR.	19. Undoubtedly healthy. Small-pox occasional; bad fever, or spleen, only in mountain valleys at a distance; goitre common. Healthiness attributable to pure bracing climate. Natives have inveterate filthy habits; seldom wash or change their clothes.
RANEEGUNGE.	20. Generally healthy. Prevailing diseases, fevers, cholera in outbreaks. <i>Causes</i> .—Mode of living; neglect of all sanitary precautions in cases of sickness.
UMRITSIR.	21. Generally healthy. Prevailing diseases, small-pox; chicken-pox; measles; cholera; intermittent fever. <i>Causes</i> .—"Utter ignoring of all sanitary arrangements in city and country;" dirty habits; close, overcrowded, ill-ventilated buildings; exposure to night air; moisture and malaria in rains.
LUCKNOW.	22. Health above average. Prevailing diseases: fevers, bowel, liver and spleen diseases; cholera at times. "Climate and good feeding" keep the people in health.
CHUNAR.	23. Generally healthy. Fevers, intermittent; small-pox; cholera; spleen. General healthiness attributable to good water; equality of temperature.
ROORKEE.	24. Population healthy. Small-pox, very common and destructive in spring, when inoculation is practised; cholera, occasional; spleen, rare. Healthiness attributable to dry sandy soil and mild climate.
JHANSI.	25. Generally healthy. Fevers and venereal; small-pox, occasional; cholera, almost unknown.
BARRACKPORE.	26. Moderately healthy. Intermittents; dysentery, acute and chronic; spleen; epidemic cholera; elephantiasis.
DELHI.	27. Generally healthy. Fevers; spleen; ulcers; small-pox, less frequent from dry weather of late, more frequent after heavy rains; ulcers, prevalent, supposed to be caused by water.
MORAR GWALIOR.	28. Very healthy. No epidemics since 1858; attributable to dry climate and soil; abundant and cheap food.
JUBBULPORE.	29. Healthy. Fevers, intermittent; spleen; bowel complaints; rapid chest disease: attributable to frequent change of temperature; numberless tanks; large tracts of jungle.
DARJEELING.	30. Natives generally healthy and strong, living much in open air. Prevailing diseases: small-pox, the scourge of the hill population; fever; sometimes spleen; goitre, also common. <i>Causes</i> .—Native houses surrounded with all kinds of filth; atmosphere quite sickening in walking through the villages.

IV. PREVAILING DISEASES AMONG EUROPEAN TROOPS, AND THEIR CAUSES.

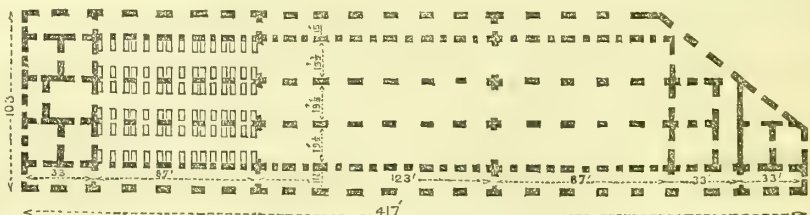
FORT WILLIAM.	1. Fevers, intermittent, quotidian, quartan, tertian, double tertian, remittent, continued; dysentery, acute, chronic; cholera, bilious, spasmodic; small-pox, benign, confluent; rheumatism acute, chronic. These diseases occasion from 60 to 65 per cent. of total sick, and from 75 to 80 per cent. of total deaths. Causes stated to be exposure and drink, bad drainage, and water supply. Soldiers' duties do not predispose to disease. About five per cent. of the sick in hospital are venereal cases, "might be lessened by police regulation." Hepatic disease nine per cent. of total sick. Cause high and variable temperature and spirituous liquors. Moderation in diet, cleanliness, mental amusement, and exercise recommended as prophylactics.
DINAPORE.	2. Fevers, remittent, quotidian, tertian; dysentery, "prevalent and severe;" cholera almost every year; rheumatism. Worst ventilated part of barrack most liable to cholera. To mitigate epidemic disease, bazaars should be cleared away. Draining, filling up holes, and preventing flooding of station required. Venereal disease occasions 53 per cent. of total sick. Lock hospital would be advantageous. Increase of marriages greatly preferable. Hepatic disease causes 6½ per cent. of total admissions, and 24 per cent. of total deaths: attributable to exposure and too full diet.
CAWNPORE.	3. Fevers, intermittent, remittent; dysentery; cholera; small-pox; rheumatism of miasmatic origin occasion about three-fifths of the admissions and four-fifths of the deaths. Admissions from hepatic disease about 35 per 1,000 of admissions. Cause, intemperate eating and drinking. Venereal cases form one-third to one-half the sick. Lock hospitals would be of little if any use.
MEERUT.	4. Fevers, intermittent, remittent, continued, occasion 56 per cent. of total admissions, and 25 per cent. of total deaths; dysentery; cholera; small-pox; rheumatism. Hepatic disease, occasions 18 per 1,000 of total admissions. <i>Causes</i> .—Intemperance; exposure; long residence; malarial fever. Eight per cent. of total admissions are venereal cases. Lock hospitals "decidedly advantageous, if combined with police supervision."
AGRA.	5. Fevers, continued and miasmatic; small-pox; cholera; rheumatism; sun-stroke. <i>Causes</i> .—climate; drinking spirits; sleeping close to ground. Liver disease. <i>Causes</i> .—Heat; exposure; alcoholic liquors; excess of diet. 8·77 per cent. of admissions are venereal cases. Lock hospitals, with inspection, recommended.
UMBALLA.	6. Fevers, quotidian, tertian, remittent; dysentery; rheumatism. Proportion of hepatic cases two to three per cent. of the constantly sick. <i>Causes</i> of hepatic disease.—Fevers; exposure; intemperance; too high living; "too much animal food without exercise in hot weather." Proportion of venereal disease to constantly sick 27·38 per cent. Increase of marriages, lock hospitals, and inspection recommended.
LOODIANA.	7. Fevers, intermittent, quotidian, remittent occasion 28 per cent. of admissions. Dysentery, acute; rheumatism. <i>Causes</i> .—Exposure to sun; lying on damp ground. Venereal disease 16 per cent. of total sick.
FEROZEPORE.	8. Fever, intermittent; dysentery; rheumatism. <i>Causes</i> .—Intemperance; exposure; and not soldier's duties. Hepatic disease not very prevalent. <i>Causes</i> .—Exposure to heat; chills; intemperance; dysentery; and fever. 16 per cent. of admissions are venereal cases.
JULLUNDUR.	9. Fevers, intermittent; dysentery; last year 16 per cent. European, 7½ per cent. native troops constantly sick from syphilis. Lock hospitals and inspection recommended.
MEAN MEER.	10. Fevers, continued, intermittent, with spleen disease, remittent; dysentery, acute, chronic, hæmorrhagic; cholera, sporadic, epidemic; rheumatism; small-pox. <i>Causes</i> .—Heat and extremes of temperature; want of exercise; ennui; sanitary defects in bazaars. Soldier's health always better under exertion in the field. Average occurrence of hepatic disease in proportion of 3·9 per cent. of total strength. Hard drinkers undoubtedly predisposed to it. Venereal disease 1 in 13 of other diseases. Lock hospital, registration, and inspection have been established. Returns show a diminished per centage of cases. Another report of later date states that this procedure diminishes the severity, not the number of cases. It is "considered advantageous," but supervision is difficult. It has been "constantly tried in India."

STATIONS.	REPLIES.
PESHAWUR.	11. Fevers, intermittent, quotidian, tertian, remittent, continued, occasion 44·9 per cent. of total admissions, and 22·8 of total deaths; dysentery, acute, chronic; cholera; small-pox; rheumatism. Zymotic diseases occasion 51½ per cent. of total deaths. Fevers attended with extreme prostration. Hepatic disease not very prevalent. Abstinence from spirits the best prophylactic. Amount of syphilis varies from 1 to 28½ per cent. of strength. Lock hospital, recommended.
SEALKOTE.	12. Fever, ephemeral; dysentery; rheumatism. Typhus or typhoid fever, cholera, small-pox, exanthemata, almost unknown. Less than 3 per cent. of admissions; less than 1 per cent. of deaths due to epidemic and endemic disease. 2 per cent. of cases due to hepatic disease, caused by intemperance or climate. Syphilis occasions a quarter of the admissions. Lock hospitals and inspection recommended.
GHAZEIPORE.	13. Fevers, quotidian, tertian, quartan, remittent, ephemeral; dysentery, acute, chronic; cholera, "severely" in 1860. <i>Causes.</i> —Total want of healthy occupation; sanitary arrangements required.
BERHAMPORE.	14. Fevers, quotidian, tertian, quartan, remittent, continued; dysentery; cholera; rheumatism. <i>Causes.</i> —Humidity and heat, acting on decaying vegetable matter; want of drainage; want of cleanliness and ventilation in bazaars; stagnant water. Hepatic disease, 10 per cent. of admissions. <i>Causes.</i> —Intemperate habits; exposure to sun; malaria. Syphilis, 16 per cent. of admissions. No precaution can be suggested. Lock hospitals unnecessary.
ALLAHABAD.	15. Fevers, intermittent, remittent, continued; dysentery; small-pox; rheumatism; diarrhoea; cholera. 50 per cent. of the admissions are from fever. Admissions from hepatitis 5 per cent. of strength. <i>Causes.</i> —Climate; intemperance; quality of food; prophylactics, abolishing use of spirits; strict attention to cleanliness; clothing; duty; food; housing; recreation. 9 per cent. of sick from syphilis. Much might be done by lock hospitals, registration, police regulation.
DUMDUM.	16. Fevers, remittent, intermittent, continued; dysentery, acute, chronic; cholera; rheumatism occasion 57 per cent. of total treated; 99 per cent. of total deaths. <i>Causes.</i> —Season and rainfall. Keeping from sun and spirits best preventive of hepatic disease. Little venereal disease. Lock hospitals recommended.
BENARES.	17. Fevers, intermittent, remittent, occasion 31 per cent. of the admissions, and 13 per cent. of the deaths; dysentery occasions 6 per cent. of admissions, 17 per cent. of deaths; cholera, ½ per cent. of admissions, 17 per cent. of deaths. <i>Causes.</i> —High temperature and moisture. Hepatic disease occasions 7 per cent. of admissions. <i>Causes.</i> —Alternation of temperature. Prophylactics, temperance; proper clothing; non-exposure to night air. Syphilis occasions 23 per cent. of admissions. Recommendations: prostitutes to be turned out of bazaars, general native hospital at each station. Lock hospitals objectionable as leading to licensed prostitution.
HAZAREEBAUGH.	18. Fevers, continued, remittent, intermittent; dysentery; diarrhoea; rheumatism, these occasion 48 per cent. of total admissions, and 60 per cent. of total deaths. <i>Causes.</i> —Powerful sun; humidity; rank vegetation; malaria from decaying vegetable matter; listlessness of mind. Hepatitis not common. One fourth of cases in hospital are syphilitic. Inspection (not by army medical officers) beneficial but immoral. Would refuse to sanction it. Not much gained by lock hospitals. They would not use them, unless compelled.
LANDOUR.	19. Hill station. Diseases: relapses of fever, intermittent, quotidian, and tertian, contracted in plains. Continued fever from exposure; dysentery seldom, except from relapse; rheumatism occasional; no cholera or small-pox; 12 per cent. of cases sent up are hepatic. <i>Causes.</i> —Climate; exposure; dram-drinking. Remedies: plenty of healthy exercise, athletic games, &c.
MUTTRA.	20. Hepatic diseases 2·84 per cent. of admissions; much more in hot weather. Preventives: avoiding exposure and chills, wearing flannel belts. Venereal disease is 14·1 per cent. of total sick; to diminish it, no cantonment to be nearer than four miles to a city. Lock hospitals would then be advantageous. One in 3·7 admissions occasioned by fever, continued, intermittent, by dysentery, small-pox, and rheumatism.
RANEEGUNGE.	21. No information.
UMRITSIR.	22. Hepatic disease occasions 4·66 per cent. of total admissions, attributable to intemperance and dysentery; complete withdrawal of spirits from canteens the best prophylactic. Venereal disease is 7 per cent. of constantly sick; increase of marriages suggested; lock hospitals not recommended. Prevailing diseases: fevers, continued, quotidian, tertian, quartan; dysentery, sub-acute, chronic; cholera; small-pox; rheumatism. Admissions from which are 40 per cent., deaths 44 per cent. of total admissions and deaths.
NYNEE TAL.	23. Hill station. Fever, quotidian; dysentery (from plains); rheumatism, acute; hepatic disease (from plains).
RAWUL PINDI.	24. Hepatic disease about 4 per cent. of admissions, produced as readily by habitual free living and excess of animal food as by intemperance. Syphilis 16 per cent. of admissions; inspection recommended. Prevailing diseases, fever, common, continued; dysentery; cholera; rheumatism.
LUCKNOW.	25. Hepatic disease 4 per cent. of total admissions. Preventives; good shelter and food, healthy exercise and amusement, steady habits, and avoiding exposure. Syphilis, from 25 to 33 per cent. of total sick; lock hospitals recommended. Prevailing diseases; fevers, intermittent, remittent, continued; dysentery; small-pox; rheumatism, which occasion upwards of 50 per cent. of the admissions, and 59 per cent. of the deaths. <i>Causes.</i> —Hot weather with rain, want of employment leading to debauchery.
CHUNAR.	26. Hepatic disease one in 31. <i>Causes.</i> —Intemperance and exposure to sun; preventive, discontinuance of spirits. Syphilis one in 31; inspection better than lock hospitals. Prevailing diseases, intermittent fever, mostly quotidian and tertian; dysentery (no small-pox); cholera occasional; intemperance, exposure, are the predisposing causes.
ROORKEE.	27. Hepatic disease 1 per cent. of cases. <i>Causes;</i> spirit drinking, malaria. Syphilis more than 50 per cent. of sick; inspection recommended. Troops suffer slightly from fever, intermittent and continued (not from dysentery), cholera, small-pox occasional, rheumatism common. These diseases occasion about one-third of the admissions; and about three-fourths of the deaths.
JHANSI.	28. One case in 15 from hepatic disease. Syphilis not prevalent. Prevailing disease; fever, intermittent; a few cases of dysentery.
BARRACKPORE.	29. Hepatic disease 2 per cent. of cases. <i>Causes.</i> —Alternations of temperature, intemperance, exposure. Prophylactics: use of flannel, temperance in eating and drinking, avoiding exposure. Syphilis 13 per cent. of total sick; lock hospitals not nearly of so

STATIONS.	REPLIES.
DELHI.	much use as in Europe. Prevailing diseases; fevers, continued, remittent, intermittent (most frequent); dysentery (frequent and dangerous); cholera; small-pox, rare; rheumatism, frequent. These diseases occasion about 38 per cent. of admissions, and 75 per cent. of deaths. Most frequent in great and close heat. <i>Causes</i> .—Crowding in barracks, bad ventilation, intemperance in eating and drinking, exposure, want of occupation.
DARJEELING.	30. Hepatic disease. <i>Causes</i> : climate, excessive eating and drinking, exposure, want of exercise of body and mind. Syphilis one-third of total sick; inspection and lock hospital recommended. Prevailing diseases; fever, intermittent, remittent, continued; dysentery, acute, chronic, hæmorrhagic; cholera; rheumatism. Cause; "exposure to night duty."
MORAR GWALIOR.	31. Ague; fever, remittent; rheumatism; and dysentery occur, but imported from plains. Never cholera or small-pox. <i>Causes</i> of soldiers' diseases in India: monotony, harassing duties, want of exercise, and incentives to it, discomfort of overcrowded unhealthy barrack rooms, his condition, generally, leading him to drink; all making him liable to any epidemic or other morbid influence. Means of promoting health, although quite within our reach, have been sadly neglected.
JUBBULPORE.	32. Hepatic disease not unusually frequent. <i>Causes</i> .—Hot dry climate, too much animal diet, too few vegetables, ardent spirits. Prophylactics: malt liquor, potatoes, instead of native vegetables. Syphilis has been as high as 80 per cent. of the sick; seldom under 12 or 20; lock hospitals and police regulation recommended. Prevailing diseases: fever, chiefly intermittent; dysentery; rheumatism occasion 44 per cent. of admissions. No cholera or small-pox.
	33. Hepatic disease 2 per cent. of cases. <i>Causes</i> .—Intemperance, excessive heat, overcrowding, bad ventilation. Syphilis 34 per cent. to 50 per cent. of cases; impossible to guard against it near large bazaars or cities; lock hospitals and police regulations recommended. Prevailing diseases: fevers, ephemeral and intermittent; dysentery; rheumatism; no cholera or small-pox.

V. SANITARY CONDITION OF BAZAARS AND NATIVE TOWNS.

FORT WILLIAM.	1. Surrounded on all sides by large and populous villages. Estimated population of Calcutta, 500,000. Water and drainage bad. Rainfall flows slowly away or evaporates, causing humidity: filth, foul drains, stagnant water, jungle, and nuisances.
DINAPORE.	2. Bazaars overcrowded, badly drained, and filthy. Last year some streets were impassable dunghills until cleared; elephant sheds and all the south of the station in a state disgraceful to any cantonment. Meat market very bad in rains; drainage very deficient; no regular system. Drains in some places choked up; in others forming deep holes of festering mud. Ventilation very bad. No latrines, although the "population is as thick as can be;" compelled to sweep in front of their own houses; only one filth cart until lately, now three; paid for by inhabitants. Dead bodies sometimes buried within huts at Dugah. Some of the native towns are disgracefully filthy.
CAWNPORE.	3. Large native town, $\frac{1}{2}$ mile distant. Bazaar drains generally good. Ventilation and water supply sufficient. Many parts crowded and ruinous. People compelled to keep space in front of premises clean. No dungpits or cesspools allowed.
MEERUT.	4. Town a mile distant from lines. Bazaar drained, well ventilated, and supplied with water from wells. Cleanliness strictly enforced. Public latrines. Native houses generally filthy. Dungheaps frequent. Pits for all kinds of refuse common.
AGRA.	5. City, 152,000 inhabitants, a mile distant. Bazaar open, clean, ventilated, not crowded. Water from wells abundant, but rather saline. Native houses clean, but villages low, with narrow and irregular streets; dunghills at the outskirts; the "more respectable" houses have cesspools. Inhabitants generally resort to the fields.
UMBALLA.	6. Large native city, 3 miles from station. Station bazaar regularly laid out in squares. Drainage might be improved. Clean on the whole, but crowded in parts. Defective water supply. Two public latrines; more required. 28 sweepers, paid by inhabitants. Native houses never perfectly clean. Fines levied for nuisance.
LOODIANA.	7. Town of Loodiana, with 50,000 inhabitants, adjoining station.
FEROZEPORE.	8. City, 14,000 inhabitants, 2 miles distant. Bazaar not drained; all refuse removed. Water from wells. Latrines only partly used.
JULLUNDUR.	9. City, 3 miles from cantonments. Bazaars generally clean and well drained. Free circulation of air; no overcrowding. Latrines.
MEAN MEER.	10. City of Lahore, 6 miles off. Suddur bazaar, 7,338 inhabitants, nearly 2 miles from centre of cantonments. Four or five other bazaars within cantonments, arranged with broad roads at right angles; kept clean. Drainage about to be improved. Plenty of good water from wells. Three latrines for bazaar, and ten others in different parts of cantonments.
PESHAWUR.	11. Large city, $1\frac{1}{2}$ miles from station. Drainage of bazaar like that of station. Ventilation free. Water supply ample. Cleanliness strictly enforced; little crowding; drains not good, but kept clean. Villages round station not dirtier than usual; probably have dungheaps within their enclosures.
SEALKOTE.	12. City $2\frac{1}{2}$ miles from station. Bazaar well laid out. Good natural drainage. Plenty of good water. No crowding. Kept clean by sweepers. Native houses of dried mud. Public latrines provided.
GHAZEEPORE.	13. City a mile from station. Bazaar like all native villages. Surface drains. Streets moderately wide; kept clean. No latrines. Water supply good. Houses good and bad.
BERHAMPORE.	14. Town contiguous to station. Nothing can be worse than sanitary condition of bazaars; conservancy establishment far too limited. Native houses dirty in the extreme; dungheaps or deep holes full of stagnant water close to them, the common cesspit of the house. Nuisance in barracks from holes full of dirty water and filth, and from elephant and bullock sheds. Bad drainage.
HAZAREEBAUGH.	15. Town, 5 to 6,000 inhabitants. Bazaar open, well ventilated, clean. Sufficient water supply. No more than ordinary crowding. Good natural drainage. No latrines, and much nuisance along one road in consequence.
ALLAHABAD.	16. Town 73,000 inhabitants, 3 miles distant. No military bazaars, except for regiments; these are generally kept clean.
DUMDUM.	17. Bazaar not crowded. "Nothing to complain of" as to drainage, ventilation, cleanliness, or water supply. A cart and six sweepers kept. Native houses generally pretty clean.
BENARES.	18. 186,000 inhabitants, between Ganges and cantonments. Bazaar tolerably clean. Many huts in rear, much crowded. "Well drained (surface)." Public latrines.
LANDOUR.	19. Small sweeping establishment, paid for by house tax; native houses in cantonments clean; those in the neighbourhood not remarkable for cleanliness.

STATIONS.	REPLIES.
MUTTRA.	20. City three-quarters of a mile off. Bazaar an accumulation of huts, without order. "Drainage bad; ventilation worse; water supply execrable." "All the wells brackish, from nitre," the earth being contaminated with all sorts of impurities. Latrines "hardly known." "In short, the bazaar is a mass of filth."
DARJEELING.	21. Bazaar well drained; houses too close, mostly built of mats and bamboos; generally surrounded by all kinds of filth. They are at a distance from depôt; but the medical officer says, they are the most filthy villages he has ever entered, and it is quite sickening to walk through them.
RANEEGUNGE.	22. Bazaar not drained; kept clean; water from tanks, carried by water carriers; latrines (at a distance); native houses near station indifferent; pits and dirt heaps abound.
UMRITSIR.	23. City $1\frac{1}{2}$ miles distant; population 120,000; station bazaar tolerably clean; native houses small; no dung hills or cesspits.
NYNEE TAL.	24. (Hill station.) Both bazars in a filthy and crowded state; no proper drainage, nor latrines; stench at times overpowering; no means of preserving cleanliness; native houses small and badly ventilated; want of public latrines causes nuisance in barracks.
RAWUL PINDI.	25. City a mile from station; three villages immediately on outskirts; a new station; bazaar well laid out, free ventilation; surface drains kept clean by sweepers; latrines (at a distance); no dung pits or cesspools.
LUCKNOW.	26. City of Lucknow, population 400,000 to 500,000, and four other cities, from a mile to two miles from cantonments; bazars only being formed, but with due regard to plan, drainage, &c.
CHUNAR.	27. Town, 14,000 inhabitants, close to station; many native houses ruinous; bazaar in city kept clean and in good order.
ROORKEE.	28. Bazaar $1\frac{1}{2}$ miles from barracks; no information as to its state.
JHANSI.	29. City a mile off; bazaar new and incomplete, but well drained; public latrines, but police insufficient at present.
BARRACKPORE.	30. Bazaar clean, tolerably drained and ventilated; not overcrowded; water supply from tank; establishment of sweepers paid by tax on occupiers.
DELHI.	31. Station inside city walls; bazaar being established.
MORAR GWALIOR.	32. Town $2\frac{1}{2}$ miles distant; bazaar well drained and ventilated; water from wells; latrines constructed; five sweepers attend to cleanliness.
JUBBULPORE.	33. Town 2 miles from station; drainage of bazaar insufficient; ventilation very bad; water supply good; cleanliness almost impossible; no latrines; every hut crowded; ruinous mud huts, with tiled roofs; no native will keep his house drains clean, unless obliged.
VI. BARRACK CONSTRUCTION.	
FORT WILLIAM.	<p>1. Fort William, 18 feet above sea level, 67 miles distant from the sea, contains five barracks occupied by soldiers.</p> <p><i>Site.</i>—Comparatively open, but ramparts, being 25 feet high, interfere with free ventilation; temperature considerably raised by reflected sun heat.</p> <p>(1.) <i>Dalhousie barracks.</i>—36 rooms for 631 non-commissioned officers and men; have held 900. There are 3 floors of barrack rooms, over a basement. Each floor consists of 3 long parallel rooms, from $81\frac{1}{2}$ to 124 feet long, $64\frac{1}{2}$ feet wide, 19 feet high, giving from 1,500 to 1,600 cubic feet, and from 79 to 85 square feet per man. The long rooms communicate by arches; each has two rows of beds; thus there are six rows of beds between the opposite windows, $64\frac{1}{2}$ feet distant.</p> <p>The following Fig. 1 is a ground plan of a floor of the barrack, showing an arrangement of cots for 306 men in one room.</p> <p>FIG. 1.—PLAN OF FIRST STORY DALHOUSIE BARRACK, FORT WILLIAM, Showing the arrangement of cots in a portion so as to accommodate 900 men in all.</p>  <p>It is stated that this accommodation may be considered "perfect."</p> <p>(2.) <i>South barrack.</i>—Thirteen rooms; 210 non-commissioned officers and men; at from 1,183 to 1,938 cubic feet, and from 64 to 108 square feet per man; length of rooms, $77\frac{3}{4}$ to $98\frac{1}{4}$ feet; breadth, $19\frac{3}{4}$ feet; height, $18\frac{1}{2}$ feet; from 16 to 26 men per room; these rooms are on second story.</p> <p>(3.) <i>North barracks.</i>—Thirty-six rooms; 210 non-commissioned officers and men; 900 to 1,800 cubic feet per man; 50 to 100 square feet per man; 28 rooms at 7 men each; 1 room at 36 men each; which last room is in length, 239 feet; width, 15 feet; height, 18 feet.</p> <p>(4.) <i>West barracks.</i>—Bomb-proof. Nine rooms; 300 men; "one-half would be too many;" 1,404 cubic feet per man; 140 square feet per man; centre room, length 200 feet, width 18 feet, height 10 feet.</p> <p>(5.) <i>Queen's barracks.</i>—156 rooms for 108 married men and 12 non-commissioned officers, formed by dividing a large room by wooden bulk heads, 8 feet high; each family room being 22 feet long, 12 feet wide, 18 feet high.</p> <p>In all the barracks, the windows are on opposite sides, with verandahs, in which many men place their cots in hot weather; doors, one-third panel, two-thirds Venetian.</p> <p>Floors, brick on edge, covered with Chunar flags.</p> <p>Materials, best burnt brick, set in lime mortar; roof, solid brick, with concrete terrace; basements never used as barracks.</p> <p>Iron cots.</p> <p>2. <i>Site.</i>—Tolerably open, but ventilation obstructed by vegetation.</p>
DINAPORE.	

STATIONS.

REPLIES.

Two of the rooms are each no less than 826 feet long, 35 feet wide, 17 or 18 feet high, with 308 men per room, giving from 1,597 to 1,690 cubic feet per man, and 94 square feet per man; one room for 92 men, gives 1,729 cubic feet per man, 102 square feet per man; 11 rooms, with 16 men each, give 1,020 cubic feet per man, and 60 square feet per man.

Doors on opposite sides; no windows; verandahs.

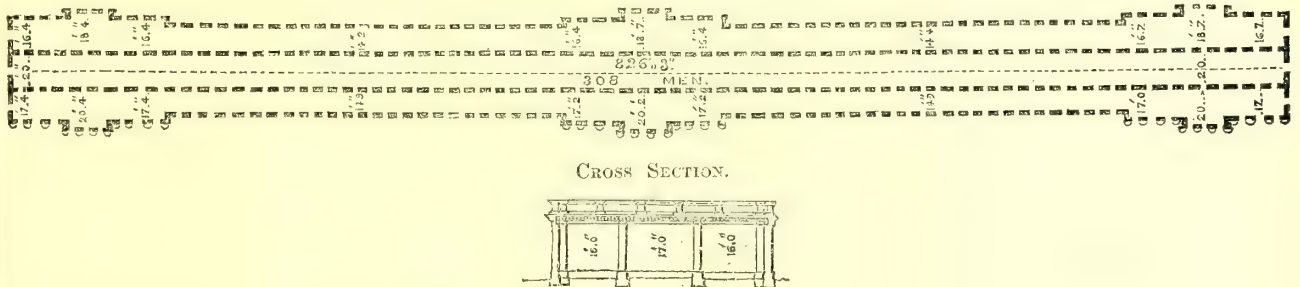
Materials, brick and lime for permanent barracks, brick and lime plinth for temporary barracks.

Floors, $1\frac{1}{2}$ to 2 feet above ground; no ventilation beneath; flooring, half-burnt brick.

Chief permanent barrack bad, runs east and west, which is the prevailing wind; hence badly ventilated.

Fig. 2 is a plan and section of part of the barracks at this station, showing a room no less than 826 feet long, having space for 308 men. It is next to impossible for barracks of this construction to be moderately healthy.

FIG. 2.—PLAN OF WEST WING INFANTRY BARRACKS, AT DINAPORE.



CAWNPORE.

Bedsteads of wood; some few of iron.

3. Site.—Open; free external ventilation.

Echelon barracks: ten ranges for 1,000 men; 100 men per room; 1,235 cubic feet per man; 41 square feet per man; each room 168 feet long, $24\frac{1}{2}$ feet wide, 30 feet high; 4 rows of beds between opposite windows, when the verandahs are used.

Foot artillery: 2 ranges; 120 men per room; 2,652 cubic feet per man; 88 square feet per man; each room 442 feet long, 24 feet wide, 25 feet high; four rows of beds between opposite windows, when the verandahs are used.

Dragoon barracks: 2 ranges; 140 men; 70 men per room; 1,106 cubic feet per man; 61 square feet per man.

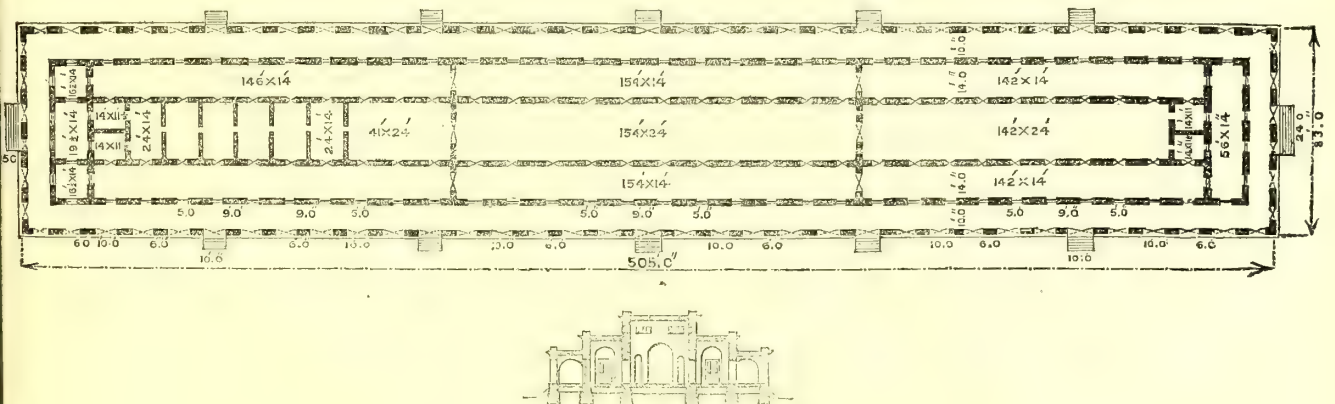
The cubic space presupposes inner verandahs not occupied, but they have invariably been occupied; doors on opposite sides.

Materials, brick and mortar, plastered and whitewashed.

Floors of flagging laid on rammed earth and broken bricks; raised 3 feet above ground; no ventilation beneath.

Fig. 3 is a plan and section of the artillery barracks, showing the usual construction of double verandah barracks, having terraced roofs. The plan also shows a long building divided by arches, which obstruct the ventilation. This enables us to judge of what must be the state of the air when the verandahs are occupied.

FIG. 3.—ARTILLERY BARRACKS, CAWNPORE.



Cots, wood with twine bottoms and tow mattresses; iron cots and cocoa-nut fibre mattresses the best.

MEERUT.

4. Site.—Open; free external ventilation varies with locality.

705 rooms; for 4,227 non-commissioned officers and men; length of men's rooms, 44, 198, 210, and 215 feet; width of men's rooms, 22, 24, 30 feet; height of men's rooms, $16\frac{1}{2}$ to $26\frac{1}{2}$ feet; cubic space per man, 868 to 1,968 feet; square feet per man, 52 to 79 feet.

Windows and doors on opposite sides.

Verandahs on both sides, occasionally used as sleeping quarters.

Materials, brick and lime mortar; thatched or tiled roofs.

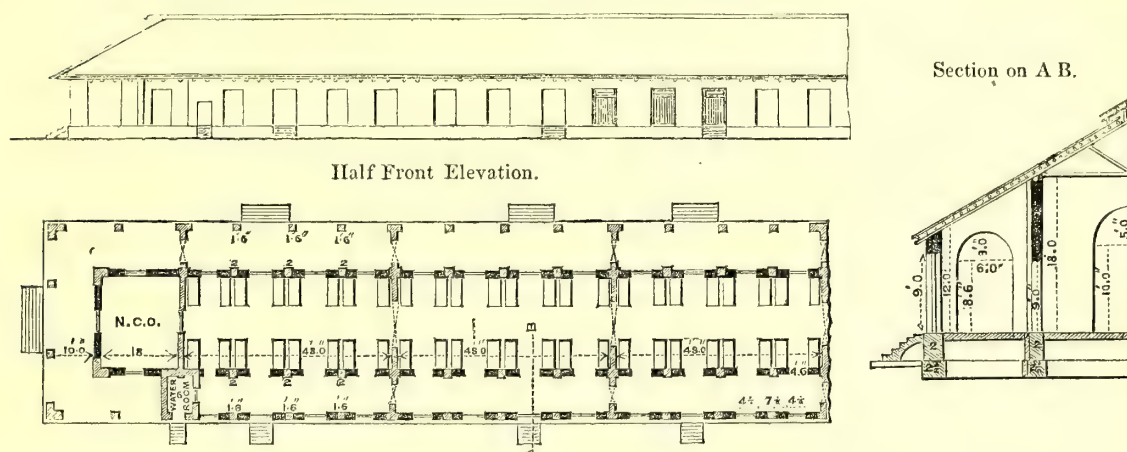
Floors, brick or stone, with concrete over; generally raised 2 feet above ground; no ventilation beneath.

Wooden cots; cotton mattress; iron bottoms would be better.

STATIONS.	REPLIES.
AGRA.	<p>5. <i>Site</i>.—Open ; few trees ; temperature hot, from baked dry soil and ravines. 76 serjeants' quarters ; 23 barrack rooms for 1,776 non-commissioned officers and men ; rooms from 204 to 288 feet long, 12 to 24 feet wide, 20 to 28 feet high ; 1,379 to 1,912 cubic feet per man ; 60 to 79 square feet per man.</p> <p>Doors on each side, with glazed fanlights ; no windows.</p> <p>Verandah, 12 feet wide, occasionally occupied as sleeping quarters.</p> <p>Materials, burnt brick and mortar ; roofs thatched.</p> <p>Floors, stone over brick, 3 feet above ground ; no ventilation beneath ; not sufficiently raised above malaria ; should be two-storied.</p> <p>Bedsteads, wood ; should be iron to keep out bugs.</p>
UMBALLA.	<p>6. <i>Site</i>.—Much tree vegetation ; regulations enforced to prevent its interfering with ventilation. 2,162 non-commissioned officers and men ; from 12 to 66 men per room ; 687 to 1,869 cubic feet per man ; 51 to 118 square feet per man ; 4 rows of beds between opposite doors and windows, if inner verandahs used as sleeping places ; there are actually 3 rows ; no jalousies or jhilmils.</p> <p>Materials, burnt brick and lime ; tiled or thatched roofs ; terraced verandahs.</p> <p>Floors of burnt brick, objectionable ; raised 1½ feet above ground ; no passage of air beneath ; ought to be raised on arches.</p> <p>Wooden cots, ought to be iron.</p>
FEROZEPORE.	<p>7. <i>Site</i>.—Open on all sides ; receives benefit of prevailing winds.</p> <p><i>Accommodation</i>.—948 non-commissioned officers and men.</p> <p><i>Barrack rooms</i>.—Length 95 to 100 feet ; width, 24 to 44 feet ; height, 20 feet 1,500 to 1,680 cubic feet per man ; 75 to 80 square feet per man.</p> <p><i>Verandahs</i>.—12 feet wide.</p> <p><i>Materials</i>.—Burnt brick and mortar.</p> <p><i>Floors</i>.—Brick and mortar, 3 feet above ground ; no ventilation below.</p> <p><i>Story</i>.—One ; rows of beds between opposite windows, 4.</p> <p><i>Bedsteads</i>.—Wooden frames.</p>
JULLUNDUR.	<p>8. <i>Site</i>.—Open to all winds.</p> <p><i>Accommodation</i>.—1,200 European, 3,000 native troops ; 16 to 24 men per room ; cubic space per man, 1,373 to 1,610 feet ; square feet per man, 45 to 75 feet ; windows on opposite sides ; verandahs all round.</p> <p><i>Materials</i>.—Pucka and kutchia bricks, with lime and mud cement.</p> <p><i>Roofs</i>.—Thatch, tile, pucka.</p> <p><i>Floors</i>.—Brick on tile over concrete, raised 1 or 2 feet above ground ; no ventilation beneath.</p> <p><i>Bedsteads</i>.—Wood.</p>
MEAN MEER.	<p>9. <i>Site</i>.—Remarkably open.</p> <p><i>Accommodation</i>.—2,214 British, 1,365 native troops.</p> <p><i>Barrack rooms</i> 96, with 16 men in each ; cubic feet, 1,703 per man ; square feet, 72 per man ; verandahs, 96, with 8 men in each. Iron-framed barracks, 4, with 52 men in each ; cubic feet per man, 1,980 ; square feet, 80. Dining-room for 104 men in each iron-framed barrack.</p> <p><i>Materials</i>.—Burnt brick and lime.</p> <p><i>Floors</i>.—Burnt brick on concrete, raised 3 feet above ground ; no ventilation beneath. Burnt bricks are hotter than sun-dried bricks for barracks.</p> <p><i>Bedsteads</i>.—Wooden ; strong and comfortable. Bedding stuffed with hempen fibre.</p>
PESHAWUR.	<p>10. <i>Accommodation</i>.—2,651 British troops.</p> <p><i>Site</i>.—Open and freely exposed to winds. <i>Temperature</i> raised by reflected sun-heat.</p> <p><i>Barrack rooms</i>, 108, 16 to 24 men per room ; cubic feet per man, 1,320 ; square feet per man, 66.</p> <p><i>Verandahs</i> sometimes occupied in winter.</p> <p><i>Materials</i>.—Burnt or unburnt brick.</p> <p><i>Floors</i>.—Brick, raised 2 to 3 feet above ground ; no passage of air beneath.</p> <p><i>Bedsteads</i>.—Wooden.</p>
SEALKOTE.	<p>11. <i>Site</i>.—Open and freely exposed to the winds.</p> <p><i>Temperature</i> raised 2° to 3° by reflected sun-heat.</p> <p><i>Accommodation</i>.—1,200 men ; 100 men per range ; cubic space per man, 1,154 to 1,928 feet ; square feet per man, 89 to 102 feet ; double verandahs all round ; distance between opposite windows, 50 feet.</p> <p><i>Materials</i>.—Sun-dried, brick-faced, with pucka brick.</p> <p><i>Roofs</i>.—Thatch and tiles.</p> <p><i>Floors</i>.—Brick, 3 feet above ground ; no ventilation beneath ; 3 rows of beds between opposite windows.</p> <p><i>Cots</i>.—Tape and string bottomed ; the latter a "vile description of bed," sheltering bugs and all sorts of vermin.</p> <p><i>Iron bedsteads</i> required.</p>
GHAZEEPORE.	<p>12. <i>Site</i>.—Open ; nothing to impede free ventilation.</p> <p><i>Accommodation</i>.—Old stables, fitted up as temporary barracks, 5 in number, each 460 feet long ; 35 feet wide ; 9, 11, 17 feet high ; from 160 to 250 men per room, cubic feet per man, 850 to 2,108 feet ; square feet per man, 62 to 99.</p> <p><i>Verandahs</i> on both sides.</p> <p><i>Materials</i>.—Pucka, with tiled roofs.</p> <p><i>Floors</i>, of old stables, partly kunkur, partly brick, raised 1 foot above ground ; no ventilation below ; neither doors nor windows.</p> <p><i>Bedding</i>.—Charpoy, blanket, &c.</p>
BERHAMPORE.	<p>13. <i>Site</i>.—Surrounded by jheels and wet ground ; barracks built in square ; ventilation impeded by bazaars, &c. ; 3 upper storied and 8 lower-roomed barracks.</p> <p><i>Accommodation</i>.—One European, and one native infantry regiment ; 24 to 100 men per room ; cubic feet per man, 1,037 to 1,314 ; square feet per man, 70 to 82 feet ; 4 rooms in each upper-roomed barrack used for dining and recreation ; no windows, only Venetian doors.</p> <p><i>Materials</i>.—Brick and mortar ; flat terraced roofs.</p> <p><i>Floors</i>, terraced and tiled, 1½ feet above ground ; no ventilation below.</p> <p><i>Bedsteads</i>.—Iron and wood ; mattresses, hemp.</p>
HAZAREEBAUGH.	<p>14. <i>Site</i>.—Open, freely ventilated.</p> <p><i>Accommodation</i>.—960 single men, 120 married ; 10 temporary barracks, 300 feet by 20 feet by 18 feet ; 100 men each barrack, at 1,080 cubic feet per man ; 63 square feet per man.</p>

STATIONS.	REPLIES.
	<p>Five temporary barracks, 24 families each ; 4,500 cubic feet per family; 200 square feet per family ; no windows, only doors and fan-lights.</p> <p><i>Verandahs</i>, 10 feet wide.</p> <p><i>Materials</i>.—Foundation and plinth of burnt bricks in mortar. <i>Superstructure</i>.—Burnt and sun-dried bricks in mud.</p> <p><i>Roofs</i>.—Tiled over thatch.</p> <p><i>Floors</i>.—Brick and stone terraced, 2 feet above ground ; no air beneath.</p> <p><i>Iron hooped cots</i>.</p> <p>Fig. 4 is a plan of one half of a single verandahed barrack at Hazareebaugh, showing the usual construction of this class of barrack.</p>

FIG. 4.—STANDARD PLAN OF THE BARRACKS AT HAZAREEBAUGH.



ALLAHABAD.

15. *Site*.—One-third of the station below the level of river ; open and exposed to winds. Indigo cultivated close to Wellington barracks ; a great nuisance. Much filth and nuisance from civil bazaars ; too close to lines.

Accommodation.—2,515 British, 1,871 native troops.

Five soldiers' barracks, 100 men per room ; cubic feet per man, 1,437 to 1,609 ; square feet per man, 73 to 80 ; rooms, 335 feet by 22 feet by 24 feet.

One barrack, 80 men per room ; 1,528 cubic feet per man ; 82½ square feet per man ; rooms for 40 married men ; giving 4,032 cubic feet per family ; and 248 square feet per family.

Folding doors badly fitting ; no windows.

Verandahs 15 feet wide ; used on emergencies for sleeping.

Materials.—Burnt and sun-dried brick.

Roofs.—Thatch and tiles.

Floors.—Flagged ; no air beneath.

Wooden cots, with cordage bottoms ; harbour vermin ; easily broken ; iron cots infinitely better.

DUMDUM.

16. *Site*.—Tolerably open ; very low.

Accommodation.—1,649 non-commissioned officers and men ; 31 to 209 men per room ; latter room is 469 feet by 28 feet by 18 feet ; 1,000 to 1,270 cubic feet per man ; 64 to 71 square feet per man.

Verandahs on both sides ; one often used for sleeping, leading inevitably to outbreak of sickness.

Materials.—Solid masonry and iron ; leak badly.

Floors.—Chunar stones, raised 3 feet, with passage of air beneath.

Roofs.—Totally insufficient. There should be wooden floors.

Wooden cots.

BENARES.

17. *Site*.—Open ; external ventilation impeded by city ; internal much obstructed by Suddur bazaar, which requires removal.

Accommodation.—Seven companies infantry, 1 troop horse artillery. 8 barrack rooms ; 38 to 180 men per room. 1 house occupied by 200 men ; cubic feet per man, 1,240 to 2,184 ; square feet per man, 77 to 136. 2 barracks, 26 families each ; cubic feet per family, 3,872 ; square feet, 242. Barrack rooms have doors on opposite sides ; no windows.

Verandahs 10 feet wide.

Materials.—Chunam stone laid in mortar.

Floors, little raised above ground ; no air below.

Wooden cots, with iron bands.

LANDOUR.

18. [Convalescent depôt.]

Site open, and beneficially exposed to winds.

Accommodation.—Twelve barracks, 84 rooms. 228 non-commissioned officers and men ; at from 888 to 1,190 cubic feet per man ; 55 to 119 square feet per man ; built of stone and lime.

Thatched roofs.

Floors, terraced, a foot above ground ; no ventilation below.

Wooden bedsteads : highly objectionable ; harbour vermin, accumulate dust and dirt ; iron bedsteads the best.

MUTTRA.

19. *Site* encumbered with trees, interfering with ventilation, also the large filthy city of Muttra ; broken ground, filthy nullahs, stagnant water, and other nuisances.

Seven barracks ; for 400 European troops ; with 40 to 104 men per room ; 1,000 to 1,575 cubic feet per man ; 60 to 75 square feet per man.

Materials, chiefly unburnt bricks and cement.

Floors raised 2 feet above ground ; stone slabs over brick ; no air below.

Ordinary cots used.

RANEEGUNGE.

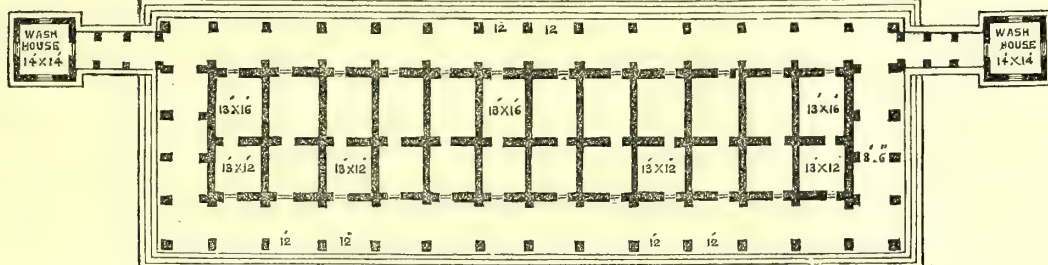
20. *Site* open, exposed to salubrious winds.

Accommodation.—1,120 European, 500 native troops ; 20 barrack rooms ; with 20, 100, and 128 men per room ; at 918 to 1,760 cubic feet and 76 to 100 square feet per man ; doors on four sides.

STATIONS.	REPLIES.
UMRITSIR.	<p><i>Verandahs</i> seldom used for sleeping.</p> <p><i>Materials</i>.—Stone and mud; sunburnt brick; thatched roofs; earthen floors, 3 feet above ground; no air below. Buildings only suitable for troops <i>en route</i>. Permanent barracks required. Iron barracks need verandahs.</p> <p><i>Bedding</i>.—Wooden cots, with iron hoops.</p> <p>21. <i>Site</i> good; freely exposed to the air.</p> <p><i>Accommodation</i>.—15 rooms; 620 British troops, 300 native troops. No dimensions given.</p> <p><i>Materials</i>.—Brick, mortar, and mud.</p> <p>Floors raised 2 feet above ground; no ventilation beneath.</p>
NYNEE TÄL.	<p><i>Bedsteads</i> of dyar; iron suggested as much superior.</p> <p>22. <i>Site</i> perfectly open; 6,409 feet above sea.</p> <p><i>Accommodation</i>.—740 British troops; 230 native troops; 21 barracks, 2 rooms in each; 20 men per room, with 630 cubic feet and 45 square feet per man; construction, temporary; stone, roofed with thatch; not sufficient for troops. Permanent barracks proposed.</p> <p>Floors pukka; 1 to 2 feet above ground; no air beneath.</p>
RAWUL PINDI.	<p><i>Verandahs</i> 6 feet wide; not used for sleeping.</p> <p><i>Bedding</i>, simple rope charpoys, with blankets and sheets.</p> <p>23. <i>Site</i> open; nothing to interfere with ventilation.</p> <p><i>Accommodation</i>.—Eight rooms, 24 men in each, each room 66 feet long by 24 feet wide and 24 feet high, exclusive of roof; giving 1,584 cubic feet and 66 square feet per man.</p> <p><i>Materials</i>.—Burnt bricks and mortar.</p> <p>Floors, raised above ground; no ventilation beneath.</p>
LUCKNOW.	<p><i>Verandahs</i>.—Double; inner one for messing.</p> <p><i>Bedsteads, wooden</i>.—Tape bottoms; iron recommended as less likely to harbour vermin; more durable and neater in appearance.</p> <p>24. <i>Cantonments</i>, about 40 feet above river, open and freely exposed to winds, but not so good as old station. There will be 20 barracks for infantry, 9 barracks for cavalry, when completed. Those for infantry, 72½ feet by 22 feet by 23 feet; 24 men per room; 1,528 cubic feet per man; 66½ square feet per man. Cavalry barracks, 52 feet by 22 feet by 23 feet; 18 men per room; 1,644 cubic feet per man; 72½ square feet per man.</p> <p><i>Materials</i>.—Burnt brick; mud cement; tiled roofs.</p>
CHUNAR.	<p>Floors.—Tile, 3 feet above level, no air beneath.</p> <p><i>Bedsteads, wooden</i>.—Much infested with bugs; iron much better.</p> <p>25. <i>Site</i> elevated, freely exposed to winds.</p> <p><i>Accommodation</i>.—268 British troops, in 25 rooms; with 1,156 to 1,305 cubic feet per man; 43 to 76 square feet per man.</p> <p><i>Materials</i>.—Stone and mortar.</p>
ROORKEE.	<p>Floors.—Terraced or paved; no passage of air beneath.</p> <p><i>Verandahs</i>.—Commonly occupied as sleeping quarters in hot weather.</p> <p><i>Cots</i>.—Wood and string; cane bottomed cots stronger; more easily kept free of insects.</p> <p>26. <i>Site</i> open; some private houses enclosed with trees.</p> <p><i>Accommodation</i>.—For 487 British troops; in 21 barracks; each 100 feet by 10 feet by 20 feet; at 30 men per room; with 666 cubic feet and 33 square feet per man.</p> <p><i>Materials</i>.—Mud bricks; thatch and tile.</p>
JHANSI.	<p>Floors.—Brick, 4 feet high; no passage of air beneath.</p> <p><i>Verandahs</i>, 10 feet wide; not used as sleeping quarters.</p> <p><i>Bedsteads, wood</i>.—Harbour for bugs in the joints; iron preferable.</p> <p>27. <i>Site</i>.—Open in every direction; no obstruction to ventilation.</p> <p><i>Infantry barracks</i>.—Two rooms; 24 men each; each room 67 feet by 22 feet by 28 feet; giving 1,715 cubic feet and 61 square feet per man.</p> <p>Two iron framed rooms, 24 men each; with 1,014 to 1,170 cubic feet and 63 to 65 square feet per man.</p>
BARRACKPORE.	<p><i>Verandahs</i>, 12 feet wide; usually occupied for sleeping in hot season, and temporarily, when the barracks are overcrowded.</p> <p>Floors.—Lime plaster; 3 feet above ground; no passage of air beneath.</p> <p>28. <i>Site</i>.—Much vegetation in neighbourhood; not interfering materially with ventilation.</p> <p><i>Accommodation</i>.—Eighty-five soldiers' rooms; 30 non-commissioned officers' rooms; for 960 single and 120 married men; 1,260 to 1,702 cubic feet per man; 60 to 95 square feet per man.</p> <p><i>Verandahs</i>, 10 to 12 feet wide; not used for sleeping.</p>
DELHI.	<p><i>Materials</i>.—Brick and mortar; pillars on iron frames; mud cement.</p> <p><i>Flooring</i>.—Tiles over brick, 2 to 3 feet above ground; no passage of air beneath.</p> <p><i>Bedsteads</i>, wooden.</p>
MORAR GWALIOR.	<p>29. <i>Site</i>, inside walls of city; not well ventilated; temperature raised by reflected sun heat.</p> <p>Present barracks temporary; for 959 European troops; 1,408 native troops.</p> <p>30. <i>Site</i> open, but trees should be cleared away.</p> <p><i>Accommodation</i>.—For two batteries of artillery, British troops; 12 companies of infantry, British troops; 1 regiment, cavalry, native troops; 2 regiments, infantry, native troops; 48 to 160 men per room; 67 to 93 square feet per man; 1,280 to 1,740 cubic feet per man.</p> <p><i>Materials</i>.—Stone or kutchra or burnt brick and mud; roofs, thatched or tiled.</p>
JUBBULPORE.	<p>Floors of concrete, brick, or stone; in new barracks will be raised 4 feet above ground; no passage of air beneath.</p> <p><i>Bedsteads</i>, wooden.</p> <p>31. <i>Site</i>.—Shut in by rocky ridges and hills; not freely exposed to wind.</p> <p><i>Accommodation</i>.—827 British; 559 native troops; in 10 ranges of barrack rooms; 303½ feet by 20 feet by 17 feet; 1,000 cubic feet per man; 60 square feet per man.</p> <p><i>Materials</i>.—Burnt brick and lime.</p> <p><i>Roof</i>.—Thatched.</p>
DARJEELING.	<p><i>Floor</i>.—Flagged; 18 inches above ground; no air beneath.</p> <p><i>Barracks</i>.—Capable of very great improvement.</p> <p><i>Verandahs</i> on both sides, used as sleeping quarters when men much crowded, as has been the case since March 1860.</p> <p>32. <i>Site</i> open; freely exposed; 7,000 feet above sea.</p> <p><i>Accommodation</i>.—For 115 to 120 convalescents, British; 210 native troops.</p> <p>Three barracks; 2 rooms each, 51 feet by 21 feet by 14 feet; 18 men per room; with 803 cubic feet and 57½ square feet per man; 28 married rooms. One married barrack, damp on account of situation. The others damp from bad roofs.</p>

STATIONS.	REPLIES.
VII. MARRIED QUARTERS. FORT WILLIAM.	<p><i>Materials.</i>—Brick and mortar, roofs shingle; floors wooden; 2 feet above ground; not very free passage of air beneath.</p> <p><i>Verandahs.</i>—Never occupied for sleeping.</p> <p><i>Drainage</i> defective.</p> <p><i>Cots.</i>—Cane bottom; bedding hemp.</p>
DINAPORE.	1. Separate rooms in Queen's barracks for 120 families. Serjeants have separate rooms at the end of all barracks.
CAWNPORE.	2. "Sufficient."
MEERUT.	3. Married people accommodated partly out of barracks, partly in temporary hospital; partly in men's barracks but separate.
AGRA.	4. "Sufficient."
UMPALLA.	5. Families occupy a large separate barrack, with plenty of room.
LOODIANA.	6. Artillery and foot have sufficient married quarters. Dragoons not quite sufficient.
FEROZEPORE.	7. No information.
	8. In artillery, families have separated barracks, two rooms and bath room per family. Fig. 5 shows the plan of these quarters.

FIG. 5.—MARRIED MEN'S BARRACK FOR THE ARTILLERY DIVISION, FEROZEPORE.



Infantry occupy corner rooms of barracks.

9. "Sufficient at present."
10. "Sufficient at present."
11. "Sufficient."
12. Sufficient for all married non-commissioned officers and privates to live separately.
13. No information.
14. Separate barracks for families. "Sufficient."
15. Accommodation for 120 married men and families.
16. Accommodation ample.
17. "Sufficient."
18. None. Either a barrack is divided into temporary quarters, or if under the same roof with unmarried men, the quarters are completely separated from them.
19. "Sufficient" accommodation in "married men's barracks."
20. Married people occupy separate houses. In one or two instances, rooms in barracks, but quite apart from unmarried soldiers.
21. "Sufficient" for married non-commissioned officers. Married men of cavalry occupy old cavalry barracks. In artillery, married people occupy barrack rooms with the men.
22. None.
23. None. Married people occupy same barracks as unmarried men, separated from them by a purdah or cloth.
24. None. Married men use the same barrack rooms as the rest, divided only by a partition.
25. None as yet.
26. Each family has 2 rooms, 18 feet by 12, and 12 feet by 12.
27. Accommodation for 15 married people. Insufficient. Many occupy barrack rooms; some few rent houses.
28. "Sufficient."
29. None. Pendalls occupied temporarily.
30. No information.
31. Married people reside in separate quarters.
32. Married quarters only temporary.
33. "Sufficient."
34. Sufficient as regards mere space.

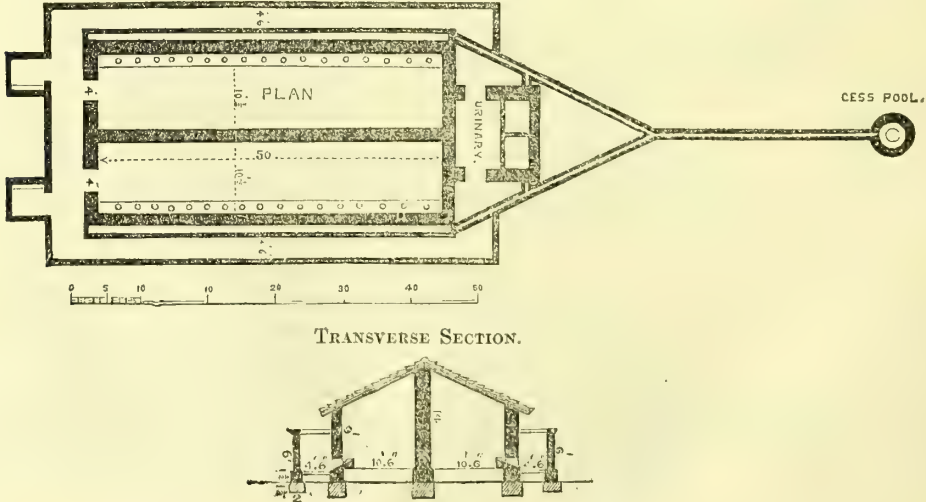
Several of the stations have no prison accommodation; or if it exist, it is of a temporary character. At those stations where there are prison cells, one-half of them are reported as "good;" and the other half as "bad," or "highly defective." The deficiencies are in construction and position. The cells too small, without proper ventilation or protection from sun heat. In some instances they are placed so as not to receive the benefit of winds; and they are so hot as to be uninhabitable during the hot months. Sometimes sickness arises from these defects. In one instance it is reported that the prison has no latrines. Generally speaking, the evidence shows that considerable improvement is required in the prison accommodation in this presidency.

IX. VENTILATION OF BARRACKS.

FORT WILLIAM.	1. By numerous doors, 12 to 13 feet high and 6 feet apart, and openings at the ceiling. Cooling by punkahs. These arrangements, with the height of wards, 17 to 20 feet, said to be "quite sufficient" for purity of air by night and day.
DINAPORE.	2. Doors and skylights, "which latter, however, do not open." Ventilation sufficient during day, when doors are open, but not during night, with closed doors. Cooling by tatties and punkahs, the former apt to cause chills, rheumatism, and ague.
CAWNPORE.	3. Doors, windows, and over-lights, near tops of walls; moveable on horizontal axes; quite sufficient. Cooling during hot winds by tatties, which effect a reduction of temperature of about 10° or more.
MEERUT.	4. By doors, windows, and openings in roof, generally sufficient. Cooling by tatties and punkahs.

STATIONS.	REPLIES.
AGRA.	5. Iron ridge ventilators, with openings in inner walls. Sufficient, provided verandahs not occupied as sleeping rooms. Cooling by tatties, which reduce the temperature of hot west wind from 120° to 80° Fahrenheit. Punkahs used.
UMBALLA.	6. By doors and windows only; tolerably efficient; could be improved by ventilators between roof and verandah. Ventilation of tents still a desideratum. Tatties used for cooling.
FEROZEPORE.	7. Ridge ventilation. Skylights or upper windows, "quite sufficient." Cooling by tatties and punkahs.
JULLUNDUR.	8. By openings along ridge, sufficient. Punkahs and tatties used for cooling.
MEAN MEER.	9. By ridge. Swing windows high up in inner walls; sufficient, when barracks not crowded. Cooling by punkahs and tatties. Thermantidotes would be an improvement.
PESHAWUR.	10. By shafts, by ridge and windows, sufficient. Cooling by tatties.
SEALKOTE.	11. Ventilating apertures along ridge, with upper windows, sufficient. Cooling by tatties.
GHAZEEPORE.	12. Ventilators on ridge. By no means sufficient. Cooling by punkahs.
BERHAMPORE.	13. Roof ventilation by holes 2½ feet in diameter; covered with ventilating zumlahs, sufficient. Punkahs for cooling.
HAZAREEBAUGH.	14. Ridge ventilation running the whole length. Fanlights on pivots over each door; sufficient, because one or more doors are kept open. Cooling by punkahs from April till September.
ALLAHABAD.	15. By doors, and in some instances by small semicircular windows over, and by roof ventilation. In cells by gratings. Generally insufficient, because doors have to be closed in high winds, dust, &c. Cooling by tatties.
DUMDUM.	16. By opposite doors and windows. Circular holes close to ceiling, and ventilating windows in upper floors; holes along roof of verandah, covered with earthenware pots. Ventilation quite insufficient, especially at night, when crowded. Cooling by punkahs.
BENARES.	17. Roof ventilation, and an ample number of doors, sufficient. Punkahs and tatties used in hot season.
LANDOUR.	18. [Convalescent depôt.] Doors and windows; only sufficient for part of the season; no roof ventilation. Barracks not well ventilated and overcrowded.
MUTTRA.	19. Ridge ventilation the entire length; not sufficient at night. Cooling by tatties.
RANEENGUNGE.	20. Iron barracks have each four openings. Others have only doorways. "Sufficient."
UMRITSIR.	21. Several methods of ventilation in use. Ridge ventilators. Skylights with windows, the latter insufficient. Cooling by tatties and punkahs.
NYNEE TÄL.	22. Two ventilators in roof of each hut. Chimneys of bad construction. Constant smoke in huts. Otherwise air "pure."
RAWUL PINDI.	23. Ridge and dormer window ventilation; quite sufficient. Cooling by tatties and punkahs.
LUCKNOW.	24. Doors, windows, ventilators in roof; quite sufficient. Cooling by tatties and punkahs.
CHUNAR.	25. Doors, windows, openings in roof; not sufficient. Cooling by tatties and punkahs.
ROORKEE.	26. Holes in ridge, covered by raised thatch. Small windows at top of walls; sufficient at this station, but in other stations have seen it often very imperfect. Cooling by punkahs and tatties; the latter very badly watered, and often quite dry.
JHANSI.	27. Ventilating windows on both sides, above doors; generally sufficient. Cooling by punkahs and tatties.
BARRACKPORE.	28. Partly by open wall, three feet under roof into verandahs; partly by ventilators in roof; generally sufficient.
DELHI.	29. Cooling by punkahs. In temporary quarters.
MORAR GWALIOR.	30. Small ventilators in ridge of old barracks. Imperfect. Ventilation in new barracks will be ample, by windows, and by tubes in ridge.
JUBBULPORE.	31. Ridge ventilation; not sufficient with a hundred men in barrack. Cooling by tatties.
DARJEELING.	32. By doors, windows, and chimneys. No roof ventilation. Not quite sufficient.
X. DRAINAGE.	1. By open masonry drains to wells opposite gateways, from which sewage is carried to level of main ditch; drainage bad, and requires manual labour. Fluid refuse swept away by garrison sweepers and water carriers with aid of fire engine; much of it evaporates; outlet a foul ditch. Bomb proof barracks damp.
FORT WILLIAM.	2. By open "saucer-shaped" drains, three feet wide, at permanent barracks; by an earthen drain at temporary barracks. Buildings all become more or less damp in wet season; temporary barracks most so. A foul ditch, leading to nullah in vicinity, often very offensive.
DINAPORE.	3. No sewers; only surface drains for carrying off rainfall. "Not intended" for draining cook-houses, privies, &c.
CAWNPORE.	Sewage from privies received in cesspits, and removed by hand daily. Fig. 6 shows a plan of one of the privies at this station, together with the cesspool arrangement usual in such structures.

FIG. 6.—PLAN AND SECTION OF PRIVY ATTACHED TO ECHELON BARRACKS, CAWNPORE.
One per Company.

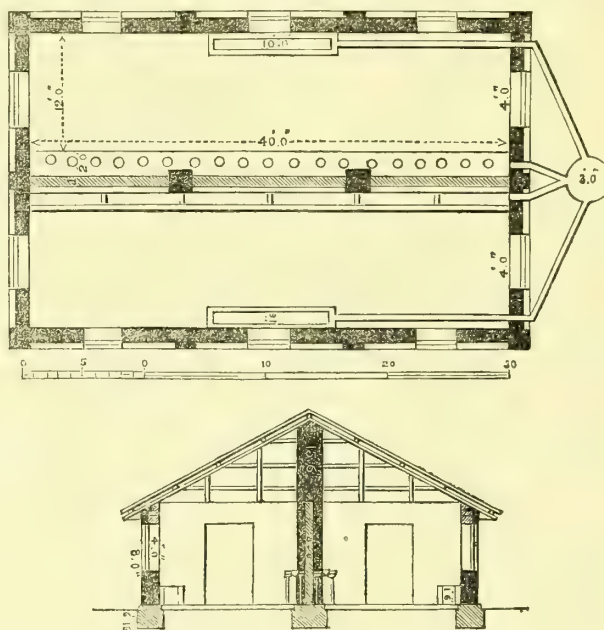


STATIONS.	REPLIES.
UMRITSIR.	21. Surface water passes off by natural drainage. Filth removed by conservancy carts. Other fluid refuse evaporates. Cesspits 30 to 50 yards from men's quarters and hospital.
NYNEE TAL.	22. Natural drainage removes surface water, barracks being built on a hill side. Fluid refuse flows down a steep declivity to plains below. No cesspits required.
RAWUL PINDI.	23. Trenches for surface water. No sewers. All sewage collected in masonry cesspools, and removed daily.
LUCKNOW.	24. Only surface drainage. All fluid refuse received into cesspits or tubs, and removed daily.
CHUNAR.	25. No sewers. Open drains 9 to 18 inches wide and deep. Other drainage received into two cesspools; contents taken away in casks night and morning.
ROORKEE.	26. Trenches for surface drainage. All filth and fluid refuse carried away in tubs.
JHANSI.	27. Surface drainage. Other drainage received into cesspits, 3 feet cube, and removed morning and evening.
BARRACKPORE.	28. Only surface drainage. Filth of all kinds removed by carts.
DELHI.	29. All refuse carried down to the river.
MORAR GWALIOR.	30. Surface drainage by open drains. All other drainage from washhouses, privies, urinals, and cookhouses conveyed into cesspools, and removed by carts. Cesspools "never less" than 50 yards from nearest well.
JUBBULPORE.	31. Simply open drains. No sewers or cesspits. All refuse carried away.
DARJEELING.	32. Open stone drains, by which most of the filth and refuse water are washed away; remainder, including that from privies, carried daily to a distance to cesspits, and earth and lime thrown over. Drainage imperfect.
WATER SUPPLY.	
FORT WILLIAM.	1. Supply principally from river and tanks, partly from rain and wells, the last brackish and unwholesome. Water for cooking, drinking, &c. is carried from a tank on the glacis (filled by surface drainage), at a cost of 134 <i>l.</i> per annum. This tank is kept "perfectly clean," and is "generally free from foul drainage and surface impurities," but from careless habits of bheesties, water sometimes taken from nearer and impurer sources. Many city tanks in a most filthy condition, producing malaria. Amount of water for troops sufficient for drinking and washing, not for bathing. Proposed to supply Fort William from the Hooghly, the filtered water of which contains 9·4 grains of solid impurities in 40 oz. (above 29 grs. per gallon). This supply said to be very perfect, but the river water is not good enough for use for 6 weeks annually.
DINAPORE.	2. Supply from wells and from Ganges. Some years ago, barrack wells poisoned by infiltration from barrack privies. Well water clear and sparkling, but a little brackish; some of it contains sulphate, oxalate, and carbonate of lime, and some chlorides; in one well there is vegetable matter and ammonia. Water raised in leathern or iron buckets, and distributed by bheesties in leathern bags. River water after filtration the best.
CAWNPORE.	3. Water derived from wells; only one tank. Not liable to pollution from leaves. Quantity abundant; no peculiarity of flavour; no chemical analysis; quality "good." Raised in leathern buckets and skins. Carried by bheesties to barracks, and kept in earthen vessels for use.
MEERUT.	4. Water from wells. Tanks used by natives; nuisance and malaria from some of them. Supply soft, excellent, unlimited. Raised by leathern buckets and bags, by hand or by cattle.
AGRA.	5. Principally from wells; occasionally from river. Well water very salt, with few exceptions. Considered heating during rainy season. Contains large quantities of muriate and sulphate of soda and lime. It is laxative, and apt to disagree at first. Supply sufficient. Raised in leathern bags by bullocks, and carried in skins by bheesties for the use of Christian and Mussulman. Hindoos carry their water in brass or earthen jars.
UMBALLA.	6. Water supply from wells; not liable to pollution; amount very limited; in hot weather most wells nearly dry; quality pure, as to sensible properties; hard; contains large quantity of carbonate of lime; no chemical analysis; not injurious to health; raised by Persian wheels and by hand; distributed by masonry channels and by carriers.
LOODIANA.	7. Entirely from wells; kept free from impurities; quality excellent; amount sufficient; no chemical analysis; raised by leather bags and distributed by carriers.
FEROZEPORE.	8. Water from wells; remarkably pure, but not free from some combination with earthy matters; soft, sufficient in quantity; raised and distributed in leather bags. No chemical analysis.
JULLUNDUR.	9. Water from wells; abundant and wholesome; no chemical analysis.
MEAN MEER.	10. Water from wells; filtered before drinking; not liable to pollution; generally good in quality, but some brackish, saline. 1,000 grs. of water contain:—carbonate of soda, 0·494 grs.; carbonate of lime, 0·14; carbonate of magnesia, 0·08; chloride of sodium, 0·095; sulphate of soda, 0·178; silica, 0·013; a small quantity of organic matter. Raised by Persian wheel or large skins. Carried in leather skins for use.
PESHAWUR.	11. Water supply from river Barah by small open canal; stored in tanks, filled daily; quantity about 15 cubic feet per second; colour from suspended matter varies from pale grey to deep red. No chemical analysis. Filtration required.
SEALKOTE.	12. Water from wells; not liable to pollution; very pure generally; some wells contain soda; hard, containing considerable proportion of sulphate of lime. "Very free from impurities." "Decidedly good." No chemical analysis; quantity abundant. Raised for use by rope and leathern bucket.
MURREE.	13. Water derived from numerous springs and two reservoirs, one not liable to pollution, the other full of leaves and surface impurities; quality inferior; colour cloudy and muddy; taste and smell more or less earthy after rain; removable by filtration, but boiling sometimes necessary; no chemical analysis; water soft; amount sufficient; quality considered inferior by native visitors, and to cause colic; boiling and filtration through sand and charcoal render it wholesome.
GHAZEEPORE.	14. Water from numerous wells and from tanks (but not for drinking purposes); quality good and sweet, "and does not seem contaminated by the amount of leaves that necessarily fall into open structures." Great nuisance from a large partially-drained tank. Amount sufficient; no chemical analysis. Raised by bucket and rope, and distributed by bheesties in skins.
BERHAMPORE.	15. Water from river, wells and tanks, chiefly from wells for European troops; supply almost unlimited; well-water tolerably pure, when filtered through charcoal; no chemical analysis. Raised in leathern buckets by hand labour.
HAZAREEBAUGH.	16. From wells and tanks; in some wells the water has a slightly saline taste, in others, it is pure; no chemical analysis, but tests show presence of silicic, phosphoric, hydrochloric, and carbonic acids; hardness, 4·5; tank water alkaline; deposited copiously on standing;

STATIONS.	REPLIES.
ALLAHABAD.	contains organic matter in considerable quantity. All water should be filtered. Drawn by bullocks.
DUMDUM.	17. Water entirely from wells; abundant; contains carbonate of lime; hard; improved by filtration; free from animalcules; sensible properties good; no chemical analysis. Raised and distributed by bullocks and water-carriers.
BENARES.	18. Water from wells and open tanks; quantity abundant; generally clear; sensible properties good. In 40 oz. there are:— <i>Well water</i> : Solid residue, 6·6 grains. Silica, 8 grains; earthy carbonates, 1·8 grains; alkaline chlorides, 0·8; alkaline sulphates, 0·3; carbonates and organic matter, 2·9. <i>Tank water</i> : Solid residue, 2·8 grains. Silica, 2 grains; earthy carbonates, 2·0; alkaline chlorides, alkaline sulphates, carbonates, and organic matter, 0·6. Tank water should be filtered. Raised and distributed for use by bheesties, in leathern bags.
LANDOUR.	19. Derived from numerous wells; clear, without taste or smell; soft and pure; no chemical analysis; contains slight trace of lime, chlorides in large proportions, slight quantity of potash and carbonic acid; amount ample. Drawn by water-carriers, with leathern buckets.
MUTTRA.	20. Water from wells, not abundant, except in rains; good as to colour, taste, and smell; no chemical analysis.
RANEEGUNGE.	21. Water from wells and from river. Some wells contain large quantities of sulphureted hydrogen on account of their low situation and the imperfect surface drainage. This water drunk by natives. In the station some wells good; others close to them impregnated with salts. Abundance of good water. Raised and distributed by ropes and leather buckets. No chemical analysis.
UMRITSIR.	22. From wells; not liable to pollution; supply equals demand; quality excellent, but rather hard; no animalcules; no chemical analysis; water raised and distributed by ropes and buckets.
NYNEE TĀL.	23. From wells; protected from impurities; apparently good; no chemical analysis; some wells contain nitrate of potash; supply ample. Drawn by means of leathern bags.
RAWUL PINDI.	24. Partly from springs, partly from lake; the latter used for drinking, bathing, and washing; supply unlimited, pure, soft, wholesome; no chemical analysis. Raised by bheesties, in skins. Part conveyed to barrack in wooden watercourse.
LUCKNOW. CHUNAR.	25. From wells and river; sensible qualities good; hard; no chemical analysis; quantity sufficient. Raised and distributed by bheesties and bullocks.
ROORKEE. JHANSI.	26. From wells; mostly good; in a few, brackish; no chemical analysis.
BARRACKPORE.	27. From Ganges and wells; quantity inexhaustible, clear, sweet, and inodorous "if allowed to settle before it is drunk." No chemical analysis; soft; under the microscope shows dust, minute fragments of vegetable matter, and feathers of insects. Drawn from Ganges into leather bags, and conveyed by bullocks and bheesties. Raised from wells by hand labour.
DELHI.	28. From canal and wells; soft, good, and very pure; no chemical analysis.
MORAR GWALIOR.	29. From wells; preserved from pollution; supply sufficient; hard; agreeable to taste; no chemical analysis.
JUBBULPORE.	30. From tanks principally, wells, and river; tanks often polluted by decayed leaves from trees; without taste or smell. <i>Analysis of imperial quart</i> .— <i>Tank water</i> : Solid residue, 2·7 grains. Earthy carbonates, 1·02 grains; silica, 38; saline and soluble matter, chiefly chlorides, sulphates, and carbonates, 1·3. <i>Well water</i> : Total solid residue, 12 grains. Earthy carbonates, with sulphates, 6·46 grains; silica, 44; soluble saline matters, chiefly chlorides and carbonates, 5·1. Both waters contain a little organic matter. [Tank water contains 10·8 grains, and well water 48 grains per gallon of impurity, besides organic matter.] Raised and distributed in skins.
DARJEELING.	31. Mostly from river, some from wells; latter, with few exceptions, brackish; not good; contains soda; no chemical analysis. Drawn and distributed in usual manner.
II. ABLUTION AND BATH ACCOM- MODATION.	32. From wells for drinking and cooking; soft, abundant, excellent; no chemical analysis. Drawn by bheesties in leather buckets, and carried in leather bags, stored in baked earthen vessels.
FORT WILLIAM.	33. From wells; abundant, clear, and well-tasted; some wells contain iron; alkaline and soft; no chemical analysis; no microscopic impurities. Raised and carried by bheesties in leathern mussock.
DINAPORE.	34. Abundant supply from numerous mountain springs, some so pure as to be fit for photographic purposes, only containing traces of lime and iron; some contain so much iron as to be used medicinally.
CAWNPORE.	1. Lavatories at end of barracks on each story; stone floors, with raised masonry basin-stands; water flows off to drain surrounding the building; plunge-baths much wanted (included in future plans).
MEERUT. AGRA.	2. Two double wash-houses and one plunge-bath for each wing of barracks; water supplied by bheesties from wells; drained into a nullah; temporary barracks have no bath; lavatories drained into cesspool wells.
UMBALLA. LOODIANA.	3. Ablution-rooms attached to barracks; no baths, but will be constructed. Water is brought from wells by pipes, and drained to nearest drain.
FEROZEPORE.	4. One lavatory per company; two plunge-baths per regiment.
JULLUNDUR. MEAN MEER.	5. Lavatories of solid masonry, with tiled roofs; water supplied from copper cistern filled from a tank attached to well; waste water collected in cesspits and "carted away;" four baths supplied from wells; waste water carried away by surface drainage.
PESHAWUR. SEALKOTE.	6. One lavatory for each barrack; water from wells; no baths.
	7. No information.
	8. Lavatories are small rooms with brick and mortar floors, "adapted for receiving and draining off the water into the subsoil outside, so that the men may freely bathe themselves." Water provided by water-carriers; no bath.
	9. One lavatory for each company; water kept in tubs; no baths.
	10. Lavatories 60 feet from barracks, 180 feet from wells supplying water; water conveyed from the well by an underground drain to lavatory, thence supplied by water-taps, and drained away by a drain; bath, a long shallow tank, "in which the men can lie down and bathe." Larger baths being erected.
	11. No lavatories for European soldiers as yet (August 1860); plunge-bath in each set of lines.
	12. Lavatory for each barrack, also three plunge-baths; water from wells; waste water runs into open cesspits, and thence carted away. It is generally used for gardens.

STATIONS.	REPLIES.
MURREE.	13. No information.
GHAZEEPORE.	14. Lavatory to each barrack ; water supplied from a reservoir behind ; drainage to a reservoir, emptied twice a day by a filth cart.
BERHAMPORE.	15. Each barrack has lavatories for men and women ; water carried from tanks and wells in goat skins, poured into cisterns, and conveyed into rooms by pipes with cocks ; drainage into surface drains.
HAZAREEBAUGH.	16. Ten double lavatories, one single ; basins supplied by water-taps from cistern, and drained away by covered drain into main drain.
ALLAHABAD.	17. Lavatories have cast iron basins, lined with porcelain, and a foot bath. Water supplied from wells by bheesties, and drained into cesspools. Fig. 8 shows the general arrangement of this class of ablution accommodation.

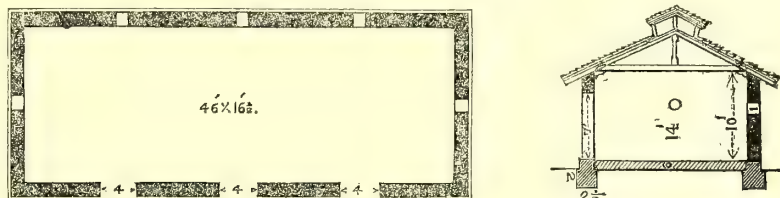
FIG. 8.—PLAN AND SECTION OF A WASH-HOUSE FOR TWO COMPANIES OF EUROPEANS TO BE ATTACHED TO EUROPEAN BARRACKS AT ALLAHABAD.



DUMDUM.	18. Lavatories with metal basins, supplied with water from stop-cocks. No baths.
BENARES.	19. One lavatory per company, supplied with water from a well drained by branch drains. One plunge bath, another required.
LANDOUR.	20. Spacious lavatory with brass basins in a trough, but from the scanty supply of water in the dry season they are not much used, and the men wash in earthen vessels. Drainage to the slope of the hill.
MUTTRA.	21. Three temporary shed lavatories. One plunge bath.
RANEEGUNGE.	22. No information.
UMRITSIR.	23. Oblong building, with masonry stand for earthen jars and basins of water.
NYNEE TÄL.	24. Hill station. No lavatories. Men wash themselves in verandahs.
RAWUL PINDI.	25. No information.
LUCKNOW.	26. Lavatories have a long masonry shelf for washing basins, also a set of small washing rooms, supplied by pipes from cisterns, receiving water from nearest well. A small canal runs the whole length of bath room, to supply water to the bathers, who can draw it in earthen or leathern buckets, and throw it over themselves. Iron bars across canal to prevent bathers "lying at full length in it, and soiling the whole supply." Drained to a drain outside.
CHUNAR.	27. Lavatory for each barrack, except one. Water supplied by bheesties, and runs out through the wall into the drains. No baths. River Ganges used.
ROORKEE.	28. Lavatories, small tiled sheds, with a wall having depressions to hold basins.
JHANSI.	29. Lavatories not finished ; to be on the standard plan.
BARRACKPORE.	30. Wash-house for each barrack. No bath.
DELHI.	31. No information.
MORAR GWALIOR.	32. Lavatory for each company. Tubs or earthen vessels for holding water, supplied by bheesties from nearest well. Wash-hand basins, earthen or metal. Drainage into a cesspool 4 or 5 feet deep. Filth or refuse matter carried away from cesspool every morning.
JUBBULPORE.	33. Lavatories have tubs or half casks for water. Drained into a drain running round building. No baths.
DARJEELING.	34. Eight bath rooms to each barrack. Good water supply from a spring. Refuse water carried off by stone drain.
XIII. DIET AND COOKING.	1. The ration in the Bengal presidency consists of bread 1 lb., meat 1 lb., vegetables 1 lb., rice 4 oz., sugar $2\frac{1}{2}$ oz., tea $\frac{7}{8}$ oz., or coffee $1\frac{3}{4}$ or $1\frac{1}{2}$ oz., firewood for cooking. The ration is considered complete. Vegetables vary according to season, and consist of potatoes, carrots, onions, cabbages, turnips, sweet potatoes, cauliflower, and pumpkins. A larger supply of potatoes is required, and soldiers' gardens would, it is conceived, enable vegetables to be raised in sufficient quantities. Sometimes there is a scarcity of vegetables, and the men suffer from eating too much animal food. It is suggested in one of the returns, that the diet scale of the navy is much better than that of the army. It consists of from 5 to $9\frac{1}{2}$ oz. of animal food, and 26 ozs. of vegetable food, while the army scale in India contains no less than 16 oz. of animal food. Sometimes the men purchase milk, butter, fish, eggs, &c., or fruit, when in season. Complaint is made that mutton is not issued often enough, and that the vegetables are inferior in quality. The men have three meals a day ; breakfast at 8 A.M., consisting of tea or coffee, bread, often animal food ; dinner at 1 p.m., and tea at 4 or 5 p.m.

STATIONS.	REPLIES.
	<p>The cookhouses are small outbuildings, at a short distance from the barracks. They are provided with rude fireplaces, raised a little above the floor, often dark and badly ventilated. No chimneys, the smoke finding its way out as it likes. There are usually four messes in a company; each mess has one copper boiler of eight gallons, one of seven, and one of two gallons, one frying pan, one gridiron, together with ladles, chopper, baskets, &c. The vessels are usually tinned twice a month. In the hands of native cooks they admit of considerable variety of cooking, such as boiling, stewing, roasting, making curries, &c. The cooking is stated generally to be "sufficient." Native cooks are engaged for the companies. They are paid by the soldiers for cooking, and also for such extras in addition to the ration as they may supply. The ration is counted as worth 3 annas 4 pice, or 5d. daily. The kitchens are generally surface drained to cesspits, from which the refuse is carried away daily; or the cesspit is sunk deep enough to be self-draining into the subsoil. Sometimes there is no drainage of any kind, the refuse water being merely thrown out on the surface of the ground. None of the cookhouses appear to have any water supply, except what is carried in skins or vessels by water-carriers.</p> <p>Fig. 9 gives the ground plan and elevation of a cookhouse at Benares, and shows the usual construction.</p>

FIG. 9.—COOKHOUSE, BENARES.



XIV. INTemperance.

FORT WILLIAM.

1. Troops about as temperate as at other stations. Seven trials for habitual drunkenness in 8th regiment in three months. In 5th Fusiliers 2 per cent. habitual drunkards. But average of habitual drunkards in European regiments in this country not less than 15 per cent.

8th regiment, direct admissions from intemperance, to total admissions,	1 in 114.
5th Fusiliers	2 in 100.
8th regiment, indirect admissions	1 in 11.
5th Fusiliers	17 in 100.

Seven regiments in Madras 1849.

	Punished per 1,000.	Admitted per 1,000.	Died per 1,000.
Teetotallers	236·9	1,308·9	11·11
Temperate	587·2	1,415·9	23·15
Intemperate	1,709·8	2,148·6	44·58

Drunkness punished as an offence. Spirits sold in regimental canteens, average daily consumption $1\frac{1}{2}$ drams per man; not issued before dinner. To men in health spirits decidedly injurious in India. They are the curse of the European soldier in India. Beer in moderation greatly preferable. Would be most beneficial to health to suppress spirits altogether, allowing a ration of beer from the canteen instead, also to substitute tea, coffee, &c.

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|-------------|---|
| DINAPORE. | 2. Confirmed drunkards from 1 to $2\frac{1}{2}$ per cent. Spirits sold in canteen, not in bazaar. Daily consumption 1 to $1\frac{1}{2}$ drams per man, 2 drams per day allowed. Spirits "probably beneficial" to old soldiers, but not to young ones." Would be beneficial to abolish spirits as a ration and abolish the sale in canteens, substituting beer, coffee, tea, &c. There should be coffee rooms where the men could have coffee, tea, lemonade, &c. and periodicals. |
| CAWNPORE. | 3. Soldiers fairly temperate. Spirits sold in bazaar; not conducive to health, efficiency, or discipline. Highly beneficial if sale could be abolished. Malt liquor, tea, and coffee preferable; but men might obtain spirits otherwise. |
| MEERUT. | 4. Soldiers temperate; rum sold at canteen. Native spirits occasionally smuggled into barracks. Soldier allowed 2 drams per day, or 1 pint of beer, 1 dram, on payment. Spirits injurious to health; malt liquors and wines less injurious; tea, coffee, &c. better than either; beneficial to prohibit sale of spirits, and permit only beer, tea, coffee, &c. |
| AGRA. | 5. Soldiers usually temperate; spirits sold in canteen, forbidden in bazaar. During cold season, 2 drams of rum, 1 quart of beer, issued to each man per diem. During hot season, 1 dram of rum, 1 quart of beer. This is the average daily consumption per man throughout the year. Evil effect of spirit drinking manifest during last field service; spirits in excess the bane of European soldier; would be better to allow beer or porter; "but they will have spirits," and to abolish the sale would drive men to the bazaar. |
| UMBALLA. | 6. Soldiers temperate; 3 per cent. of admissions caused directly by drunkenness, and 15 per cent. indirectly. Artillery consume three quarters of a gallon of spirits per month per man; hussars, $1\frac{1}{2}$ drams per day; injurious to health and discipline; beneficial to suppress sale of spirits, and substitute beer, tea, coffee, &c. |
| FEROZEPORE. | 7. Soldiers generally temperate; from 1 to 2 per cent. confirmed drunkards; spirits sold in canteen. Each man consumes about 6 oz. rum and 1 pint malt liquor, or 3 oz. rum and 2 pints malt liquor per day. Spirits in moderation rather prejudicial by promoting dram drinking in excess. Advantageous to suppress the sale, if other spirits could not be obtained. Moderate use of beer healthy. Tea, lemonade, &c., better than any. If all spirit selling were suppressed, beer, tea or coffee would materially benefit health. There should be a coffee shop, with reading room and workshops. |
| JULLUNDUR. | 8. Soldiers temperate; no confirmed drunkards; spirits sold in canteen. Average consumption less than a dram per man per day. Injurious to health and discipline. Would be beneficial to abolish sale and substitute beer, coffee, tea, &c. Coffee should be issued before morning parade; and beer at dinner and at night. |
| MEAN MEER. | 9. Soldiers temperate. Consume a great deal of malt liquor in lieu of spirits. One out of 204 admissions caused by drinking. Amount allowed per man per day, 2 drams of spirits, 1 pint of beer, or 1 dram and 2 pints. Would be more healthy without spirits. It tends to subvert discipline and efficiency. Decidedly in favour of beer in place of spirits; but abstinent man more enduring of fatigue and less obnoxious to disease than temperate man. |

STATIONS.	REPLIES.
PESHAWUR.	10. Soldiers temperate; little more than 1 per cent of admissions directly from drink. Average consumption less than a dram per man per day. Would be unadvisable to abolish sale in canteen, as some old soldiers could not do without it. With sufficient malt liquor, sale of spirits could be suppressed.
SEALKOTE.	11. Temperate; about 3 per cent. confirmed drunkards. Average consumption of spirits, 1 dram a day. Some men never take them. Spirits most injurious to health, and prejudicial to efficiency and discipline; should never be offered for sale, as men are induced to take spirits who never would, if they were not so handy. Under no circumstances, except extraordinary fatigue, should spirits be issued; only beer, tea, or coffee should be allowed; and the loss of revenue otherwise compensated for.
GHAZEEPORE.	12. On the whole temperate. Rum sold in canteen; none in bazaar. Two drams a day per man can be purchased. Sale of spirits in bazaar ought by all means to be abolished; but not injurious as sold in canteens. In moderation not injurious; but good malt liquor preferable to spirits in any form. Coffee in the morning better for the soldiers in all points. Total abolition of spirits would not be advisable. No canteen. Spirits and beer issued at once from the tub.
BERHAMPORE.	13. Soldiers usually temperate; 1 in 120 admissions produced directly, 1 in 10 indirectly by drink. Among temperate men, 45½ per cent. of sickness; 34¼ per cent. of crime. Among drunkards, 52½ per cent. of sickness; 65¾ per cent. of crime. Spirits injurious, except to old soldiers, who have indulged in them. Sale should be abolished in bazaars, and allowed under restrictions in canteen. Would be beneficial to substitute beer, except to those who have long indulged in spirits. Well-conducted coffee and reading rooms should be established at a distance from canteens.
HAZAREEBAUGH.	14. Soldiers as a body temperate; one-third of diseases and one-half of crimes, directly or indirectly from drink; but no statistics. Each man may purchase $\frac{1}{20}$ gallon of spirits per day. Actual consumption in 1859, 6¼ gallons per man per year. Spirits decidedly injurious to health, and not conducive to efficiency or discipline. Abolish altogether sale of spirits in canteen and bazaar. Injurious even in moderation. Long cherished idea as to their necessity for the British soldier thoroughly exploded. A man who drinks tea or coffee will do more work than a dram drinker, though considered sober. It is an error to sell spirits in canteen to prevent men obtaining worse spirits in bazaars. It creates craving to be satisfied elsewhere. Selling rum in canteen is an unmitigated curse to a regiment, destructive alike to health and discipline. Even malt liquor not necessary to health in India, but not injurious, or less so than spirits. It will be a "happy day" when only coffee, tea, lemonade, &c. are drunk.
ALLAHABAD.	15. Soldiers temperate; about 1 per cent. confirmed drunkards. Out of 5,021 admissions in 1859, 36 were from delirium tremens (5 fatal); 25 from ebrietas. Many diseases, especially of liver, indirectly from drink. Much sickness and mortality also indirectly. Spirits injurious to health. Entire substitution of malt liquor in canteens would be beneficial. Probable amount of spirits consumed less than a dram per man per day. But 1 quart of beer and 2 drams of rum may be purchased. Suppress sale of spirits, permit beer, coffee, tea, lemonade, &c. only to be sold.
DUMDUM.	16. Soldiers usually temperate. Out of 850 admissions, 2 were from delirium tremens; 10 ebrietas. Spirits sold in canteen. Drugged spirits in bazaar. Spirits injurious to health, most prejudicial to discipline. Would be beneficial to suppress sale in canteens, and to permit only beer, coffee, tea, &c. to be sold, with exceptions in special cases. Permit no native grog shops within 4 miles of cantonment.
BENARES.	17. On the whole temperate. Spirits sold in canteen. Each man may purchase 2 drams a day. Average consumption last half-year, ½ a dram and ½ a pint of malt liquor daily per man. Spirits certainly injurious, and the great cause of sickness and crime in a regiment. Malt liquor beneficial. Prohibit sale of spirits in canteens, and permit only beer, coffee, tea, &c. to be sold.
LANDOUR.	18. Spirits sold in canteen, if allowed by surgeon. Extent 2 drams a day. In moderation conducive to health. Nothing deleterious to discipline or efficiency in issuing spirits in well-regulated canteens. Health, morality, and discipline, very much improved since use of malt liquor encouraged.
MUTTEA.	19. Artillery very intemperate; 10 per cent. confirmed drunkards. Cavalry temperate; 1 admission in 91½ caused directly by intemperance; 2 drams of rum per man per day allowed in canteen. Any amount of bazaar spirits attainable. As a general rule, spirits not conducive to health or discipline; but could not be withheld from men accustomed to them. Suppress sale to all men under 30 years of age. Malt liquor better. Suppress spirits gradually, and permit only beer, coffee, tea, lemonade to be sold.
RANEEGUNGE.	20. Troops temperate. Spirits sold in bazaar. No canteen. In moderation not injurious. But malt liquor the best beverage.
UMRITSIR.	21. "Rather intemperate." Directly, one-sixth, indirectly one-half, of admissions from drink. Spirits sold in canteen, but not allowed in bazaar. Average consumption, 2 drams per man per day. Its effect on health "injurious to the last degree." Malt liquor and wines beneficial. Suppress spirits altogether, and permit beer, coffee, and tea to be sold; but it might be injudicious, as men who wanted spirits could get country liquor.
NYNEE TÄL.	22. Temperate. One case delirium tremens last year. Men all invalids, require daily stimulant, 1 quart of beer and 1 dram of rum allowed daily. Amount specified conducive to health. Suppression of spirits generally would be beneficial, with exceptional cases.
RAWUL PINDI.	23. Temperate; 7 out of 282 admissions directly, and 1 out of 282 admissions indirectly from drink. Rum sold in canteen; 2 drams a day allowed. More injurious to health than otherwise. Necessary on a march. If abolished, worse spirits would be got. Malt liquor preferable.
LUCKNOW.	24. Not much intemperance. Spirits sold in canteen. As a rule not conducive to health. Should be abolished, except in exceptional cases. Malt liquor and wine beyond doubt preferable. Beneficial to prohibit the sale in canteens, substituting beer, tea, coffee.
CHUNAR.	25. Soldiers mostly temperate. One man in 20 a confirmed drunkard. Admissions on a ten years' average, from drink, directly, 1 in 3; indirectly, 1 in 7½. In 6 years, among 12 total abstainers, no deaths, no crimes. Among 576 temperate men, deaths, 8·84 per cent. of strength; 4·12 of admissions. Crime, 42·01 of strength. Among drunkards, deaths 14·21 per cent. of strength; 8·13 per cent. of admissions. Crime, 426·87 per cent. of strength. Temperate men, with few exceptions, all drink occasionally. Spirits sold in canteen; about 2 drams per man per day consumed. Impossible to state how much is sold in bazaar. Use

STATIONS.	REPLIES.
ROORKEE.	<p>of spirits, except in few cases, injurious and most destructive as regards efficiency and discipline. Malt liquor beneficial. Prohibit sale of spirits, except in certain cases. Discourage by every means men acquiring a taste for it. Absolutely interdict it on passage out, giving malt liquor instead.</p> <p>26. Soldiers generally temperate. Still much disease and crime from drinking of spirits. Sold both in canteen and bazaar. "All spirit drinking injurious to health." Almost all crime caused by it. Ought to be abolished in canteens and bazaars. At present collectors encourage sale as much as they can, for the sake of revenue. In Burmah, when malt liquor could be had, health always improved. Marked change for the worse when spirit was issued instead. Since beer was introduced, the tremulous, yellow-skinned, emaciated spirit-drinker rarely met with.</p>
JHANSI.	<p>27. Temperate. Spirit sold at canteen. Not injurious in moderation. Not conducive to health. Malt liquor and wine beneficial, being tonics. Spirits only temporary stimulants. Beer might be substituted by degrees for spirits, but would not be beneficial to prohibit sale to men accustomed to spirits.</p>
BARRACKPORE.	<p>28. Liquor too easily procured. A good deal of intemperance. A rather large number of confirmed drunkards. Fourteen to 15 per cent. of admissions directly from drink. Spirits, injurious to health. If entirely abolished among European troops, and dietary improved, &c., mortality would be "extraordinarily diminished." Malt liquors, although not essential, not injurious. Decidedly beneficial to suppress spirits, though it would excite discontent at first. Men should have employment, recreation, good tea, coffee, milk, more variety of food and cooking.</p>
DELHI.	<p>29. "Inclined to be intemperate." Four men per company confirmed drunkards. Spirits sold in canteen. About three-fourths take one dram, one fourth two drams each per day; injurious. Moderate use of malt liquor or wine good. Not beneficial to suppress the sale of spirits, because country liquor would be bought instead.</p>
MORAR GWALIOR.	<p>30. Several intemperate men. Liquor difficult to get at present. Less than 1 per cent. of admissions directly; more than 2½ per cent. indirectly, from drink. Spirit causes a good deal of sickness. Fatal cases occur mostly among intemperate men. Drunkenness much the prevailing crime at station. Spirits sold in canteen to the extent of one dram with beer, two without, per diem. Ardent spirits, except as medicine, always injurious. Malt liquor much less so. Most beneficial to suppress sale of spirits, if men did not use native liquor. Recommended prohibition of distillation, except for medical or chemical purposes.</p>
JUBBULPORE.	<p>31. As a rule intemperate. One in 200 a confirmed drunkard. Spirits sold in canteen, and illegally in bazaar. Some men take one dram, others two per diem. Old soldiers often take a dram before parade; injurious. Highly beneficial to abolish spirits. Malt liquor beneficial. No doubt a cup of good hot coffee most wholesome stimulant for a soldier. Entire suppression of spirits would undoubtedly increase health and efficiency of troops.</p>
DARJEELING.	<p>32. Soldiers temperate. No admission to hospital from intemperance. Each man not attending hospital, or in hospital, may purchase daily 2 drams rum, or 1 dram of rum and 1 bottle "day." No hesitation whatever in saying that spirits are "decidedly and highly injurious" to troops, and anything but conducive to efficiency or good order. Would be, without doubt, beneficial to abolish altogether the use of spirituous liquors, if done gradually and wisely. The soldier would not be such a drunkard but for his condition. Better that condition, and the British army may become a sober one. Wine, malt liquor, and spirits all injurious in excess. Malt liquor least so. Use of tea, coffee, lemonade, &c. would afford a striking contrast in the result to the other drinks mentioned. There should be restaurants where men could get tea, coffee, newspapers, magazines, and mix with men of other regiments, instead of the discomfort of the everlasting barrack room.</p>
<p>XV. INSTRUCTION AND RECREATION.</p>	
FORT WILLIAM.	<p>1. There are at this station one ball court and eight skittle alleys; two regimental schools and a garrison school; one garrison library and regimental libraries; a theatre and a gymnasium. There are no day rooms, no soldiers' clubs, no gardens, no workshops. Cricket, foot-ball, and quoits are played morning and evening. Present means said to be "sufficient." Savings banks decidedly most advantageous. Ground floors of barracks and verandahs afford ample shade for recreation.</p>
DINAPORE.	<p>2. One five court and four skittle grounds. A school, a library, and reading room, well lighted. A soldiers' garden, not used. Workshops insufficient. A station theatre. No gymnasia. Means not at all sufficient to keep the men occupied during wet weather and heat. A large covered space wanted for workshops, skittle grounds, ball alleys, quoits, &c. A farmyard would be advantageous, as would also be the institution of savings banks. Men confined to barracks in hot weather; said to be "beneficial." No shade, but from verandahs.</p>
CAWNPORE.	<p>3. A ball court and skittle grounds. Regimental schools, libraries, and reading rooms. Workshops for tailors, shoemakers, and armourers. Cricket and quoits. Theatre occasionally. No gymnasium. Means insufficient. Properly constructed skittle grounds, gymnasia, and shooting galleries, and swimming baths required. Regimental savings banks in full operation. Men confined to barracks from 7 a.m. to 5½ p.m. in hot weather. "At least there is an order to that effect, but it is often disobeyed." No shade whatever, except barrack verandahs.</p>
MEERUT.	<p>4. Ball courts and covered skittle grounds. Schools and a theatre. No library, no day room, no soldiers' club. No gardens, no workshops, no gymnasia. Present means not sufficient to keep men occupied during wet or heat. Savings banks very advantageous. Men should have indoor employments at trades. Shade quite insufficient. Men confined to barracks from 8 a.m. to 4½ p.m. in hot weather. Less restriction in cold season, "and with the best possible results."</p>
AGRA.	<p>5. Double ball court, and three skittle alleys; schools, library, and reading room, indifferently lighted at night; soldiers' garden, worked by natives, supplies vegetables for mess; no soldiers' clubs, no day rooms, no workshops, no theatre in barracks, no gymnasium. Means insufficient for affording occupation in hot and wet weather. Men confined to barracks between morning and evening parades; restriction said to be "necessary, but very irksome." A large covered building for gymnasium, workshops, games, &c., "would draw many men from their cots, where they idle and sleep all day." No sufficient shade. Savings banks useful for provident men.</p>
UMBALLA.	<p>6. Ball courts and skittle grounds. Schools, library, and reading room, well lighted. Soldiers' garden. No day rooms, no soldiers' club, no workshops, no theatre, no gymnasia. Lofty</p>

STATIONS.	REPLIES.
LOODIANA. FEROZEPORE.	<p>spacious buildings for these purposes would add greatly to health, comfort, and amusement in hot weather. Part of building should be used for games; part for library, reading room, coffee room, theatre, plunge baths. Shade not sufficient. Men confined to barracks from breakfast to 5 p.m., "beneficial."</p> <p>7. No information.</p> <p>8. Ball courts and skittle grounds. Schools, library, and reading room, sufficiently lighted. One soldiers' garden, theatre, and gymnasium. No day rooms, no workshops. These latter, with a coffee shop, would be an important inducement for men occupying themselves during the heat.</p>
JULLUNDUR.	<p>9. Ball courts and skittle alleys. A regimental school, library, and reading room, sufficiently lighted at night. One garden, a private theatre, not in use. No workshops, no gymnasias, no sufficient shade. There are savings banks; decidedly advantageous.</p>
MEAN MEER.	<p>10. Skittle grounds. Schools, library, and reading rooms. Several theatres. Billiard room for serjeants. Cricket, chess, backgammon, bagatelle for men. No ball courts, no day rooms, no clubs, no gardens, no workshops, no gymnasias. Photography, modeling, and drawing suggested. No sufficient shade. Double fives court much needed. Men confined to barracks in heat of day. Savings banks have been of greatest use.</p>
PESHAWUR.	<p>11. Ball court and skittle grounds. Schools, libraries, and reading rooms, well lighted at night. A theatre. No workshops, no gymnasias, no garden. There should be regimental gymnasias and reading rooms, separate from barracks. Men confined to barracks in hot weather from 10 a.m. to 4 p.m. Savings banks highly advantageous. No shade.</p>
SEALKOTE.	<p>12. Ball courts and skittle grounds. Schools and regimental libraries. A reading room, very well lighted at night, provided with chess, backgammon, dominoes, and 16 newspapers and periodicals. A soldiers' garden, with seeds and tools provided by Government, who grant prizes for best cultivation. Armourers', saddlers', tailors', shoemakers', and one watchmaker's, shops. Theatres. Cricket and regimental clubs, foot balls and quoits; the latter a favourite game. A gymnasium strongly recommended. Workshops for every trade might be instituted. Savings banks advantageous; that of one regiment has 8,000%. Sufficient shade for exercise. Present means sufficient, if properly used.</p>
MURREE. GHAZEEPORE.	<p>13. No information.</p>
BERHAMPORE.	<p>14. One ball court, two skittle grounds. No other means of instruction or recreation. "Almost everything in this way has yet to be done." Men confined to barracks from 8 a.m. to 5 p.m. No shade, except verandahs, which are too small and under water during the rains.</p>
HAZAREEBAUGH.	<p>15. Five ball courts, two skittle grounds. Library and reading room, but neither lighted at night. A theatre is being fitted up. No schools, no day rooms, no soldiers' gardens, no workshops, no gymnasias, no sufficient shade. Men restricted to barracks from 8 a.m. to 5½ p.m. Savings banks advantageous.</p>
ALLAHABAD.	<p>16. Ball court and skittle grounds. Regimental school, Government library, not lighted at night. A temperance reading room, well lighted, and having upwards of 200 members. No gardens. Armourers', shoemakers', and tailors' shops. A small theatre. No gymnasium. Further means of amusement and occupation advisable, "as the long days of the Indian hot weather hang heavily on the soldiers' hands." Men can exercise in the verandahs.</p>
DUMDUM.	<p>17. Skittle grounds. Schools, libraries, and reading rooms, well lighted sometimes, but generally lighting defective. No ball courts, no day rooms, no clubs, no gardens, no workshops. All commanding officers concur in recommending the latter. No theatre, no gymnasium. Present means not sufficient for hot and wet weather. Soldiers confined to barracks from 8 a.m. to 5 p.m.; said to be "beneficial to health." Men exercise in verandahs. Savings banks highly advantageous.</p>
BENARES.	<p>18. Fives courts and several skittle grounds. A school; no library, nor reading room; no day room, nor soldiers' club; no gardens, no workshops, nor gymnasias; no theatre, except a barrack room, occasionally used. Present means "totally insufficient for occupying the men." Great success lately attended the opening of a small museum, illustrated by lectures showing "that soldiers are ready to avail themselves of any means of rational amusement in the evening, in preference to spending all their time in the canteen." No sufficient shade.</p>
LANDOUR.	<p>19. One ball court and three skittle grounds. Two schools. One library and reading room, sufficiently lighted at night. One day room. One garden, two workshops, a station theatre. No gymnasium. One gymnasium and more workshops required. Present means scarcely sufficient. No sufficient shade. Men confined to barracks from 8 a.m. to 5 p.m., "with the very best effect on their health."</p>
MUTTRA.	<p>20. A ball court, four skittle grounds, school room, good library and theatre. No reading nor day rooms; no soldiers' gardens, no workshops, nor gymnasias. No restriction as to exposure required.</p>
RANEEGUNGE. UMRITSIR.	<p>21. No means of instruction, occupation, or amusement whatever, except a soldiers' garden, for which there are no tools, although indented for a year ago. Carpentry, saddlery, and coopers' work are in great demand, and would benefit the men, as regards health, morals, and finance. No sufficient shade.</p>
NYNEE TÁL.	<p>22. Only two skittle grounds, and no sufficient shade for exercise.</p>
RAWUL PINDI.	<p>23. A ball court and two skittle grounds. Schools, library in an unsuitable room. No day room, no club, no gardens, no workshop, no theatre, no gymnasias. Men not sufficiently occupied during wet and heat. Restricted to barracks, which is supposed to be beneficial to health.</p>
LUCKNOW.	<p>24. Two skittle grounds, one school, one library, well lighted; men confined to barracks in heat of day. Present means not sufficient to keep men occupied. No shade, except verandahs.</p>
CHUNAR.	<p>25. Nothing but schools, no ball courts, no skittle grounds, no day rooms, no gardens, no workshops, no theatre, no gymnasias, no library or reading room, except the barrack room. Present means not sufficient; men confined to barracks during the day "with the best results."</p>
	<p>26. The following means are being established:—ball courts and skittle grounds, schools, library and reading room, day room, gardens, theatre and gymnasias; but no workshops, which should be built, and then the means would be ample. Men restricted to barracks in hot months.</p>
	<p>27. No ball court, one skittle ground under construction; two schools, a library and reading room, not kept open at night. No day rooms, no clubs, no gardens, no workshops, no theatre, no gymnasias. Present means insufficient. No restriction as to exposure in sun and rain, "Men go about at all times, and except when under the influence of liquor do not appear to suffer from exposure." Shade insufficient. [N.B.—The mean temperature of</p>

STATIONS.	REPLIES.
ROORKEE. JHANSI. BARRACKPORE.	<p>this station is 65° in December and January; and 92° in June; the sun temperature as high as 120° in June, and yet the men do not "suffer from exposure".]</p> <p>28. No information.</p> <p>29. Schools, library and reading room, day room, one garden, and workshops. No ball courts, no skittle ground, no theatre, no gymnasia. Present means not sufficient; all the above should be supplied, together with swimming baths. Shade not sufficient. In hot weather, men restricted to barracks from 8 a.m. to 5 p.m. Savings banks advantageous.</p>
DELHI. MORAR GWALIOR.	<p>30. Companies' skittle alleys, a school, library, and reading room, used as a day room. Present means not sufficient. No gardens, no workshops. The following are required:—fives courts, a theatre, gymnasia, swimming baths, public reading of good biographies, travels, novels, &c. Trades of various kinds, such as clothing, accoutrements, barrack furniture, watch making, printing, paper making, baking. Savings banks should be connected with workshops. No sufficient shade.</p> <p>31. Skittle grounds, schools, a library and reading room sufficient. Soldiers confined to barracks in hot weather. Shade not sufficient.</p>
JUBBULPORE. DARJEELING.	<p>32. Company skittle grounds, regimental schools, library and reading room. No doubt ball courts, clubs, gardens, workshops, theatre, and gymnasia will be introduced in due course. Shade insufficient.</p> <p>33. One skittle ground, one school, one regimental library and reading room, one armourers' shop, one theatre. Means insufficient. No sufficient shade.</p>
XVI. DRESS.	<p>34. Two skittle grounds in a very bad state of repair; one school, good library and reading room, two gardens worked by natives. Tailors, shoemakers, tinsmiths work at their trades in barracks; only carpenters have a workshop. A hospital reading room and reader. Means insufficient. Rains fall incessantly for five months, and men are pent up in barrack rooms to the great injury of their health. Different kinds of recreation under cover should be provided for this.</p> <p>There are two kinds of dress in use, one for cold weather, the same as in England; the other consisting of khakee tunic and trowsers, wicker helmet for summer wear. Dress generally considered as suitable for climate and duties. The boots are complained of as being bad. Flannel is considered indispensable. Great coats are used on night guard. Surgeon Major Hare, 2d Bengal Fusiliers, gives in the Roorkee report some interesting information regarding the waterproofing of soldiers' clothing, which is worthy of consideration. At Peshawur, a wadded coat is issued for winter wear.</p>
XVII. DUTIES.	<p>The routine of duties varies in different regiments and at different stations. They consist of drills, exercises, and guards; drills occupy one to one and a half hours in the early morning, and half an hour to one hour in the evening; from peculiar circumstances they sometimes do not recur every day. Guards last 24 hours, coming round sometimes every fifth day, giving the men four successive nights in bed, sometimes only once a fortnight, or once in three weeks. With few exceptions, the reporters concur in stating that night guards are not injurious to health, if proper precautions are exercised as to clothing and shelter. From neglect of these, men coming off guard are often found affected with slight rheumatism or bowel complaint. No injury follows night guards properly conducted, even at unhealthy stations. One of the reports indeed states that they are not only not prejudicial, but rather beneficial in hot weather. A few of the reports state night guards to be directly injurious. There is no evidence that the men suffer in health from the usual drills, duties, and exercises, except in the case of raw recruits. Grooming horses is said to be healthy. At all the stations the practice exists of confining men the whole day to barracks in hot weather; the confinement beginning as early in one case as 6½ a.m., and lasting till the approach of sunset.</p>
XVIII. PERIOD OF SERVICE IN INDIA.	<p>All the reports concur in stating that, before a soldier is sent to India, he should be perfected in his drill at home; otherwise he will be sure to suffer from the climate. All the reports, with three or four exceptions, recommend that the soldier should be sent direct from home to India, instead of to any intermediate station. They all concur in stating that none but men whose constitutions are fully formed are fitted for Indian service; and the ages between 20 and 25 are, in general, considered the best ages for beginning such service. They further agree in this important point, that men should be sent from England so as to arrive in India between November and February; there is a general concurrence as to the propriety of exercising great care with recruits on first landing there, and as to sending them direct to their regiments.</p> <p>There is considerable difference as to the period of useful service a soldier may fulfil in India. The lowest period named is from three to five years; the highest from 15 to 25 years. The opinion in one station report is that a soldier in India may serve as long as in any country out of his own, provided due care be taken of his health. Under existing sanitary conditions, the prevailing opinion appears to be, that a soldier can serve in India from 10 to 12 or, perhaps, to 15 years at certain stations.</p>
XIX. HILL STATIONS. FORT WILLIAM. DINAPORE. CAWNPORE. MEERUT. AGRA.	<p>Invalids leaving India should do so in time to reach England in early summer.</p> <p>1. No experience. But consider hill climates beneficial to the weak and to men suffering from functional disease; but useless, or even hurtful, to organic disease. Troops on return to plains not more liable to fevers. At Kussowlie, Subathoo, Simla, and Dugshai, "white purging" prevails, often causing serious losses in the regiments. Croup and diphtheria also occur. Natives suffer from typhoid fever. "Troops should be located on hills, with "short periods of service on plains." Best elevations 4,000 to 8,000 feet, with good drainage, thorough ventilation, space, and freedom from local causes of diseases.</p> <p>2. No experience, but approve. But there is too often want of room for exercise, and difficulty in feeding the men. Hazareebaugh has a climate almost equal to the hills for health.</p> <p>3. No experience. A certain number of men should be selected from all corps and sent to the hills alternately.</p> <p>4. No experience.</p> <p>5. Decidedly approves of hill stations. Hot season there most agreeable, but cold season most invigorating. Men residing on hills keep their stamina best and stand work better on the plains than other troops. Barracks at Landour imperfect. Elevations of 4,000 feet beyond the influence of tropical climates, and less cloudy, but not so cold and bracing as higher elevations. Plenty of level ground, good water, and easy access are desiderata.</p>

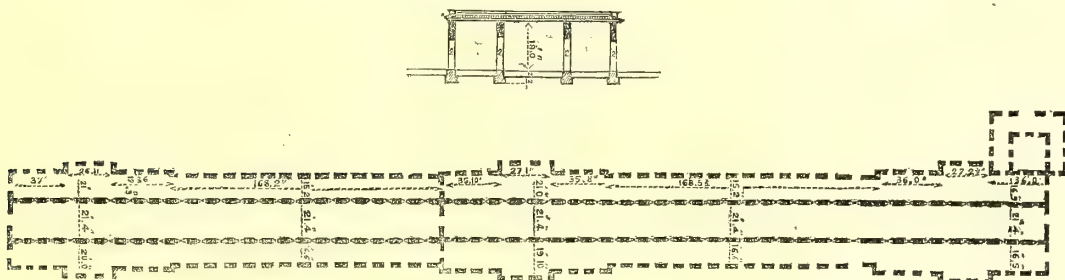
STATIONS.	REPLIES.
UMBALLA.	6. Hill stations are highly favourable to troops arriving in health, if lodged in good barracks; unfavourable in some states of disease. Dry, spacious, well ventilated barracks have been the great want of hill stations. Want of vegetables has been productive of much mischief. Approves of hill stations.
LOODIANA. FEROZEPORE.	7. No experience. 8. Approves. Occasional location every third or fourth season on the hills the best manner of using hill stations.
JULLUNDUR. MEAN MEER.	9. Disapproves of hill stations generally. 10. Approves most strongly; but troops have suffered at hill stations from bad barracks, want of sanitary measures, and indifferent rations. Those with organic disease are sure to suffer. Men on arriving are liable to internal congestions, and no hill station has perfect immunity from cholera, bowel complaints, and fevers. Men on returning to the plains suffer from febrile attacks at first, but are afterwards healthier than those who remained on plains. Residence at 4,000 feet safe during whole year; at greater elevations from April till November only. Service on plains, with short periods of residence on hills, would be most healthy.
PESHAWUR.	11. No experience, but approves; and, as a general rule, considers it would be more healthy to locate troops on plains with short service on hills.
SEALKOTE.	12. Troops do better on plains than hills, where station is healthy; they are more efficient and less liable to bowel affections. Where plain stations are healthy, no advantage in quartering troops on hills. Occasional change may benefit a regiment. "It has, however, not yet been shown that European cavalry corps, never quartered at hill stations, are less efficient in any way than infantry corps, taking their tour at these stations."
MURREE. GHAZEEPORE.	13. No information. 14. Approves most decidedly. "There is a form of diarrhœa and dysentery prevalent at Kussowlie and Subathoo, most difficult to treat or cure; and, I believe, it is the same at most other hill stations."
BERHAMPORE.	15. Strongly approves. Mild diarrhœa prevails, attributed to the drinking water. Considers service in plains, with change to hills, the best.
HAZAREEBAUGH.	16. Hills healthy for healthy men. Caution required for invalids. Quite unsuited to many diseases. Favourable to most lung diseases. Persons coming from plains liable to bowel complaints. Warm clothing required. Too much the fashion to coop men up on rainy days in gloomy hill barracks.
ALLAHABAD. DUMDUM. BENARES. LANDOUR.	17. Strongly recommends occasional residence; but considers standard of health among troops in Upper Provinces, as a rule, not inferior to that among troops on hills. 18. No experience. 19. No experience.
	20. Thinks hill stations, as a rule, should be set aside for sick and weakly men, carefully selected from regiments on the plains, but not for whole regiments. Has been at Kussowlie, Landour, Simla, Subathoo, Murree. Has observed diarrhœa contracted at Kussowlie, where barracks are faulty and overcrowded; never almost gets well, until patient removed to plains, "and not then, unless disease taken in time." Has known "scorbutic diarrhœa" almost decimate a regiment at Kussowlie." Landour remarkably healthy. Thinks service in plains with short periods in hills the best; but would insist on numerous sanatoria in hills, with the best possible barracks, &c.
MUTTRA. RANEEGUNGE. UMRITSIR. NYNEE TÂL.	21. No experience; but approves of hill stations. 22. No experience. 23. No experience; but approves of hill stations. 24. Approves most decidedly. Headquarters should be on the hills, with detachments doing duty on the plains.
RAWUL PINDI.	25. Decidedly approves; but does not believe that every altitude will be found equally healthy. Convalescents suffer all more or less from diarrhœa. Recommends wearing flannel.
LUCKNOW.	26. Approves of hill stations; but troops very liable to diarrhœa on arriving. Considers location on hills with short service on plains the best.
CHUNAR. ROORKEE.	27. No experience. 28. Much approves; but regiments suffering from disease have often had great mortality and sickness on being sent to hills. Would locate entire regiments on hills. Diarrhœa very common. Chief want of hill stations, fresh vegetables and pure water. In rains, water loaded with rotten vegetable matter, causing diarrhœa.
JHANSI. BARRACKPORE. DELHI.	29. No experience. 30. No experience. 31. Approves. Troops should be located on hills with short service on plains. Accommodation not sufficient for convalescents at any hill station.
MORAR GWALIOR.	32. No experience; but has no great confidence in hill stations. Considers that invalids should be sent to the sea-side.
JUBBULPORE.	33. Has been in charge at Dugshai. During first season mortality large, more than one-half from hill diarrhœa; worst cases among men who had previously suffered from fever in Peshawur. Excess of cold caused much mortality. Health improved in second year. European troops should be located on well chosen hill stations with short service on plains.
DARJEELING.	34. Approves strongly. No peculiar diseases at Darjeeling. Troops should be located on hills, with short service on plains. Present barrack and hospital accommodation here not sufficient for health or comfort.
XX. HOSPITALS.	
FORT WILLIAM.	1. Site.—Three-quarters of a mile from Fort; partly open; site, "healthy for Calcutta." Water supply from tank. Drainage.—Imperfect; mere open surface drains, discharging into a foul open ditch, receiving the sewage of the gaol and hospital, 100 yards from the wards; a great nuisance. Construction.—Sick only on upper floors; roof water carried off by surface drains; walls, brick and mortar; verandahs, inner one frequently used for sick; buildings, 2 and 3 floors high; constructed in 1795. Accommodation.—Forty-two wards for 420 beds, at from 1,630 to 1,927 cubic feet, and from 78 to 181 square feet per bed. Numerous windows open to the floor. Ventilation by windows, doors, jhilmils; sufficient. A constant current through the wards and no closeness. Punkahs are used. Cleansing.—Walls and ceilings cleansed and whitewashed once yearly. Latrines 61 feet from wards, reached by covered passage; ordinary close stools emptied when used.

STATIONS.	REPLIES.
DINAPORE.	<p><i>Lavatory and baths.</i>—Hot and cold baths in each wing, besides ordinary bathing room.</p> <p><i>Hospital washing</i> in compound.</p> <p><i>Bedding.</i>—Wooden or iron cots, the latter preferable.</p> <p><i>Storage.</i>—Sufficient at ordinary times.</p> <p><i>Cooking.</i>—Common native cooking places and an open fire for roasting.</p> <p><i>Attendance.</i>—Hospital serjeant, two European ward masters, and native ward coolies. Proposed to introduce European female nurses, one to every 25 patients, to whom it would be "more grateful."</p> <p><i>Sanitary state.</i>—"As good as circumstances will allow."</p> <p><i>Convalescents.</i>—Special wards "superfluous," as "soldiers are generally kept in hospital till reported fit for duty."</p> <p><i>Female hospital.</i>—Buildings not very airy, but arrangements "most satisfactory."</p> <p>2. <i>Site.</i>—As healthy as can be obtained, but not well ventilated. That of temporary hospital somewhat better. Cook-houses and privies not judiciously placed.</p> <p><i>Water supply</i> from wells and river, abundant.</p> <p><i>Drainage</i> by pukka drains to river; temporary hospital drained into cesspools.</p> <p><i>Construction.</i>—Floors $1\frac{1}{2}$ to 2 feet above ground; no passage for air beneath; brick and mortar; verandahs 10 feet wide, used to accommodate sick when central ward is full. Buildings on one floor; erected in 1821, 1851, and 1859. Fig. 10 is a plan and section of this hospital, showing that it is only a long passage 633 feet in length, a most unsuitable construction for a hospital.</p>

FIG. 10.—PLAN OF EUROPEAN PERMANENT HOSPITAL AT DINAPORE.

Total length of Ward 633 feet; 150 Beds.

CROSS SECTION OF HOSPITAL.



Accommodation.—Two wards for 128 and 150 beds respectively, at from 1,308 to 1,595 cubic feet and 77 to 88 square feet per bed.

Ventilation.—Wind does not blow across the permanent hospital. It does so in the temporary hospital; doors and skylights used in former; doors, openings, and roof ventilation in latter; ventilation sufficient in permanent hospital only when doors are open; sufficient at all times in the temporary one; tatties used for cooling.

Cleansing.—Limewashing twice a year, and every 3 months to the height of 6 feet.

Latrines over drains to the river bank; water supplied by hand; offensive in spite of use of lime and charcoal.

Lavatory and bath.—Shower and slipper baths; earthen dishes for the feet; lavatory with basins; water supplied by bheesties, turned on by a cock; "means sufficient."

Hospital washing by dhoobies on river bank.

Storage ample; dry in dry season, "but damp, as all places are at the station, during the rains."

Bedding.—Iron or wooden frames; mattress and pillows of country hemp; sheets and country blankets; bedside carpet.

Cooking.—Ordinary Indian cookhouse, with pots, pans, frying-pans, and spits, "which enable an Indian cook to prepare anything."

Attendance.—Hospital serjeants for discipline, 20 ward coolies and 1 superintendent per regiment, "generally very kind and attentive;" a comrade in severe cases.

Sanitary state.—Generally good. No gangrene or pyæmia; cholera and fever have appeared at times.

Convalescents.—Walk on the roof of hospital and by river side. Often sent out on elephants or in doolies to take the air.

Female hospitals.—Two, with about 1,000 cubic feet, and 50 to 60 square feet, per bed; female attendants; "present arrangements satisfactory."

3. *Site* open and freely ventilated.

Water supply "abundant and good."

Drainage.—Only by surface drains; all impurities are conveyed to a distance daily.

Construction.—Stone floors $3\frac{1}{2}$ to 4 feet above ground; no ventilation beneath. Thatched roof with tiles. Double verandahs; inner ones used for sick when necessary. Building on one floor.

Accommodation.—Three wards of 24 beds each, at 2,349 cubic feet and 87 square feet per bed. When verandahs used, number of beds doubled.

Ventilation by doors and pipes carried through thatch. Hospital receives full benefit of prevailing winds. Means "sufficient."

Cleansing.—Walls and ceilings of wards cleaned and limewashed every six months or oftener.

Latrines 40 yards from hospital; consist of a shallow drain, and are offensive.

Lavatory and bath.—Small plunge bath, on the edge of which are placed vessels for washing; "neither sufficient nor convenient."

Hospital washing done at a distance.

Storage sufficient.

Bedding.—Iron and wooden bedsteads; two mattresses.

Cooking "tolerably well performed."

Attendance.—Hospital serjeant, orderlies, ward coolies; "sufficient."

Sanitary state "tolerably good."

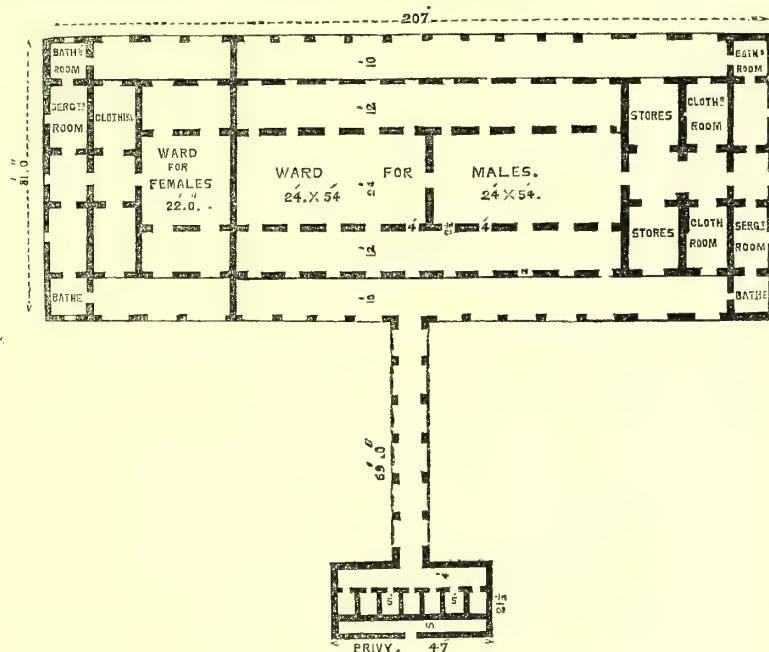
Convalescents are taken out on elephants and in spring bullock carts. No shady walks; no convalescent ward; one would be advantageous.

CAWNPORE.

STATIONS.	REPLIES.
MEERUT.	<p><i>Female hospital.</i>—None; sick attended at present in their barracks.</p> <p>4. <i>Site</i> open, freely ventilated, and healthy.</p> <p><i>Water supply</i> “abundant and wholesome.”</p> <p><i>Drainage</i> by open masonry drains into tank and nullah.</p> <p><i>Construction.</i>—Floors 1 to 2 feet above ground; no passage for air beneath; materials brick and mortar; roof, tiles over thatch; verandahs all round, some double; inner one sometimes used for sick. Built in 1810, 1811, 1830, 1845, 1846, 1856.</p> <p><i>Accommodation.</i>—Four wards, containing 428 beds, at from 1,052 to 1,622 cubic feet, and from 67 to 78 square feet per bed. One of the wards contains as many as 160, another 100, and another 104 beds.</p> <p><i>Ventilation.</i>—Hospital receives full benefit of prevailing winds. Doors, windows, and circular holes in side walls, and also in roof. Kuskus tatties, and thermantidotes used for cooling the air.</p> <p><i>Cleansing.</i>—Limewashing annually, or oftener if required.</p> <p><i>Latrines</i> adjoin hospital; supplied with water; contents removed in filth carts; urinal has a cesspool.</p> <p><i>Lavatory and bath.</i>—One bath in lavatory; said to be “sufficient.”</p> <p><i>Hospital washing</i> done by native washermen.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding.</i>—Wooden bedsteads, hemp mattresses, sheets, and blankets; iron bedsteads recommended.</p> <p><i>Cooking.</i>—Common Indian kitchen; diets properly cooked.</p> <p><i>Attendance.</i>—Hospital serjeant and natives; no nurses; orderlies for special cases.</p> <p><i>Sanitary state</i> “excellent.” No hospital disease.</p> <p><i>Convalescents.</i>—No wards, but such would be advantageous; elephants and doolies used for airing.</p>
AGRA.	<p><i>Female hospitals.</i>—Separate arrangements; “satisfactory.”</p> <p>5. <i>Site</i> open, healthy, and freely ventilated.</p> <p><i>Water supply</i> ample from wells, though generally very salt; several better wells used for drinking.</p> <p><i>Drainage.</i>—None except on surface; during hot and cold season the washing and bathing water spreads over ground and sinks into soil or evaporates. Main drain only runs after heavy rains.</p> <p><i>Construction.</i>—Hospital on single floor, raised 2½ feet, but no passage of air below; materials brick and mortar; thatched roof; double verandahs, inner one frequently used by sick or convalescents.</p> <p><i>Accommodation.</i>—Three wards; 120 beds, at from 1,320 to 2,135 cubic feet, and from 55 to 73 square feet per bed.</p> <p><i>Ventilation</i> by ridge ventilators, open doors, tatties, and thermantidotes; also punkahs; “sufficient.”</p> <p><i>Cleansing.</i>—Whitewashing quarterly or oftener.</p> <p><i>Latrines</i> over cesspits, into which close stools are emptied; very offensive.</p> <p><i>Ablution and bath room.</i>—Bathing tubs; “sufficient for the purpose and convenient;” a wash-house being constructed.</p> <p><i>Hospital washing</i> done at a distance.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding.</i>—Bedsteads of wood, hemp mattresses and pillows; cotton sheets, woollen blankets, or wadded cotton “resais.”</p> <p><i>Cooking.</i>—Kitchen same as in barracks; “sufficient.”</p> <p><i>Attendance.</i>—Hospital serjeant for discipline; regular establishment for European corps at ordinary times consists of 79 individuals, to whom are added in hot seasons 161 bheesties and coolies, making in all 240.</p> <p><i>Sanitary state.</i>—Hospitals “as free from disease as ground floor hospitals of this construction can be.” All tropical hospitals should be two storied (the sick above).</p> <p><i>Convalescents.</i>—No wards; men sent to light duty in barracks; exercise by elephants and doolies; seats in verandahs and arm chairs.</p>
UMBALLA.	<p><i>Female hospital.</i>—One adjoining general hospital; “satisfactory.”</p> <p>6. <i>Site</i> open, freely ventilated, and healthy. That of native infantry hospital near foul nullahs.</p> <p><i>Water supply</i> “wholesome, but very limited indeed.”</p> <p><i>Drainage</i> by surface drains; all refuse water carried away.</p> <p><i>Construction.</i>—Hospitals on one floor, raised 3½ feet above ground; no passage of air beneath; built of burnt bricks and lime; thatched or tiled; verandahs on both sides; inner frequently used for sick; built in 1845–6, and 1859.</p> <p><i>Accommodation.</i>—31 wards; 356 beds, at from 1,500 to 1,872 cubic feet, and from 72 to 108 square feet per bed.</p> <p><i>Ventilation.</i>—Hospitals receive benefit of prevailing winds. Ventilation by doors, windows, and in ridge; “sufficient;” tatties and thermantidotes used for cooling.</p> <p><i>Cleansing.</i>—Limewashing once a year or oftener.</p> <p><i>Latrines</i> in rear of hospital; shallow cesspits cleansed daily.</p> <p><i>Ablution and bath room</i> has brass and earthenware basins along the wall; tubs for bathing. Inexpensive improvements could be made.</p> <p><i>Hospital washing</i> done at a distance.</p> <p><i>Storage</i> not sufficient.</p> <p><i>Bedding.</i>—Wooden bedsteads, tow mattresses, sheets, and country blankets; iron bedsteads required.</p> <p><i>Cooking</i> by usual Indian method; “much cannot be said in general in praise of the cooking, but it is sufficient.”</p> <p><i>Attendance</i> “ample and liberal.”</p> <p><i>Sanitary state</i> “satisfactory.”</p> <p><i>Convalescents.</i>—No wards, but they “would be useful, as enabling the surgeon to regulate diet, exercise, and exposure of convalescents.” Exercise by carts, elephants, and doolies. No shaded walks.</p>
LOODIANA.	<p><i>Female hospital.</i>—In separate buildings. A privy required for each.</p> <p>7. <i>Site</i> open, freely ventilated.</p> <p><i>Water supply</i> abundant and wholesome.</p> <p><i>Drainage</i> by open natural surface drains. All impurities removed by sweepers.</p>

STATIONS.	REPLIES.
<p>FEROZEPORE.</p>	<p><i>Construction.</i>—One ground floor ward of burnt bricks and lime. Closed verandah all round; used for sick when necessary.</p> <p><i>Ventilation</i> by windows and skylights; “sufficient.”</p> <p><i>Cleansing</i> of walls and ceilings whenever required.</p> <p><i>Storage</i> sufficient.</p> <p><i>Attendance.</i>—One native doctor, one cooly, one water-carrier, one sweeper, “sufficient for ordinary wants of sick.”</p> <p><i>Sanitary state.</i>—No epidemic disease has appeared in ward.</p> <p><i>Female hospital.</i>—Present arrangement “sufficient,” (which means <i>none</i>).</p> <p>8. <i>Sites</i> open, freely ventilated.</p> <p><i>Water supply</i> from wells in hospital grounds.</p> <p><i>Drainage.</i>—None; water from bath rooms allowed to sink into subsoil, as also roof water.</p> <p>“Drainage not necessary.”</p> <p><i>Construction.</i>—On one floor, built of brick and mortar; verandahs. Built in 1846.</p> <p><i>Accommodation.</i>—Seven wards, 188 beds, 1,600 to 1,900 cubic feet, and 66 to 72 square feet per bed.</p> <p><i>Ventilation.</i>—Prevailing winds admitted; doors 7 feet apart; ventilators in ridge; “sufficient;” punkahs, tatties, and a thermantidote used for cooling; warming by ordinary chimney fire-places for wood.</p> <p><i>Cleansing</i> of walls and ceilings once a year or oftener.</p> <p><i>Latrines.</i>—Same as in barracks; filth removed by sweepers; no cesspits; lime and wood ashes used to prevent smell.</p> <p><i>Lavatory and bath</i> constructed in verandah corners; very deficient in infantry hospital.</p> <p><i>Hospital washing</i> done in open air.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding.</i>—Wooden bedsteads; bedding as in medical code.</p> <p><i>Attendance.</i>—Hospital serjeant and natives; a soldier attends extreme cases.</p> <p><i>Sanitary state.</i>—“Excellent.”</p> <p><i>Convalescents.</i>—No separate wards; patients use the regimental garden for exercise.</p> <p><i>Female hospital.</i>—Separate wards, with native attendant; “satisfactory.”</p> <p>Fig. 11 is a plan of one of the hospitals at Ferozepore, showing the double verandah construction, the position of the privies, and the provision for sick women and children, where there is no separate female hospital.</p>

FIG. 11.—PLAN OF THE HOSPITAL FOR THE ARTILLERY DIVISION, FEROZEPORE.

**JULLUNDUR.**

9. *Site.*—Open and healthy.

Water supply.—Abundant and wholesome.

Drainage.—None; all filth removed in carts; imperfect surface drains for roof water, which is not removed, but sinks into subsoil.

Construction.—Mud walls; verandahs all round; thatched roofs; floors 3 feet above ground; no passage of air beneath. Built in 1847-48.

Accommodation.—Three wards; 58 beds, at 902 to 1,728 cubic feet, and 57 to 72 square feet per bed.

Ventilation.—Free exposure to winds; ridge ventilation; no windows; cooling by punkahs and tatties; “sufficient.”

Cleansing.—Walls and ceilings limewashed annually, or oftener.

Latrines.—“Well drained,” and “seldom offensive.”

Lavatories and baths.—Basins fixed in masonry; “gurrahs for douche baths,” and tubs for warm baths.

Hospital washing done by a dhoby.

Storage sufficient.

Bedding.—Wooden bedsteads; “bedding good.”

Cooking.—Ordinary kitchen; cooking generally good.

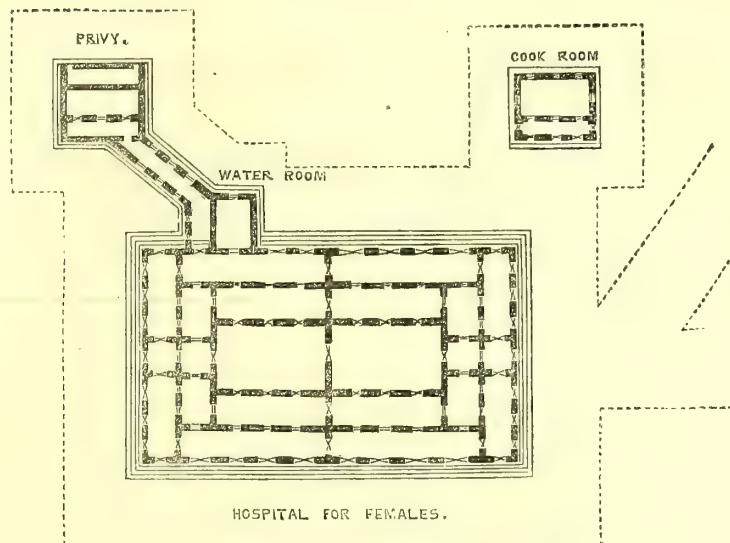
Attendance.—“Sufficient.”

Sanitary state.—“Most healthy.”

Convalescents.—No wards; “unnecessary.” No provision for exercise, except hospital compound where there is no shade.

STATIONS.	REPLIES.
MEAN MEER.	<p><i>Female hospital.</i>—A ward for women and children, "with an ayah, when necessary."</p> <p>10. <i>Site.</i>—Two European hospitals on sites open and good. One occupies an area of 60,000 square yards.</p> <p><i>Water supply.</i>—Abundant and good, from a well within enclosure.</p> <p><i>Drainage</i> of wash-houses and cook-houses, either into deep covered cesspools or small shallow reservoirs, whence it is carried away daily; they are close to the hospital; surface drainage by small cut channels for roof and rain water.</p> <p><i>Construction.</i>—Solid masonry; floors raised 3½ feet above ground; no ventilation below. Verandahs 10 feet broad; outer ones not used for sick; on one side divided into compartments for wash-houses. "This bad system is detrimental to ventilation." Hospital built in 1854-55.</p> <p><i>Accommodation.</i>—In E1 hospital, 10 wards; 160 beds, at 1,728 cubic feet and 72 square feet per bed. Verandahs are occupied by sick on pressure.</p> <p><i>Ventilation.</i>—Full exposure to prevailing winds; doors, windows, and ridge openings; not sufficient if hospital were crowded; cooling by thermantidotes, punkahs, and tatties. Fire-places for warming.</p> <p><i>Cleansing.</i>—Partial whitewashing once a quarter.</p> <p><i>Latrines.</i>—Pans and moveable urinals; contents removed twice a day; "not ordinarily" "offensive, if kept clean."</p> <p><i>Lavatories and baths.</i>—In compartments walled off in outer verandah; tables with basins drained into a cesspool. Slipper baths and tubs in hospital for sick.</p> <p><i>Hospital washing</i> done seven miles away.</p> <p><i>Storage</i> scanty.</p> <p><i>Bedding.</i>—Same as in barracks.</p> <p><i>Cooking.</i>—Low mud or brick fireplaces with side ledges, to support pans and kettles; also brick fireplaces; "sufficient."</p> <p><i>Attendance.</i>—Hospital serjeant and two orderlies, with ward coolies; "enough."</p> <p><i>Sanitary state.</i>—"Splendid and commodious buildings." Improvements in cooling air; in latrines, &c., in progress; ventilation defective.</p> <p><i>Convalescents.</i>—No special wards; exercise by carts, elephants, and doolies.</p> <p><i>Female hospital.</i>—One within each hospital enclosure. Managed like the men's hospital.</p>
PESHAWUR.	<p>11. <i>Sites.</i>—Open; free ventilation; good drainage. No malaria.</p> <p><i>Water supply.</i>—Abundant and wholesome.</p> <p><i>Drainage.</i>—All refuse water, and other impurities, carted away; surface drains for removing rain and roof water.</p> <p><i>Construction.</i>—Wards raised 2 feet above ground; no ventilation beneath; double verandahs, inner ones used for sick when necessary; hospital on one floor.</p> <p><i>Accommodation.</i>—Three hospitals; 21 wards; 900 beds (including female hospital), at 1,320 cubic feet, and 66 square feet per bed.</p> <p><i>Ventilation.</i>—Opposite doors; swing windows; thermantidotes for cooling; fireplaces for warming.</p> <p><i>Cleansing</i> of walls and ceilings twice a year.</p> <p><i>Latrines and urinals.</i>—Same as in barracks; cleansed daily.</p> <p><i>Lavatory and bath.</i>—Incomplete and insufficient; no wash-houses; only a portion of outer verandah used; cold baths administered by leather bags or waterpots.</p> <p><i>Hospital washing and drying</i> out of station.</p> <p><i>Storage</i> crowded.</p> <p><i>Bedding.</i>—Same as in barracks, except that a chopped hemp mattress is allowed.</p> <p><i>Cooking.</i>—Kitchens, temporary mud buildings without doors or windows; "insufficient," but cooking "sufficient."</p> <p><i>Attendance.</i>—Hospital serjeant; native servants; an orderly, when necessary.</p> <p><i>Sanitary state.</i>—Good, except for ablution.</p> <p><i>Convalescents.</i>—No wards required; exercise, in doolies or on elephants.</p> <p><i>Female hospitals.</i>—Separate buildings, with matron and native female servants; "very satisfactory."</p>
SEALKOTE.	<p>12. <i>Site.</i>—Well ventilated and healthy.</p> <p><i>Water supply.</i>—Good.</p> <p><i>Drainage.</i>—Refuse water and other impurities removed in carts; surface drainage "ample" for removing roof water and rainfall.</p> <p><i>Construction.</i>—On one floor; brick masonry; tiled roofs; double verandahs (inner ones might hold sick, if necessary); floors of brick, raised 3 feet above ground; no ventilation beneath. Built in 1852-53.</p> <p><i>Accommodation.</i>—Ten wards; 160 beds, at 1,930 cubic feet and 78 square feet per bed.</p> <p><i>Ventilation.</i>—Free exposure to winds; ridge ventilators; windows opening in centre; cooling by punkahs and tatties; warming by fireplaces.</p> <p><i>Cleansing.</i>—Whitewashing twice a year; four times to the height of 6 feet.</p> <p><i>Latrines.</i>—Usual construction; filth removed daily in carts.</p> <p><i>Ablution and bath room</i> attached to each wing; plenty of water laid on from wells; baths in each room.</p> <p><i>Hospital washing</i> done at a distance.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding.</i>—Wooden cots, "which so harbour bugs that they are constantly broken by the men" "in their efforts to expel the vermin, and the repeated repairs required are most expensive."</p> <p><i>Cooking.</i>—In kitchens similar to those of barracks.</p> <p><i>Attendance.</i>—One hospital serjeant; more permanent hospital orderlies required; nurses not employed, but strongly recommended.</p> <p><i>Sanitary state.</i>—"Highly satisfactory."</p> <p><i>Convalescents' wards.</i>—"Not necessary;" doolies and elephants used for exercise.</p> <p><i>Female hospitals.</i>—"Excellent" and "perfectly satisfactory." Fig. 12 gives a plan of this building, and also the construction of the more recent female hospitals in the north-west.</p>

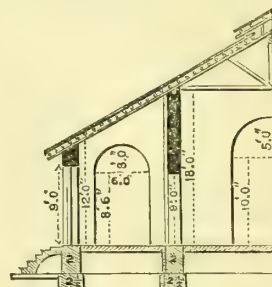
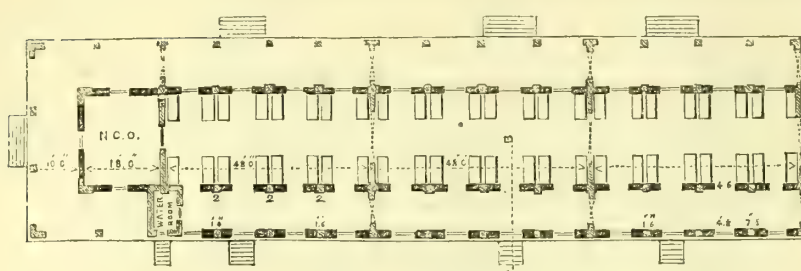
FIG. 12.—HOSPITAL FOR FEMALES, SEALKOTE.



STATIONS.	REPLIES.
MURREE. GHAZEIPORE.	<p>13. No information.</p> <p>14. <i>Site</i>.—Open, and “perhaps as good as could be chosen.”</p> <p><i>Water supply</i>.—“Good.”</p> <p><i>Drainage</i> by pukka brick drains.</p> <p><i>Construction</i>.—Single story buildings, of pukka and kutcha bricks; tiled roofs; floors, 2 feet from ground; no ventilation beneath; verandahs sometimes used for sick.</p> <p><i>Accommodation</i>.—Three wards, 156 beds, from 775 to 1,309 cubic feet, and 68 to 93 square feet per bed (100 beds have 775 cubic feet each).</p> <p><i>Ventilation</i>.—Free outside; windows; roof ventilators; “sufficient.”</p> <p><i>Cleansing</i>.—Limewashing on requisition.</p> <p><i>Latrines</i> drained into cesspit, cleansed twice a day.</p> <p><i>Lavatories</i>.—Same as in barracks; large baths required.</p> <p><i>Hospital washing</i> done by dhobies.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding</i>.—Same as in barracks, infested with bugs and other vermin, to the great distress of the sick. “Scalding the bedsteads with turpentine, corrosive sublimate, &c., is resorted to “to destroy these insects, but with very partial success.” Iron bedsteads required.</p> <p><i>Cooking</i> “sufficient.” Kitchen of ordinary construction.</p> <p><i>Attendance</i> “liberal.”</p> <p><i>Sanitary state</i> “as perfect as means will allow.” “Of course all the buildings, generally, are most unsuitable for hospital purposes.”</p> <p><i>Convalescents</i>.—Wards might be established; elephants and doolies for exercise; no shade.</p> <p><i>Female hospital</i>.—None; sick treated in their own quarters.</p>
BERHAMPORE.	<p>15. <i>Site</i> objectionable; close to dry river bed; high walls impede ventilation, except in upper floor.</p> <p><i>Water supply</i> from wells; requires filtration for use.</p> <p><i>Drainage</i>.—Very imperfect, only one small drain communicating with a cesspool, 30 yards from hospital; not sufficient fall to carry off rain water speedily.</p> <p><i>Construction</i>.—Brick and mortar; terraced roof; 2 floors.</p> <p><i>Accommodation</i>.—Seven wards, 156 beds; 1,257 to 1,287 cubic feet; 64 to 66 square feet per bed.</p> <p><i>Ventilation</i>.—Venetian doors in lower story; glazed doors in upper; openings above doors; punkahs; ventilation “sufficient.”</p> <p><i>Cleansing</i>.—Limewashing twice a year.</p> <p><i>Latrines</i>.—Thirty-six yards from hospital; iron pans 2 feet deep with metal covers; drainage very imperfect; native hospital has a cesspool.</p> <p><i>Lavatory</i>.—Baked earthen basins; bath house with hot and cold baths, out of repair; wooden tubs used; very inconvenient.</p> <p><i>Hospital washing</i> done at a distance.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding</i>.—Wooden bedsteads; mattress and pillows of hemp; sheets and country blankets.</p> <p><i>Cooking</i>.—Usual kitchen utensils; “sufficient.”</p> <p><i>Attendance</i>.—Hospital serjeant and orderlies from regiment; trained orderlies would be greatly preferable.</p> <p><i>Sanitary state</i>.—No sick on lower floor at present; upper floor satisfactory; improved drainage and baths required.</p> <p><i>Convalescents</i>.—No wards; only the verandahs; no shaded walks or seats.</p> <p><i>Female hospital</i>.—One ward set apart for sick; same medicines and comforts supplied as for men; 1 anna a day deducted as stoppage.</p>
HAZAREEBAUGH.	<p>16. <i>Site</i>.—Open, freely ventilated, healthy and unexceptionable.</p> <p><i>Water supply</i> good and sufficient.</p> <p><i>Drainage</i>.—Rain drains off by a ditch in front and outside hospital wall; all sewage from privies, cook-room, &c. removed by carts.</p> <p><i>Construction</i>.—Stone, burnt bricks and mortar, sun-dried bricks and mud; roof, tiled over thatch; verandahs; floors 4 feet above ground; no passage for air beneath; 1 floor built in 1858–59. Fig 13, shows one-half of one of the hospitals at this station, and also the usual arrangement of beds in single verandahed hospitals.</p>

FIG. 13.—STANDARD PLAN OF THE HOSPITALS AT HAZAREEBAUGH.

SECTION ON A. B.



STATIONS.

REPLIES.

ALLAHABAD.

Accommodation.—Six wards, 96 beds; 1,080 cubic feet, 60 square feet per bed.
Ventilation.—Hospital broadside to wind; wooden doors; no windows except fan-lights over doors; roof ventilators; glass doors, and Venetians suggested; cooling by punkahs; other means unnecessary; warming by open fireplaces..
Cleansing.—Limewashing once a year, or oftener on requisition.
Latrines.—On standard plan; contents removed 2 miles from barracks; lime and charcoal used.
Lavatory.—Water laid on to each basin; dirty water drained away by covered drains; “sufficient;” no baths; “sick wash in the basins of the lavatory, and can always afterwards, if they please, get a skin full of water thrown over them by the water-carriers.”
Hospital washing done by dhobies (5 allowed for a corps) at a distance.
Storage not dry enough; stores at present in the female hospital.
Bedding.—Iron-hooped cots; mattresses seldom sufficiently thick to prevent the patients feeling the hoops; pillows stuffed with country hemp; sheets and blankets.
Cooking.—Ordinary Indian arrangements; pay too small to secure services of cooks, “with even moderate pretensions to the name;” plain roasting, boiling, &c., all that can be expected. “No delicacy of any kind, likely to tempt the capricious appetite of a sick man, could be prepared by these miserable pretenders.”
Attendance.—Usual arrangements; “European nurses, professionally trained, might be most advantageously introduced into the hospitals in this country.”
Sanitary state “very good,” “but more light would be an advantage.”
Convalescents.—No wards; convalescents sent back to barracks; no shaded walks, except verandahs; elephants used for exercising.
Female hospital.—One, 5 wards; 80 beds; 1,080 cubic feet and 60 square feet per bed; female attendants; arrangements very good and satisfactory.

17. *Site.*—The best in the lines.
Water supply good and wholesome, filtered through sand and charcoal.
Drainage.—Very imperfect, inadequate during rains; roof-water mostly sinks into subsoil, only shallow narrow surface drains.
Construction.—Floors level with ground; total want of ventilation beneath; materials, baked and sun dried brick; thatch and tile roofs, insufficient for coolness; verandahs 15 feet wide, sometimes used for sick; buildings on one floor.
Accommodation.—Four hospitals; 9 wards; 780 beds; seven wards have 100 beds each, with from 990 to 2,033 cubic feet; and from 40 to 88 square feet per bed; built in 1858–59.
Ventilation.—Hospitals face the wind; in most instances no windows, except openings over doors, and openings in roof; ventilation very defective, especially when doors have to be closed; tatties used for cooling; no means of warming.
Cleansing.—Limewashing on requisition.
Latrines of usual construction, cleansed daily.
Lavatory.—Cast-iron basins, lined with porcelain on benches; water supplied from wells by bheesties; distance from hospital too great; no baths.
Hospital washing by washermen, well done.
Storage.—Of small sun dried bricks, tolerably dry.
Bedding.—Wooden bedsteads, fragile; harbour vermin; constantly requiring repairs.
Cooking.—Usual kitchen apparatus; proper cooking stoves required; want of suitable apparatus for roasting and grinding coffee.
Attendance “ample;” besides usual provision, 6 European nurses in general hospital, found to add much to comfort of sick.
Sanitary state “good;” but cholera has occurred; hospitals merely temporary, and deficient in many requirements.
Convalescents.—No wards; exercise on elephants; no shade.
Female hospital.—None; wards set apart in other hospitals; female attendants allowed.

DUMDUM.

18. *Site.*—Generally healthy.
Water supply.—Wholesome, but not abundant.
Drainage.—By surface drains. Lavatory water conveyed away with roof water. Other foul water flows into a pit and is carried away daily.
Construction.—One-storied; raised on brick arches 3 feet above ground, with free ventilation beneath. Masonry walls. One hospital iron-framed. Verandahs used for sick when centre wards full.
Accommodation.—Main hospital, 20 wards; iron-framed hospital, 7 wards; native hospital, 6 wards; female hospital, 9 wards; total beds, 390, at from 1,072 to 1,637 cubic feet and 78 square feet per bed.
Ventilation.—Full benefit of prevailing winds. Numerous doors and windows. Ventilating skylights. Punkahs for cooling.
Cleansing.—Limewashing once a year, or on requisition.
Latrines.—Usual construction. Contents removed by cart every morning.
Lavatory.—Metal basins. Water laid on. Hot, warm, and shower baths.
Hospital washing.—Done by dhobies.
Storage.—Sufficient.
Bedding.—Wooden bedsteads. Iron bedsteads, with coir mattresses, are to be introduced.
Cooking.—Usual arrangements. Cooks not highly paid, and of the worst description.

STATIONS.	REPLIES.
BENARES.	<p><i>Attendance.</i>—Usual arrangements. When sick men cannot quit their beds, one or two comrades are allowed to attend them.</p> <p><i>Sanitary state.</i>—Satisfactory.</p> <p><i>Convalescents.</i>—No wards. Not required. Walks, but no shade. Exercise given by an ambulance bullock waggon.</p> <p><i>Female hospital.</i>—One with 23 beds. Female attendants but no matron. An experienced nurse, capable of assisting at confinements, required.</p> <p>19. <i>Site.</i>—Generally healthy.</p> <p><i>Water supply.</i>—Abundant and good.</p> <p><i>Drainage.</i>—None; roof water sinks into ground; refuse water removed in filth carts.</p> <p><i>Construction.</i>—On one floor. Raised 2 feet above ground. No ventilation beneath. Materials, bricks, with thatched roof. Verandahs all round.</p> <p><i>Accommodation.</i>—6 wards; 176 beds, at 1,161 to 1,584 cubic feet, and 72 to 75 square feet per bed.</p> <p><i>Ventilation.</i>—Hospitals exposed to prevailing winds. Doors numerous on opposite sides. Windows few. These with ridge ventilation sufficient. Cooling by tatties.</p> <p><i>Cleansing.</i>—Limewashing twice a year, or oftener.</p> <p><i>Latrines.</i>—Iron pans, emptied twice a day.</p> <p><i>Lavatory.</i>—Sufficient. A proper bath-room required.</p> <p><i>Hospital washing.</i>—By native washermen.</p> <p><i>Storage.</i>—Sufficient.</p> <p><i>Bedding.</i>—Wooden cots, inferior tow mattresses, coarse blankets. English blankets required.</p> <p><i>Cooking.</i>—Usual arrangements; “sufficient.”</p> <p><i>Attendance.</i>—Usual provision.</p> <p><i>Sanitary state.</i>—Good.</p> <p><i>Convalescents.</i>—No wards. No shaded walks. Take airing morning and evening on elephants and in ambulances along public roads.</p> <p><i>Female hospital.</i>—A small one; but a larger, with a lying-in-ward, is required.</p>
LANDOUR.	<p>20. <i>Site.</i>—Unobjectionable.</p> <p><i>Water supply.</i>—Sufficient for culinary, drinking, and ordinary washing purposes; not for bathing.</p> <p><i>Drainage.</i>—Natural, on surface. Water runs down steep slopes and ravines.</p> <p><i>Construction.</i>—Stone and lime; terraced roof. Verandahs. One floor, raised 2 feet above ground, with passage for air beneath. Built in 1846.</p> <p><i>Accommodation.</i>—4 wards, 60 beds; 935 to 996 cubic feet, 53 to 55 square feet per bed.</p> <p><i>Ventilation.</i>—Sufficient, from position of hospital; doors, windows, and ventilators in the wall. No cooling required. Warming by open fireplaces, 2 in each ward.</p> <p><i>Cleansing.</i>—Limewashing twice a year, or oftener.</p> <p><i>Latrines.</i>—Drained; never offensive.</p> <p><i>Lavatory.</i>—Brazen vessels filled from a trough; portable baths.</p> <p><i>Hospital washing.</i>—Done at a distance.</p> <p><i>Storage.</i>—Sufficient.</p> <p><i>Bedding.</i>—Wooden bedsteads; bedding very good. All cots should be of iron.</p> <p><i>Cooking.</i>—Means “sufficient.”</p> <p><i>Attendance.</i>—Hospital serjeant, selected by chance or necessity from the sick men on arrival. A great grievance, repeatedly but fruitlessly represented. Orderlies obtained from barracks. No nurses.</p> <p><i>Sanitary state.</i>—Hospital has been remarkably free from disease.</p> <p><i>Convalescents.</i>—Wards not necessary. Weakly men carried out in sedan chairs. Little available ground for exercise.</p> <p><i>Female hospital.</i>—None; sick obliged to be taken into a spare ward.</p>
MUTTRA.	<p>21. <i>Site.</i>—Cavalry hospital good. Artillery hospital too near the city, with a dry nullah close to it.</p> <p><i>Water supply.</i>—Good.</p> <p><i>Drainage.</i>—No drains; refuse water and other impurities collected in cesspools and removed daily.</p> <p><i>Construction.</i>—Burnt and unburnt bricks. Tiled and thatched roofs. Verandahs; inner ones very frequently used for sick. Single-storied. Floors 2½ feet from ground. No passage for air beneath.</p> <p><i>Accommodation.</i>—3 wards, 48 beds; square feet per bed, 64 to 75; cubic feet per bed, 1,350 to 1,422; the new female hospital used for cavalry.</p> <p><i>Ventilation.</i>—(External) of cavalry hospital good; of artillery hospital not so. No windows; doors opposite each other, with roof ventilators. Thermantidotes for cooling.</p> <p><i>Cleansing.</i>—Walls swept down weekly; whitewashed annually, or oftener.</p> <p><i>Latrines.</i>—Copper pans. Contents carted away every morning for combustion in one of the many brick-kilns that surround the station and help to poison the air. Privy drainage runs into cesspool. No supply of water except by bheesties.</p> <p><i>Lavatory.</i>—Earthen pans or basins, and earthen vessels filled with water; not convenient. No means of bathing but a moveable warm and slipper bath.</p> <p><i>Hospital washing</i> done at the river.</p> <p><i>Storage.</i>—Sufficient.</p> <p><i>Bedding.</i>—Common cots, with tow mattresses, and pillows, &c.</p> <p><i>Cooking arrangements</i> “sufficient.”</p> <p><i>Attendance.</i>—Insufficient; more European supervision required. “In times of increased sickness, apathy and laziness of natives always embarrassing, and a source of complaint and discontent to the patient.”</p> <p><i>Sanitary state.</i>—Fair; but, as a general rule, hospitals are badly lighted and gloomy. Light enters from a couple of panes in the doors near the top; and, when closed, darkness almost complete. Windows wanted.</p> <p><i>Convalescents.</i>—No wards. Sick exercised on elephants, or in doolies.</p> <p><i>Female Hospital.</i>—One for cavalry (part of the old cavalry hospital); none for artillery.</p>
RANEEGUNGE.	<p>22. <i>Site.</i>—Healthy.</p> <p><i>Water supply.</i>—Good, but has to be brought from a distance.</p> <p><i>Drainage.</i>—Roof water sinks into subsoil; no drains; refuse water and other impurities are carried away in carts and buckets.</p>

STATIONS.	REPLIES.
UMRITSIR.	<p><i>Construction.</i>—On one floor; 18 inches above ground; no ventilation beneath; brick, stone, and mud; verandahs all round. Built in 1857–60.</p> <p><i>Accommodation.</i>—Three wards; 114 beds at from 765 to 1,450 cubic feet and from 45 to 70 square feet per bed.</p> <p><i>Ventilation.</i>—Exposed to winds by doors; no means of cooling.</p> <p><i>Cleansing.</i>—Limewashing every six months or oftener.</p> <p><i>Latrines.</i>—“Naturally drained;” contents removed daily.</p> <p><i>Lavatory.</i>—“Sufficient;” no baths.</p> <p><i>Hospital washing</i> at a distance.</p> <p><i>Storage</i> very imperfect.</p> <p><i>Bedding.</i>—Wooden cots; mattress, and cotton quilt.</p> <p><i>Cooking.</i>—Kitchen very imperfect.</p> <p><i>Attendance.</i>—Hospital serjeant; natives; regimental orderlies, if required.</p> <p><i>Sanitary state.</i>—“Good;” hospital sufficient for temporary purposes; far from being complete; ventilation and lavatory very bad.</p> <p><i>Convalescents.</i>—No ward; no provision for exercise.</p> <p><i>Female hospital.</i>—Separate building; “satisfactory.”</p> <p>23. <i>Site.</i>—Healthy.</p> <p><i>Water supply.</i>—Abundant and wholesome.</p> <p><i>Drainage.</i>—No sewers; refuse water and other impurities otherwise removed; roof water evaporates or is absorbed.</p> <p><i>Construction.</i>—Bricks and mortar; verandahs; one floor only; raised 2 feet from ground; no ventilation below.</p> <p><i>Accommodation.</i>—Two wards; 20 beds each, at 1,420 cubic feet and 71 square feet per bed.</p> <p><i>Ventilation.</i>—Windows, ridge openings, punkahs, tatties, and thermantidotes; hardly sufficient; warming in winter months by stoves.</p> <p><i>Cleansing.</i>—Limewashing once a year.</p> <p><i>Latrines.</i>—“If the filth is removed directly, which it should be, they would not be offensive.”</p> <p><i>Lavatory.</i>—Sufficient; a large moveable bath for sick.</p> <p><i>Hospital washing</i> by dhobies attached to hospital.</p> <p><i>Bedding.</i>—Wooden cots; tow mattresses, &c.</p> <p><i>Cooking.</i>—Native kitchen; “sufficient.”</p> <p><i>Attendance.</i>—“Sufficient.”</p> <p><i>Sanitary state.</i>—“Good;” no epidemic, “with the exception of cholera,” has appeared in wards.</p> <p><i>Convalescents.</i>—No wards; would be advantageous only at large stations, where there are general hospitals. No shaded walks.</p> <p><i>Female hospital.</i>—A small bungalow; “very unsatisfactory.”</p>
NYNEE TÄL.	<p>24. <i>Site.</i>—Healthy; freely ventilated.</p> <p><i>Water supply.</i>—Good.</p> <p><i>Drainage.</i>—None required.</p> <p><i>Construction.</i>—Two floors; lowest 6 inches above ground, highest 10 feet; materials, rubble, stone and lime; open verandahs all round.</p> <p><i>Accommodation.</i>—Eleven wards; 45 beds. Patients fluctuate from 50 to 3.</p> <p><i>Ventilation.</i>—Scarcely possible to ventilate properly, too many windows; situation exposed; draught too strong; warming by open fires in winter.</p> <p><i>Cleansing.</i>—Limewashing all over once a year; every three months 6 feet high.</p> <p><i>Latrines</i> kept clean by sweepers.</p> <p><i>Lavatory.</i>—Chatties and tubs for washing; no baths; sick bathe in lake.</p> <p><i>Hospital washing</i> by washermen.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding.</i>—Wooden cots.</p> <p><i>Attendance.</i>—One hospital serjeant; one European barber; one European orderly.</p> <p><i>Sanitary state.</i>—Healthy; “during rains, however, open surfaces of blisters, &c., do not heal kindly.”</p> <p><i>Convalescents.</i>—All are so; exercise in chairs carried by coolies; shaded walks.</p> <p><i>Female hospital.</i>—One separate room. All the present arrangements temporary and unsatisfactory.</p>
RAWUL PINDI.	<p>25. <i>Site.</i>—Open and freely ventilated.</p> <p><i>Water supply.</i>—From well in compound; abundant and most excellent.</p> <p><i>Drainage.</i>—None; refuse water runs into cesspools; emptied daily.</p> <p><i>Construction.</i>—One-storied; floor 2 feet above ground; no ventilation below; double verandahs, inner one only used for special cases of sickness. Built 1853–57.</p> <p><i>Accommodation.</i>—One ward; 20 beds, 1,900 cubic feet, 95 square feet per bed.</p> <p><i>Ventilation.</i>—By doors on opposite sides, pivot windows, ridge ventilators; always sufficient; cooling by tatties and punkahs; fireplace in each verandah.</p> <p><i>Cleansing.</i>—Limewashing once a year or oftener.</p> <p><i>Latrines.</i>—Contents removed daily.</p> <p><i>Lavatory.</i>—Small washing-room to each wing; not sufficient for sick nor their utensils; a plunge bath in each wing, not used because not considered beneficial.</p> <p><i>Hospital washing</i> by dhobies.</p> <p><i>Storage</i> not sufficient.</p> <p><i>Bedding.</i>—Wooden bedsteads, highly objectionable, cumbersome, unsightly, become filled with bugs, causing loss of sleep and positive injury; iron bedsteads required; bedding suitable.</p> <p><i>Cooking.</i>—In ordinary Indian kitchen.</p> <p><i>Attendance</i> sufficient.</p> <p><i>Sanitary state.</i>—“Good,” with the exceptions mentioned.</p> <p><i>Convalescents.</i>—No wards; no shaded walks; exercise in doolies.</p> <p><i>Female hospital.</i>—A special ward; “satisfactory.”</p>
LUCKNOW.	<p>26. <i>Site.</i>—Good; best available.</p> <p><i>Water supply.</i>—Sufficient.</p> <p><i>Drainage.</i>—None; only on surface.</p> <p><i>Construction.</i>—Burnt bricks and lime; tiled roofs; verandahs; floors raised 3 feet; no passage of air beneath; built 1859.</p> <p><i>Accommodation.</i>—Ten wards, with a number of small rooms, 2,737 cubic feet, and 75 square feet per bed.</p>

STATIONS.	REPLIES.
CHUNAR.	<p><i>Ventilation</i>.—Windows on pivots near top of wall; doors; ventilating tiles in ridge; cooling by tatties.</p> <p><i>Cleansing</i>.—Limewashing once a year, oftener if necessary.</p> <p><i>Latrines</i>.—Too close to main buildings; water supply not sufficient; contents removed by sweepers.</p> <p><i>Lavatory</i>.—A small room to each ward; patients wash in tubs or earthen vessels without arrangement; one or two masonry baths; barely sufficient.</p> <p><i>Hospital washing</i> by dhobies.</p> <p><i>Storage</i>.—Quite sufficient.</p> <p><i>Bedding</i>.—Wooden cots, mattress, &c.; iron cots better.</p> <p><i>Cooking</i>.—Good and sufficiently varied.</p> <p><i>Convalescents</i>.—No special wards; exercise in verandahs or on elephants.</p> <p><i>Female hospitals</i>.—Provided; “quite satisfactory.”</p> <p><i>Sanitary state</i>.—“Good.” Larger and better bathing houses would be an improvement.</p> <p>27. <i>Site</i>.—Partially open and freely ventilated only to the north and west.</p> <p><i>Water supply</i> abundant.</p> <p><i>Drainage</i>.—Surface guttering, with an outlet 30 yards distant; insufficient.</p> <p><i>Construction</i>.—Stone and lime; verandahs; inner ones occasionally used for sick or convalescents; building one-storied; floor, 6 feet above ground; no ventilation beneath.</p> <p><i>Accommodation</i>.—Four wards, 46 beds, at 1,187 to 1,316 cubic feet, and 68 to 87 square feet per bed.</p> <p><i>Ventilation</i>.—No windows; numerous doors, with ridge openings; occasional closeness in hot weather; cooling by punkahs and tatties.</p> <p><i>Cleansing</i>.—Limewashing once a year, or oftener.</p> <p><i>Latrines</i>.—Fifty feet from hospital; cleansed in the usual Indian way; “not more offensive than such places are in this country.”</p> <p><i>Lavatory</i>.—Part of verandah; also serving as bath room; “sufficient.”</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding</i>.—Cane-bottomed bedsteads; tow mattress, &c.</p> <p><i>Cooking</i>.—Indian and English cooking apparatus; cooking properly done, and varied according to order.</p> <p><i>Attendance</i>.—Hospital serjeant and usual native establishment; in serious cases “a waiting man from the battalion, who is relieved daily;” not sufficient.</p> <p><i>Sanitary state</i>.—“Healthy;” position of latrines and kitchen not good; buildings interfere with ventilation.</p> <p><i>Convalescents</i>.—No wards; exercise taken by river side or on ramparts.</p> <p><i>Female hospital</i>.—In same compound as male hospital; two wards, “satisfactory,” but a nurse required.</p>
ROORKEE.	<p>28. Hospital is a barrack.</p> <p><i>Ventilation</i>.—By holes in roof; “sufficient;” no means of cooling.</p> <p><i>Cleansing</i>.—Limewashing once a year.</p> <p><i>Latrines</i>.—Cleansed by sweepers.</p> <p><i>Lavatory</i>.—A small shed; “sufficient;” a bathing tub and foot bath, also “sufficient.”</p> <p><i>Hospital washing</i>.—By washermen.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding</i>.—Wooden cots, harbouring bugs; iron better.</p> <p><i>Cooking</i>.—Kitchen simply a hut; cooks prepare food on ground; “this arrangement is not good, but we are accustomed to it in India.”</p> <p><i>Attendance</i>.—Not sufficient; “healthy men are detached for this duty from the barracks, but “they dislike it, and often neglect their patients.”</p> <p><i>Sanitary state</i> “good.”</p> <p><i>Convalescents</i>.—No ward; exercise morning and evening, sometimes on elephants; extra doolies required.</p> <p><i>Female hospital</i>.—One; “sufficient.”</p>
JHANSI. BARRACKPORE.	<p>29. Hospitals not yet built. A barrack used temporarily. No female hospital.</p> <p>30. <i>Site</i> open; generally healthy.</p> <p><i>Water supply</i> from tank close to hospital; abundant and generally wholesome.</p> <p><i>Drainage</i> by open masonry; drains to river; “sufficient.”</p> <p><i>Construction</i>.—An iron-framed building with verandah; one immense hall, 411 feet long, 38½ feet wide, and 23 feet 8 inches high. Verandahs. Building on one floor 3 or 4 feet high, and planked over.</p> <p><i>Accommodation</i>, 150 beds, all in one ward (60 beds on each side, 30 beds down the middle), at 1,809 cubic feet, and 86 square feet per bed.</p> <p><i>Ventilation</i> by doors and openings in ridge; “sufficient.”</p> <p><i>Cleansing</i>.—Limewashing annually, or oftener.</p> <p><i>Latrines</i> of usual construction. Contents removed daily.</p> <p><i>Lavatory</i> attached to hospital. Two bath rooms with two baths in each. Earthen dishes used for ablution.</p> <p><i>Hospital washing</i> by dhobies.</p> <p><i>Storage</i> insufficient. Bedding and clothing partly kept in verandahs, and injured by wet or damp (since remedied).</p> <p><i>Bedding</i>.—Wooden bedsteads; tow mattresses.</p> <p><i>Cooking</i> “sufficient.”</p> <p><i>Attendance</i>.—Usual establishment. Comrades allowed in serious cases.</p> <p><i>Sanitary state</i> good, but more accommodation in the way of store rooms and small wards required.</p> <p><i>Convalescents</i>.—No wards; not needed. No provision for exercise, except verandahs. Weakly men taken out on elephants.</p> <p><i>Female hospital</i>, none. “Certainly desirable.”</p>
DELHI.	<p>31. No regular hospital. A temporary hospital of bricks, stone and mortar, on one floor. Too much surrounded by walls and other buildings for free ventilation. No windows, only doors. Ventilation of wards by doors and openings. Latrines of usual construction. Lavatories with iron and wooden baths. Cooking pretty well done. Whole arrangements temporary.</p> <p>32. Present hospital an old barrack, on an open, airy site, but has a sluggish malarious nullah in front.</p>
MORAR GWALIOR.	<p><i>Water supply</i>.—Any amount available.</p>

STATIONS.	REPLIES.
JUBBULPORE.	<p><i>Drainage</i> into cesspits constantly emptied. <i>Construction</i>, on one floor, raised 5 to 6 feet above ground. <i>Accommodation</i>.—Five wards, 100 beds, 1,540 cubic feet, and 103 square feet per bed. <i>Ventilation</i>.—No windows, only doors. <i>Lavatory</i>, temporary. Sick bathed in tubs. Neither sufficient nor convenient. <i>Storage</i> indifferent. None properly so called. Sometimes tents used, sometimes part of the hospital when there is room. <i>Cooking</i>.—Kitchen “not commodious.” <i>Sanitary state</i> in every respect objectionable. New hospital much required. “<i>No women and no hospital</i>, which arrangements are very unsatisfactory.” 33. <i>Site</i>.—Generally good. <i>Water supply</i> abundant. <i>Drainage</i> by open pukka drains. No provision for conveying away the roof water. <i>Construction</i>.—Unfinished; on one floor; raised 2 feet above ground; no ventilation beneath. Materials brick and lime. Tiled roofs. Verandahs. <i>Accommodation</i>.—Three wards, 60 beds; 1,768 cubic feet and 81 square feet per bed. <i>Ventilation</i>.—No windows; doors half glazed; 15 on each side. A ventilator in each door. Apertures at top of wall and in roof. Sufficient; tatties for cooling. <i>Cleansing</i>.—Limewashing twice a year. <i>Latrines</i> connected with a cesspit cleansed daily by filth carts. <i>Lavatory</i> at the ends of verandahs. Bath room under same roof as latrines, but separated “sufficient.” <i>Hospital washing</i> by dhobies. <i>Storage</i> unfinished. <i>Bedding</i>.—Wooden bedsteads; iron better. <i>Cooking</i> sufficient. <i>Attendance</i>.—Hospital serjeant and two orderlies, increased as required. <i>Convalescents</i>.—Wards none, such would undoubtedly be advantageous. Only verandahs for exercise. <i>Female hospital</i>, none. Treated in barrack rooms. “A most unsatisfactory arrangement.” <i>Sanitary state</i>.—Hospital incomplete. No dead house, &c.</p>
DARJEELING.	<p>34. <i>Site</i>.—Far too exposed. <i>Water supply</i>.—Good and sufficient. <i>Drainage</i>.—Not carried far enough down hill. Means of conveying away roof water bad. Surface drainage and guttering insufficient. <i>Construction</i>.—Brick and mortar; one story; with verandahs. <i>Accommodation</i>.—Two wards; 34 beds, 1,100 cubic feet, and 75 square feet per bed. <i>Ventilation</i>.—By windows and doors; insufficient light; insufficient ventilation. Warming by fireplaces. <i>Cleansing</i>.—Limewashing once a year; too seldom. <i>Latrines</i>.—Under same roof as hospital; very badly drained; water supply defective; state offensive. Western verandah was used for accommodating sick, when patients obliged to leave wards on account of effluvia from privy. This was shut up “after five years writing about it.” <i>Lavatory</i>.—Close to privy; cold and offensive from its proximity. No fireplace in it. Several men have to wash in same utensil, and to dry with same towel several days running. “<i>In fact, the inducements to remain dirty are, especially in the case of sickly men, greater than those to be clean.</i>” No means of bathing, properly so called. <i>Hospital washing</i>.—Means sufficient, except during rains. <i>Storage</i>.—Not sufficient. <i>Bedding</i>.—No cots; only barrack bedsteads; far too narrow for sick men. Mattresses stuffed with coarse hemp; hard, lumpy, and furrowy. Blankets and pillows very inferior. “<i>Last year’s supply</i>” almost all “<i>worm-eaten</i>,” had been previously used in the plains. <i>Cooking</i>.—Cooks not numerous enough, nor sufficiently paid. Impossible to get anything like a good cook for the trifling wages. <i>Attendance</i>.—“<i>Sufficient up here,</i>” but hospital serjeant and orderlies should be better paid. <i>Sanitary state</i>.—“<i>Bad.</i>” <i>Convalescents</i>.—No wards. Wards would be an advantage. No provision for exercise. <i>Female hospital</i>.—None. Women and children treated in their own quarters. Would be satisfactory enough if the married quarters were not so dark and damp as they are.</p>
XXI. BURIAL OF THE DEAD.	<p>Every station has a British burial ground, situated at a proper distance from cantonments. The grounds are generally well kept, and of suitable soil. One body is buried in a grave; rarely re-opened, except for relatives. One or two of the low lying grounds appear to be wet. But no nuisance or injury to health is ever said to arise from any of them. A burial takes place generally as soon as arrangements can be made, 12 to 24 hours after death. Mohametans bury their dead in separate grounds; generally at a considerable distance from barracks. Their practice of burial is not so careful as that in the British grounds. And sometimes considerable nuisance arises from the dead becoming partially exposed by wild animals or by heavy rains. Near large cities, the grounds become at times very offensive; and better regulations on the part of the authorities appear to be called for. Hindoos burn their dead, and throw the remains, more or less imperfectly consumed, into the rivers. The burning ghats are sometimes too close to the stations, and give rise to nuisance. At other times, the poor merely singe the body, and throw it into the river. Some additional regulation in these matters appears to be required at certain stations.</p>

MADRAS PRESIDENCY.

ABSTRACT OF SANITARY DETAILS IN RETURNS FROM PRINCIPAL STATIONS WHERE THERE IS ACCOMMODATION FOR BRITISH TROOPS.

Replies to the questions issued by the Commission have been received from 49 stations in the Madras Presidency and its dependencies, at 29 of which there is accommodation for European troops.

A number of these were occupied solely by native troops at the time the returns were made.

The following abstract is confined to the more important stations where the largest number of European troops have been located.

The lowest stations are *Fort St. George* and *Poonamallee* on the level of the sea. The highest occupied purely as a military station is *Bangalore*, 3,000 feet above the level of the sea.

There are two hill stations, *Ramandroog* and *Wellington*, the former 3,300, the latter 6,000 feet above the sea.

About 8,500 men are barracked at elevations between the sea level and 1,000 feet above.

About 4,500 are placed at heights between 1,000 and 1,800 feet. Nearly 1,700 are barracked at *Bangalore*, at an altitude of 3,000 feet, and about 1,000 at the two hill stations.

The sea side stations of *Fort St. George*, *Waltair*, and *Vizagapatam* occupy sandy soils ; the last is on a swampy tidal estuary.

The barracks and hospitals at *St. Thomas' Mount* are close under the hill, which rises 180 feet above them.

The higher stations are on granite and trap rock, sandstone, and limestone.

Bangalore is an undulating sandy table land, partly swampy.

The Neilgherries in the neighbourhood of *Wellington* are mountainous, and consist of schists and basaltic dykes.

The plain at *Poonamallee* is under water in the rains.

Rangoon and *Tonghoo* are both situated in low, jungly, marshy districts.

In many parts of the Madras Presidency there are districts of country of a healthy character, and possessing climates similar to the best of the south of Europe. Very few of the climates of existing stations are reported as unhealthy, while many are considered as decidedly conducive to health.

TOPO-
GRAPHY
AND MOR-
TALITY.

Stations.	Elevation above		Accom- moda- tion for British Troops.	Actual Occupation.	Mortality per 1,000 per annum British Troops.		Remarks.
	Sea.	Country.			Total.	Miasmatic Diseases.	
Secunderabad -	Fect. 1,800	Fect. various	1,961	2,978	59.74		Undulating ; rocky ; large tanks ; granite and sand.
Vizagapatam -	10	0	310	310			On sea-shore ; close to tidal marsh ; alluvium and gravel.
Waltair -	200	150					Sand hills, with deep, clean, dry ravines ; close to sea.
Bellary -	1,600	60	1,038	1,084	48.6		Undulating ; dry ; black soil ; granite.
Madras -	0	0	1,030		34.69*	16.21	Flat ; sandy ; dry ; clay ; resting on primitive formation.
Fort St. George }							
Vellore -	675	0		248			Hilly ; alluvium ; part swampy ; primitive rocks.
Bangalore -	3,000	0	1,639		23.69*	12.69	Undulating ; sandy and dry ; part swampy in rain.
Cannanore -	20	0	1,094		21.25*	8.86	On the sea-coast ; laterite with red gravel.
Trichinopoly -	250		1,095		31.07		Alluvial ; granite and trap rock.
Rangoon -	80	70	1,150	1,033			Flat ; jungly ; swampy ; clay ; sandstone ; laterite.
Tonghoo -	300	35	1,160	681			Flat ; marshy ; jungly ; red sand ; clay ; laterite ; iron ore.
Ramandroog -	3,300	1,000	50				Hilly ; covered with jungle ; a table land ; scanty water supply ; exposed to winds ; no cultivation.
Kamptee -	900	0	1,396	1,396	37.26*	23.45	Flat ; black soil ; wet in rains ; sandstone and limestone.
Arcoot -	550	30	366				Partly cultivated ; sandy ; dry, broken ground, flooded in monsoon, producing malaria ; quarter of a mile from river Pallar.
Jaulnah -	1,652		427		10.3		Hilly ; trap rock ; red and black soil.
Poonamallee -	2	0	600		89.55*	69.65	Plain ; under water in monsoon ; sandy.
Wellington (Jackatalla) }	6,000	5,000	907		39.11*	21.93	Mountainous ; schists ; ferruginous clay ; basaltic dykes. Open ; small hills ; numerous tanks ; St. Thomas' Mount rises close behind barracks, and 180 feet above parade, impeding ventilation and increasing heat.
St. Thomas' Mount							

STATIONS.	REPLIES.
II. LOCAL CLIMATES.	
FORT ST. GEORGE.	On the whole favourable to health. From November to February cool, dry, pleasant. Temperature 76° to 78° F. Air moist in May and October. Maximum temperature in May 99°. Minimum in December and January 65°. No violent changes. Heavy dew in December and January, with fog 2 or 3 feet above the surface. Air always damp during long-shore winds. Dusty during north winds. Dysentery during October rains. Hepatitis and fever in hot season. January and February the most healthy months ; August and September the most unhealthy.
SECUNDERABAD.	Remarkably dry. Rain falls on 50 days annually. Average annual fall, 28 inches. Very changeable. Great attention required to clothing and shelter. Mean maximum temperature of year 95° in May. Mean minimum 64° in December and January. Sun temperature 113° in May. Hot winds, excessive heat and parching, with occasional dust storms, from March till June, which are however the healthiest months. July, August, September, the most unhealthy, when hepatitis, dysentery, diarrhoea, fever, continued, ephemeral, remittent and typhoid, prevail.
VIZAGAPATAM AND WALTAIR.	Climate healthy, rather relaxing. Damp and muggy in south-west monsoon. Usual temperature 92° F. in hot, 70° F. in cold season. Sea-breeze constant. Daily variations slight. Climate healthy. European troops should be healthy, if properly clothed and kept from liquor. Flannel should always be worn. In August and September some remittent fever ; other months healthy.
VELLORE.	No observations. Climate hot, but healthy.

* The mortality for the Madras stations is taken partly from the mortality returns for Queen's infantry in the Appendix. The instances in which this is done are marked *. The mortality of the other stations refers partly to Queen's, partly to British troops of the Indian army, and is taken partly from Sir Alexander Tulloch's evidence, partly from the report of Inspector-General Pearse (Appendix).

STATIONS.	REPLIES.
BELLARY.	Dry; not very hot. Highest mean maximum 92° F. in May; lowest 78° in January. Mean minimum from 65° in February to 77° in May. Mean monthly range of temperature 8° to 16°. No fogs. Dust storms occasionally. Climate favourable to health of troops, but less animal food and stimulating drink desirable in hot weather. Intermittents, occasional remittents, and bowel complaints occur from October till January. Ephemeral or continued fever in hot months. Rainy season healthy.
BANGALORE.	Climate one of the best in India. Maximum temperature 97°; minimum 55½°. Mean temperature 75°. Sun's rays powerful. From November till February cold renders woollen clothing and blankets necessary. Most favourable to health. Severe fevers rare. Cholera seldom occurs, but liver disease and dysentery are common. December to April, August, and September healthy. May to July, October and November unhealthy.
CANNANORE.	A sea-coast climate. Generally equable. Occasionally chilly. In wet season moist. Productive among Europeans of loss of tone and debility after long residence. Flannel under-clothing at all times necessary. Mean maximum 81° to 90° F. Mean minimum 73° to 82°. Rainfall 122 to 124 inches.
TRICHINOPOLY.	Hot for two-thirds or three-fourths of year. Mean annual temperature 85° F. Maximum above 100°. Sun temperature 140°. Mean annual rainfall 30 inches. Whirlwinds of dust in May, June, and July. Rivers and tanks dried up. Vegetation suspended. Climate enervating, impairing digestion. Light diet; little animal food necessary. Woollen clothing required for three months. April to July unhealthy; cholera and fever prevail. November to January healthy.
KAMPTEE.	Year divided into cold, hot, and rainy seasons. Cold season from October to January. Temperature 68° in house, 38° at sunrise outside. Hot season from March to June; 85° to 98° F. in house. Rainy season preceded by distressing sultriness, causing langour, restlessness, <i>malaise</i> , exhaustion. Considerable diurnal variation. Heavy dews; sometimes fogs. Maximum temperature observed 110°. Rainy season most unhealthy. Cholera, March, April, July, August; also fevers and bowel disease.
ARCOT.	No meteorological instruments. Climate generally a dry heat. Hot and cold weather most healthy. Immediately before and after monsoon unhealthy.
ST. THOMAS' MOUNT.	No observations. Climate dry for at least nine months. Hot all the year round, varying from 71° minimum to 95° maximum. Heavy rains in October and November. Average annual fall 30 to 40 inches. Climate equable. Fogs rare. Damp at times. Effect on health debilitating from excessive heat; best precautions against which, are moderate diet (animal and vegetable), total abolition of spirituous liquors, moderate quantity of malt liquor, woollen clothing in rainy and cool season, morning drill, sufficient recreation and exercise. October to December most unhealthy months. Severe fever, dysentery, and hepatic disease prevail. January and February healthiest.
WELLINGTON (Jackatalla.)	Climate excellent. Changes gradual. On first arrival battalion suffered much from low fever; not attributable to climate, but to want of drainage of barrack square. March to May unhealthy, apparently from reason mentioned. Barrack square frequently an immense swamp. 1859, barometer from 24.307 to 24.400; mean maximum temperature, 66° F. to 75° F.; mean minimum temperature, 60° to 65°; mean temperature, 63° to 69½°.
RAMANDROOG.	Climate salubrious. Heat never above 84° degrees in shade. No hot winds. Night and morning mists in June, July, and August. September and October pleasant. November and December decidedly cold. All convalescents whatever are better here from March to June than on plains. But in cold and rainy seasons, rheumatism, hepatitis, pulmonary and syphilitic disease are aggravated. Healthy from September to January. Unhealthy (so called) April to August. Fever, rheumatism, hepatic, and pulmonary diseases then prevail. Mean maximum temperature, 85°; lowest mean, 64°; daily range, 4° to 9°.
POONAMALLEE.	Considered healthy. Sea-breeze daily. Highest mean maximum temperature, 87.2° F.; lowest mean minimum, 74.2° F. Rainfall 38½ inches. Ophthalmia and fevers during hot land winds. Catarrhal affections during wet cold season. Healthy months, January to May. Unhealthy, June to September. Prevailing diseases of these months, bowel and liver complaints.
JAULNAH.	No meteorological instruments nor records. Climate generally salubrious; dry and cold; liable to great and sudden variations. Fogs and damp rare; air pure; influence on health salutary. December and January most healthy. August to November unhealthy; fever, dysentery, diarrhoea, rheumatism, then prevail.
RANGOON.	Only eight months' observations. Highest mean maximum 96°. Lowest mean minimum 63°. Mean daily range of temperature from 6°.4 to 28°.9. Climate dry from middle of October till middle of May. Heavy dews and mists January to March. Healthy for European, not for native troops. March till May healthy. During wet season bowel complaints prevail.
TONGHOO.	Highest mean maximum 98° in April, rising to 105°. Lowest mean minimum 57° in January. Sometimes falls to 49°. November to end of February most healthy. May to end of August most unhealthy. Fevers and bowel complaints prevail. Climate good for a tropical one.

III. PREVAILING DISEASES AMONG NATIVE POPULATION, AND THEIR CAUSES.

FORT ST. GEORGE.	Continued fevers, diarrhoea, dysentery. Cholera, a few cases, almost daily among natives; occasionally epidemic. Natives who cannot work, generally poor and unhealthy from bad and insufficient food, and are obliged to live in lowest and worst drained locality.
SECUNDERABAD.	Population hale and robust looking, with occasional outbreaks of epidemics. In Hyderabad there are all the influences at work which tend to cause and to propagate zymotic diseases; the most common of which are cholera, smallpox, diarrhoea, dysentery, guinea worm, rheumatism, fevers, often producing spleen disease. Climate and diet not unwholesome; but in Hyderabad, and in a very much less degree in Secunderabad, overcrowding, want of drainage and sanitary measures generally, produce disease among the population.
VIZAGAPATAM AND WALTAIR.	At Vizagapatam, the prevailing diseases are cholera, smallpox, chicken-pox, intermittent and remittent fever, rheumatism, beriberi, lepra, elephantiasis; fevers appear to depend on wind blowing from jungles.
BELLARY.	Generally healthy. Cholera occasionally; fever at times, not malarious, at setting in of rains and during north-east wind. Ophthalmia in rains. Healthiness attributable to dry atmosphere and no superabundance of vegetation.

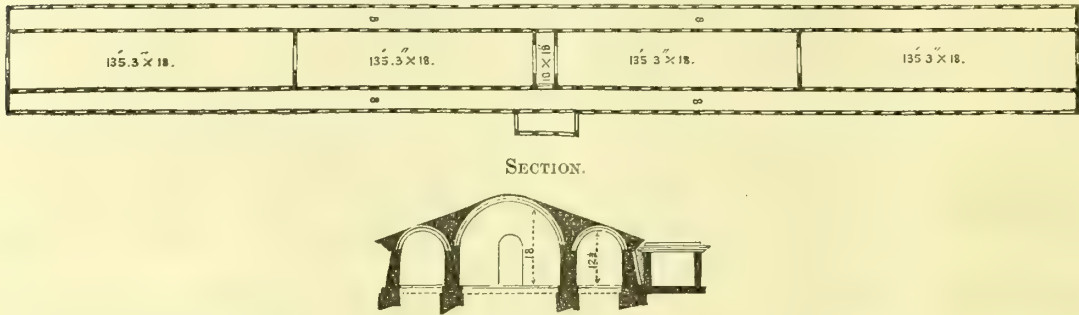
STATIONS.	REPLIES.
VELLORE. BANGALORE.	Epidemics occasionally; none for some years. Fevers occur after drying up of paddy fields. Intermittent (quotidian); dysentery; diarrhoea; rheumatism; hepatic disease; cholera, occasionally. Population healthy.
CANNANORE.	Town of Cannanore at certain periods very unhealthy. Prevailing diseases, cholera, smallpox, dysentery, diarrhoea, attributable to overcrowding, burying dead among the houses, &c.
TRICHINOPOLY.	Bowel complaints and fevers, not to excess. Native population healthy, attributable to simple and unstimulating nature of mode of living. Itch and leprosy frequent, caused by bad sanitary condition of houses and want of ablution.
KAMPTEE.	Fever, smallpox, cholera, stomach and bowel complaints; irregularity in diet and indulgence in bang and liquor, chief causes.
ARCOT.	No definite information. Epidemic cholera occasionally breaks out.
ST. THOMAS' MOUNT. WELLINGTON (Jackatalla).	Intermittent fever, cholera, smallpox; due to crowding, want of ventilation, and filth. Natives healthy, attributable to general abstemiousness. But those who arrive from low country suffer from intermittent and spleen disease, from sleeping on the ground. Those who sleep on charpoys not affected.
RAMANDROOG. POONAMALLEE.	Native population said to be healthy. No definite information.
JAULNAH.	Smallpox and cholera, attributable to overcrowding and filth.
RANGOON. TONGHOO.	Population healthy, attributable to salubrity of climate. Prevailing diseases, intermittent and remittent fevers.
III. PREVAILING DISEASES AMONG EUROPEAN TROOPS. FORT ST. GEORGE.	Native population said to be "very healthy." Native population liable to intermittent fevers and spleen disease; said to be due to the marshy and jungly nature of the country.
SECUNDERABAD.	Continued fever, dysentery, hepatic disease. Shelter from sun and moderation in eating and drinking the best preventives for hepatic disease. Sanitary improvement of town recommended. About 35 per cent. constantly sick from venereal disease. Lock hospitals recommended. In 4 years, 1855 to 1859, admissions from hepatic disease were 6·84 per cent. of total admissions. In the same period, among native troops, there were 0·23 per cent. That is to say, for every native soldier affected with liver disease, 30 British soldiers were affected. Every possible discouragement should be given to the use of ardent spirits. Unnecessary exposure to the sun and chills should be avoided. During same years, 19½ per cent. of admissions were from venereal, against 4·29 per cent. among native troops. A lock hospital has been long in existence, with these "excellent results." (!)
VIZAGAPATAM AND WALTAIR.	Dysentery is endemic among Europeans, occasionally attaining a fatal malignancy; cholera, more or less; also smallpox; rheumatism and fevers very prevalent, latter rarely malarious, but obscurely remittent and adynamic, often turning into typhoid. Very little hepatic disease. About 6 per cent. of total sick are from venereal. At most stations, dispensaries are all that is required to diminish it. Police surveillance of women in India is "most objectionable and liable to the greatest abuse" from bribery of agents. Nothing to be gained from lock hospitals.
BELLARY.	Fevers, chiefly quotidian, not uncommon; dysentery occasionally fatal; no cholera for 2½ years; smallpox occasionally in hot months; rheumatism common during the south-west monsoon; 28 per cent. of admissions, and 29 per cent. of total deaths are due to malarial disease. Fevers, cholera, smallpox, most frequent diseases. Hepatic disease amounted in 5 years to 3·77 per cent. of admissions. "Less spirits, or better none, would be the best prophylactic." Venereal disease has formed 40 per cent. of constantly sick for many years. Best remedy, marriage, at present cost but eventual saving. Lock hospitals advantageous, if efficiently worked.
VELLORE.	Most common zymotic diseases are intermittents in cold season; sometimes remittents, not severe; ephemeral in hot weather; little dysentery; cholera about every 3 or 4 years; rheumatism frequent; bowel complaints occasion 20½ per cent. of the mortality; 24 per cent. of the admissions and 44½ per cent. of the deaths arise from malarial disease.
BANGALORE.	Ephemeral, quotidian, tertian, and a few cases of quartan fever prevail. A few cases of dysentery, but no cholera this year. [This refers to native troops.] In 1859-60, 4 per cent. of the strength admitted to hospital with hepatic disease. Temperance, clothing, and avoidance of exposure, are prophylactics. Venereal disease constitutes half the sickness in hospital. Lock hospitals have been recently established. Benefit hoped from them, if properly conducted.
CANNANORE.	Most common malarial diseases among troops are, quotidian and continued fever, acute dysentery, and rheumatism. Adjacent to the barracks is the bazaar, in which are several tanneries, a slaughter-house, and other nuisances. Disinfection of drains and latrines recommended to diminish the frequency of malarial disease. About 4 per cent. of cases under treatment are hepatic disease, attributed to climate. About 33 per cent. of total sick are from venereal disease. Lock hospitals, with stringent police regulation, suggested.
TRICHINOPOLY.	Prevailing epidemic diseases are fevers of continued and remittent types, sometimes intermittent, all asthenic in form, and accompanied by other diseases. Dysentery common during south-west monsoon. Rheumatism at the same time; generally very obstinate. Proportion of liver disease 1 to 34 of other diseases. Cause, often high temperature, but more frequently spirituous liquors. It arises from sun, drink, damp, sudden changes of temperature, sometimes from dysentery, also from scrofulous habit. Men who in England would suffer from phthisis, get abscess of the liver in India. Proportion of venereal one-fourth or one-fifth of the total sick. In one European corps, 600 to 700 strong, half the strength was in hospital during the year from syphilis. Men when ill are away 20 days from duty. Remedy, marriage; lock hospitals of little use, "as they frequently become instruments of tyranny or revenge." Disease communicable long before the sufferer is aware of its existence. Lock hospitals, with stringent police regulation, might be of use. Troops suffer from fever, intermittent most common, cholera, smallpox. Most fertile source of disease among soldiers, bad spirituous liquor not obtained in canteen.

STATIONS.	REPLIES.
KAMPTEE.	In artillery, in September 1859, 3 cases scorbutus from insufficient vegetables. Better description of vegetables much required. Has been frequently reported. During the last 3 years, one thirty-sixth of whole admissions have been from hepatic disease. Causes: high temperature, exposure to sun, improper food, abuse of spirits, malaria, bad ventilation of barracks. One-fifth of admissions in artillery from venereal disease. Lock hospitals recommended. Prevailing diseases: fevers, of malarial origin, intermittent and remittent; dysentery, which alone causes a fifth part of the mortality; cholera, smallpox, rheumatism.
ARCOT.	About 2·85 per cent. of admissions from hepatic disease. Usually a primary disease, and more particularly in those of intemperate habits. During the last two years 19 per cent. of constantly sick from venereal disease. Lock hospitals and police inspection recommended. Prevailing diseases are, fevers, dysentery, cholera, and rheumatism. Typhoid fevers have lately appeared. In 1857-8, 50 per cent. of the deaths from dysentery. In 1858-9, 84 per cent. of deaths from cholera. In same year, out of 118 average strength, 343 admissions into hospital, and 25 deaths. Cholera of that year arose from imperfect drainage of barracks.
ST. THOMAS' MOUNT.	Usually 4 or 5 cases of hepatic disease under treatment, caused by solar heat and intemperance; also the result of fevers. Seven cases in 54 due to venereal. Police regulations and lock hospitals suggested. Fevers and bowel complaints prevail. Dysentery and fever most prevalent in monsoon; liver disease in hot season. Personal causes: drinking spirits, exposure, eating unripe fruit. Preventives: large, well-ventilated barracks and hospitals, proper drainage and latrines, abundance of water, wholesome diet, abstinence from spirits.
WELLINGTON (Jackatalla).	A few cases of scorbutus among men of broken-down constitution. Change to a warmer station was always had recourse to. A few fresh cases of hepatic disease have occurred from stimulants. Fifty-seven per cent. of total sick are from venereal. Lock hospitals recommended, and stopping pay while men are in hospital. Remittent fever very common, March till June; not so frequent since barrack was drained. Dysentery, a few cases. No cholera. Per-centages to total admissions and deaths as follow:—Admissions: fevers, 12 per cent.; dysentery, 24 per cent.; rheumatism, 4½ per cent. Deaths: fevers, 38 per cent.
RAMANDROOG.	Hepatic and syphilitic diseases imported. Occasional slight ephemeral fever at beginning of hot season. Other zymotic diseases are relapses.
POONAMALLEE.	Hepatic diseases, 1 in 12 of cases in hospital, attributable to climatic influences, aggravated by intemperance. Very little venereal. Stringent police regulations and lock hospitals desirable.
	Most prevalent fevers: common, continued, and remittent. Dysentery, chiefly relapses, in cases sent for change of air. A few cases of malignant cholera have occurred among most drunken pensioners. Rheumatism, chiefly syphilitic. These diseases yield 20 per cent. of admissions, and 33 per cent. of deaths.
JAULNAH.	9 to 10 per cent. of admissions from liver disease, caused by intemperance and unnecessary exposure. "Best precautionary measure, stopping sale of intoxicating liquors." Ten per cent. of cases are venereal. Police regulation and lock hospitals recommended.
	Admissions from fever, 1 in 4 of total admissions; deaths, 1 in 15 of total deaths. From dysentery, admissions from 1 in 2½ to 1 in 4½; deaths, 1 in 15. From cholera, admissions 1 in 52 to 1 in 122; deaths, 1 in 7½. Smallpox, admissions, 1 in 66; deaths, 1 in 15. Rheumatism, admissions 1 in 14. Most prevalent fevers, remittent and intermittent. Cholera sometimes epidemic. Zymotic diseases most prevalent in hot and wet seasons, with a close atmosphere. Intemperance, exposure, eating unripe fruit and vegetables, predisposing causes.
RANGOON.	In the Pegu division, admissions from hepatic disease 2 per cent. of total admissions, and deaths 11½ per cent. of total deaths. Causes: climate, sun, ardent spirits, chills. Fevers, ephemeral, intermittent, remittent, and continued, occasion 16½ per cent. of admissions and 9½ per cent. of deaths. Dysentery and diarrhoea in rains.
TONGHOO.	Mortality during last two years about 1 per cent. of strength. Hepatic disease infrequent. Venereal rare. Cholera unknown. Prevailing diseases: fever, intermittent and remittent, and dysentery.
V. SANITARY STATE OF BAZAARS AND NATIVE TOWNS.	
MADRAS.	Most offensive effluvia from river Koom, which "probably" predispose to disease among those exposed to their influence. Air in Black Town and Triplecane loaded with mephitic effluvia at night. Fort bazaar small, clean, and well-ventilated. Bazaars at Perambore and Vepery not well cleaned. Atmosphere around "perfectly poisoned." Drainage very bad.
SECUNDERABAD.	Hyderabad is a "hot-bed" of cholera. Sanitary condition very bad. All main streets of Secunderabad bazaar are drained; many back streets not so. External ventilation, on the whole, good. No overcrowding. "Superintendent of police visits bazaar once a week, and fines those in front of whose houses any filth or nuisance is found." Natives ordered to resort to privies, but "no doubt the order is extensively evaded." Water supply from wells; some of them brackish. Supply fails in hot season, and great inconvenience is experienced.
VIZAGAPATAM AND WALTAIR.	Sanitary state of bazaars very bad, and although under improvement, never likely to be good. Houses crowded. Habits of the people filthy and offensive. Water from wells not overabundant; said to be good. Large heaps of filth near the fishermen's huts about the fort. Dungheaps and cesspits among native houses being removed. The "greatest possible nuisance" at times in consequence of drying fish and from the state of the drains. Troops should be removed from this nuisance at Vizagapatam to Waltair. At Waltair, large foul ditch in the bazaar used as a necessary by natives, 500 yards from barracks.
BELLARY.	"Good" drainage, and ventilation lately much improved. Water supply deficient. Cleanliness attended to. Filth removed half a mile, and buried. Streets irregularly built, confined, and crowded, preventing free circulation of air. Nullahs run through bazaar, which occasionally overflow their banks and spread among the houses, many of which are mere hovels. In the better class there is generally a cesspool, "which must be injurious to health."
VELLORE.	Well drained. No latrines. Cleanliness scarcely attended to. Natives perfectly indifferent to condition of their houses. Few of them without those hot-beds of disease, dungheaps and cesspits. Wind blowing over native houses and drains causes nuisance in barracks.

STATIONS.	REPLIES.
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Fig. 2 shows the Madras artillery barracks at this station.

FIG. 2.—PLAN OF MADRAS ARTILLERY BARRACKS, SECUNDERABAD.



VIZAGAPATAM AND
WALTAIR.

BELLARY.

Cots wooden. Commander-in-Chief states that, for upwards of 4 years, he has attempted unsuccessfully to obtain iron cots.

At *Vizagapatam*, one barrack room for 72 men, at 560 cubic feet, and 43 square feet per man. Five temporary barracks at *Waltair*, giving about 800 cubic feet and 53 square feet per man. At *Waltair*, built of wattle and daub, with verandahs and thatched roof. At *Vizagapatam*, of brick, stone, and mortar. Those at *Waltair* liked by the men; cool and healthy. Those at *Vizagapatam*, hot and close, objectionable in every way, ought to be rebuilt.

No passage of air beneath floors.

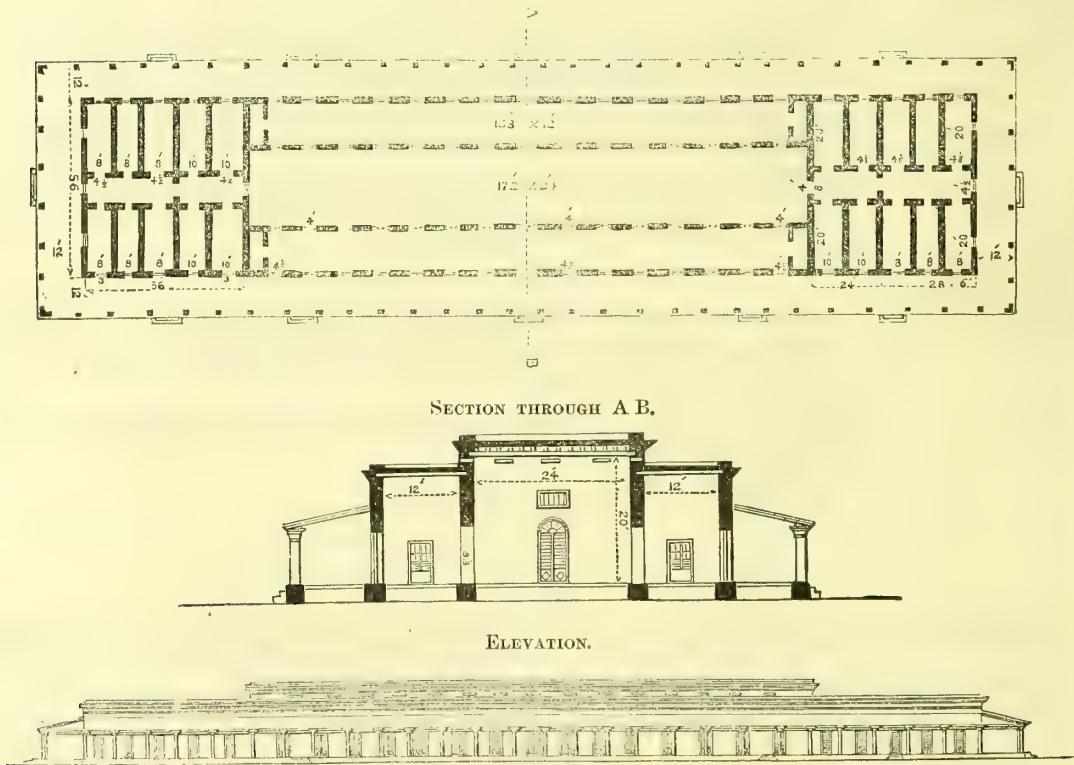
Bedsteads of wood, infested with bugs to a great extent. Iron should be issued.

Nine barrack ranges for men; each consisting of one centre room for 64 men, and two inner verandahs for 18 men each. Cubic feet per man, 1,290 to 1,685; square feet, 64 to 105. Materials, stone. Floors of granite slabs, 2½ feet above ground, with no ventilation beneath.

Construction commenced in 1843, completed in 1858.

Fig. 3 gives a plan and section of these barracks.

FIG. 3.—NEW EUROPEAN BARRACKS, BELLARY.



VELLORE.

BANGALORE.

Beds merely planks on wooden trestles. Bugs abound in all the barracks. Iron cots required.

No information as to accommodation. Materials, brick and chunam, with tiled roof. Flooring of tiles and cement, 6 inches above ground; no ventilation beneath.

Materials, stone, brick, and mortar.

Floors of flags or chunam; some raised above ground. No passage of air beneath.

All have verandahs; never used as sleeping places.

Bedsteads of planks on wooden trestles. Iron would be better.

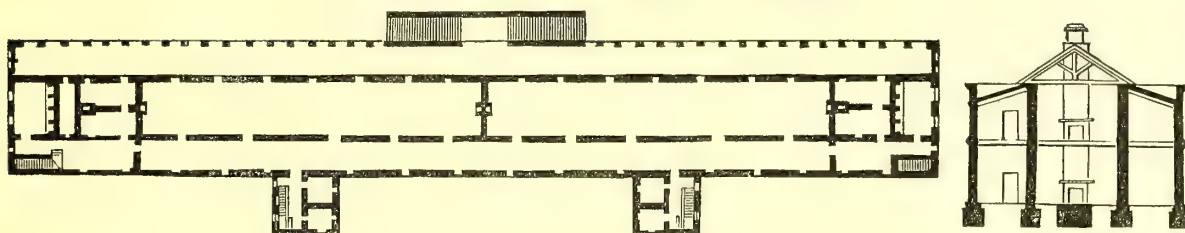
Whitewashing once a year inside, and once every two years outside, but oftener, if necessary.

Barracks at the station for horse artillery, for foot artillery, for cavalry, and for infantry.

Horse artillery barracks in two ranges, containing 90 men each, at 1,000 cubic feet and 46 square feet per man. Foot artillery barracks consist of two ranges, 29 men in each, at 1,000 cubic feet and about 70 square feet per man. For cavalry eight ranges, 88 men each, at 1,000 cubic feet and 46 square feet per man. Infantry barracks are in six ranges, containing 52 to 113 men per range, at about the same cubic space and superficial area.

STATIONS.	REPLIES.
CANNANORE.	No details of accommodation. Verandahs : inner ones used as sleeping quarters for 103 men. Bedsteads of boards and trestles, infested with bugs ; iron ones required. Floors of laterite stone, raised 4 feet. No passage of air beneath. Walls of laterite plastered. Walls and ceilings limewashed once a year.
TRICHINOPOLY.	Accommodation for 148 artillery, and 947 infantry. Artillery barracks consist of two centre rooms, enclosed verandah and hall. Infantry barracks consist of one tiled room, no less than 1,011 feet long, a bomb-proof 795 feet long, and five temporary barracks. Cubic space per man not given, but appears to be, from the dimensions, 530 cubic feet per man for infantry, and 816 cubic feet per man for artillery. Materials, brick and chunam. Walls and ceilings limewashed once a year, or oftener. Planks and trestles for beds.
KAMPTEE.	One barrack for 1,056 infantry in ten ranges ; one for 340 artillery in three ranges. Numbers of men per room not given ; nor cubic space per man. Verandahs, 10 feet wide. General construction faulty. 80 to 100 men massed under the same roof for eating and sleeping, "which is highly objectionable," "when for many months of the year, the men are confined to barracks for 20 out of 24 hours." Buildings too low. Windows ought to be glazed. Materials, brick and lime. Flagged floors raised above ground ; but no ventilation below. Limewashing, once a year. Bedsteads, wood.
ARCOT.	Eight ranges, with accommodation for 360 non-commissioned officers and men at 1,000 cubic feet, and from 66 to 100 square feet per man. Serjeants' rooms give 969 cubic feet, and 80 square feet per man. Materials, brick in chunam and clay. Pantile roof. Floors of brick, granite, and chunam ; not raised above the ground. Verandahs, in which are placed serjeants' quarters. Wooden and iron cots. Cleansing and limewashing whenever required.
ST. THOMAS' MOUNT.	Constructed of bricks. Floors of chunam or brick. Buildings too low, and unsuited to the climate ; ought to be raised on arches. Verandahs. Limewashing annually. Iron and wooden cots. Dimensions not given. No cubic space. No superficial area.
WELLINGTON.	When completed, 20 barrack rooms (16 at present), to contain 42 men per room, at 967 to 1,320 cubic feet, and 64 to 66 square feet per man. 10 enclosed verandahs for mess rooms for 42 men each, at 482 to 557 cubic feet, and 37 square feet per man. Materials, brick and mortar, plastered inside and out. Flooring granite, asphalte, and teak, 1 foot 6 inches above ground ; free current of air beneath. Limewashing once a year. Bedsteads, planks and wooden trestles. Iron cots better. Fig. 4 shows the ground plan of the men's barracks.

FIG. 4.—GROUND PLAN OF BARRACKS AT WELLINGTON.



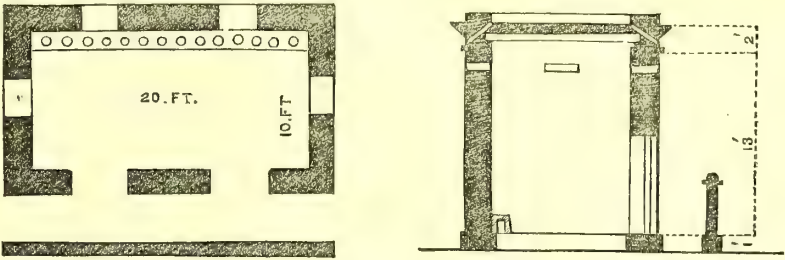
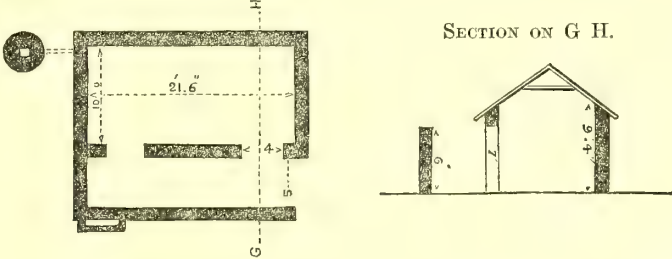
RAMANDROOG.	Built of stone. Stone floors, raised, but no passage of air beneath. Verandahs often occupied as sleeping quarters. Ten rooms. Accommodation for 4 non-commissioned officers and 46 men, at from 1,042 to 1,155 cubic feet per man, and from 58 to 65 square feet per man.
POONAMALLEE.	Bedsteads wood, very bad ; building swarms with bugs ; iron bedsteads preferable. Two long rooms, with 300 men in each. Space per man, if given correctly, is incredibly small, 112 cubic feet and 8½ square feet per man. Barracks pukka built. Verandah on one side, frequently used as sleeping quarters. Floors of large square bricks, level of ground. Buildings every way unsuitable ; have been condemned.
JAULNAH.	Materials, stone, brick, chunam. Floors raised 3 feet above ground, stone ; no air passage beneath. Glazed windows. Verandahs used as sleeping quarters in very hot weather. Men take meals in back enclosed verandah. Only an artillery barrack, 2 ranges, for 115 men, at 1,030 cubic feet and 60 square feet per man. Infantry, 312 in number, occupy private dwelling houses.
RANGOON.	European infantry barracks, 18 rooms, each 140 × 45 × 18 feet high ; 50 men per room, at 2,200 cubic feet and 120 square feet per man. Five European artillery barracks, 50 men each ; same dimensions. No verandah. Roof on both sides carried 10 feet beyond outer wall. Floors of plank and bamboo ; raised from 2 to 8 feet above the ground ; free ventilation underneath. Materials, wood.
TONGHOO.	Twenty European infantry barracks ; 50 men in each, at 2,302 cubic feet and 131 square feet per man. Four artillery barracks, 40 men in each, at 870 cubic feet and 60 square feet per man. Open verandah 12 feet wide. Materials wood. Floors raised from 3 to 7 feet above ground ; free ventilation beneath. Bedsteads most uncomfortable.

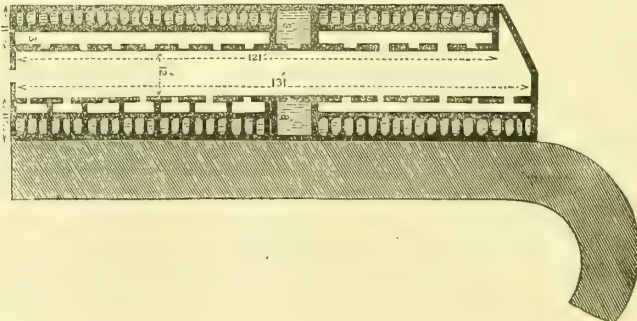
VII. MARRIED QUARTERS.

FORT ST. GEORGE.

There are 81 married quarters in the patchery, and 10 in the barrack square, making 91, instead of 150 as required for a full regiment. Recently a regiment had 126 families, and the number over 91 had to be accommodated in barrack rooms.

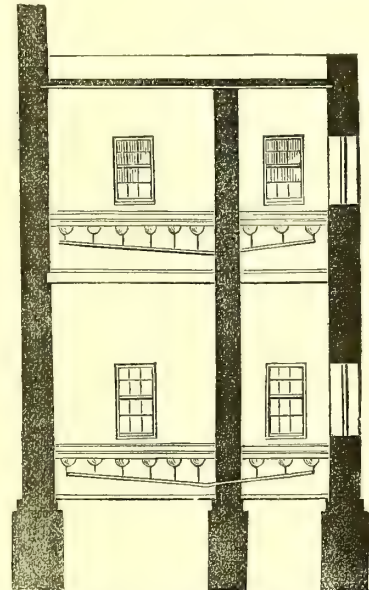
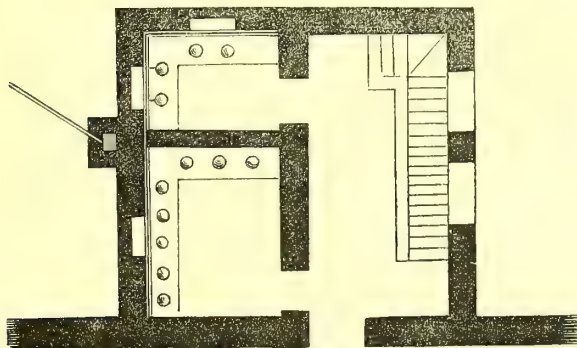
STATIONS.	REPLIES.
SECUNDERABAD.	"Sufficient."
VIZAGAPATAM AND WALTAIR.	Separate houses in the former. A building divided in separate quarters at the latter station.
BELLARY.	Ample accommodation in separate rooms.
VELLORE.	No information.
BANGALORE.	Sufficient married quarters, built or sanctioned for the cavalry and artillery barracks. Insufficient and very bad for the infantry, but the barrack is condemned, and to be given up.
CANNANORE.	In this case, some married people are in barrack rooms, but not with single men.
TRICHINOPOLY.	Married people are quartered in a Christian village. Separate ranges for them are very desirable.
KAMPTEE.	No separate quarters. A portion of the barrack accommodation has been given over for married people.
ARCOT.	Married quarters temporary. Most objectionable in every respect.
ST. THOMAS' MOUNT.	A separate barrack. Rooms divided by curtains.
WELLINGTON.	Married quarters insufficient; others being erected.
RAMANDROOG.	Married quarters "ample."
POONAMALLEE.	Sufficient for the present number.
JAULNAH.	None. Married people occupy barrack rooms with single men, but separated by curtains.
RANGOON.	Not sufficient special quarters. Those who have none live in the patchery, which is private property, consisting of most miserable hovels, badly situated, devoid of ventilation, and unfit for Europeans.
TONGHOO.	No special quarters. Artillery have a patchery.
	None, except for artillery, which are bad and not sufficiently roomy. Others sanctioned.
PRISON CELLS.	The prison and cell accommodation appears to be of an inferior character. At Secunderabad and Wellington prisons are being built. At nearly all the other stations the cells are described as more or less bad and unwholesome; as being too small, badly ventilated, damp, or too hot, or tainted by the proximity of privies. At Kamptee the cells are away from the barracks, and there is no quarter for any one in charge. These cells are otherwise bad, and cannot be used. The prison and cell accommodation will require improvement at the same time as the stations generally.
VIII. VENTILATION OF BARRACKS.	
FORT ST. GEORGE.	By opposite doors and windows. Venetian shutters to upper floor. Earthen tubes in roof. Half doors generally open night and day. Punkahs for cooling. Huts not ventilated.
SECUNDERABAD.	Ventilation by doors, windows, ridge ventilators, skylights, and upper wall ventilators; said to be sufficient to keep the air pure if the ventilators are kept open. Cooling by tatties.
VIZAGAPATAM AND WALTAIR.	No means of ventilation at Vizagapatam, except windows and doors; insufficient. At Waltair, ventilation insured by not carrying wall up to roof; quite sufficient. Punkahs used for cooling at Vizagapatam; not required at Waltair.
BELLARY.	No windows. Doors, half venetian, half panel. Openings for ventilation in side walls, nearly at top, having glass frames on pivots. Moveable fanlights above doors, sufficient. Punkahs used for cooling.
VELLORE.	None, except by doors and windows. No means of cooling the air.
BANGALORE.	All the barracks have windows and doors. In new buildings, roof and floor ventilation; generally sufficient, but defective in some old buildings.
CANNANORE.	By doors, windows, penthouses in roof, and ventilators in walls; not sufficient when doors and windows are shut. Punkahs not required.
TRICHINOPOLY.	Ventilation in bombproofs by windows and doors; in old artillery barrack by doors. Both insufficient. In other barracks, ridge ventilation, sufficient. Punkahs and tatties for cooling.
KAMPTEE.	Windows on opposite sides, unglazed. Three openings in roof of each barrack. "Ventilation most faulty and deficient." Punkahs and tatties for cooling.
ARCOT.	Windows on opposite sides with ventilators above. "Sufficient." Cooling by punkahs and tatties.
ST. THOMAS' MOUNT.	By an opening in the roof. Windows and doors on both sides; sufficient. Cooling by punkahs.
WELLINGTON.	Windows and doors opening to verandahs. Ventilating windows with ventilators 6 inches square. Sufficient. Warming by fire-places.
RAMANDROOG.	Ventilators near ceiling. Windows, doors, upper half venetianed; a great disadvantage in wet and windy weather. Half glass doors required. Warming by fire-places.
POONAMALLEE.	Windows on opposite sides. Small openings in roof. By no means sufficient.
JAULNAH.	Doors, windows, ridge ventilators, and fanlights; good, and generally sufficient in horse artillery; in native infantry and cavalry very deficient. Punkahs and tatties for cooling.
RANGOON.	Doors; and windows on opposite sides. Also a narrow opening, 4 to 6 inches wide, along the top of side walls. Might be improved by having ridge ventilation all along.
TONGHOO.	Doors; windows; a space between the roof and the top of the wall, and ventilating boards at the floor.
IX. DRAINAGE.	
FORT ST. GEORGE.	Fifty thousand rupees lately sanctioned for improving drainage of Fort St. George. Old privies "as bad as they well could be;" new ones being constructed. Arrangements at native lines, as described, simply abominable. Drainage, in the proper sense, cannot be said to exist; such as it is, it is worse than useless. "No cesspits within the fort of any consequence." Main drain of town 80 yards distant. Effluvia from it very offensive, with north-east wind.
SECUNDERABAD.	Undergoing improvement, in old barracks, by built drains, 4 feet by 3 feet, to an outlet 476 yards distant. Artillery barracks drained by surface drains to a soldiers' garden 140 yards distant. No drainage of any kind at Trimulgherry. Fluid refuse evaporates, or sinks into subsoil. A nullah, which intersects the cantonment, at times very unpleasant. Extent of cantonment said to be so enormous as to preclude any general surface draining. Parades and lines kept clean by regimental followers; bazaar by police.
VIZAGAPATAM AND WALTAIR.	At Vizagapatam, open surface drains to sea and back-water. At Waltair, drainage runs off by surface; said to be sufficient. At Vizagapatam, water lies on surface, unless cleared away. Chunam is spread over it at intervals. One or two bad drains near hospital.
BELLARY.	None, except the fall of the ground. Privies cleansed twice a day; contents thrown on the ground two miles away. Fig. 5 shows the structure of privies of this class.

STATIONS.	REPLIES.
<p>VELLORE. BANGALORE.</p> <p>CANNANORE.</p> <p>TRICHINOPOLY.</p> <p>KAMPTEE.</p> <p>ARCOT.</p> <p>ST. THOMAS' MOUNT.</p> <p>WELLINGTON.</p> <p>RAMANDROOG.</p> <p>POONAMALLEE.</p> <p>JAULNAH.</p>	<p>FIG. 5.—PLAN OF ONE OF THE PRIVIES ATTACHED TO THE BARRACKS, &c., BELLARY.</p>  <p>SECTION.</p> <p>Exceedingly defective. Attended to by local prisoners. Nightsoil carted away to a distance. All drainage by open surface drains to the Ulsoor tank, half a mile from most remote barrack. Sufficient for surface water. Ground favourable for drainage. No swamps or decidedly wet ground. The tank which receives the drainage is largely used for drinking purposes by the native population. All solid refuse carried away.</p> <p>Open drains, one foot deep, one foot broad; partially paved with stone. Privies sewered to covered drains. Outlet into the sea 60 yards off. Drainage not sufficient. During wet season, all floors damp. Drains badly constructed.</p> <p>An open drain on all sides of barracks. Outlet into an open ditch, 50 yards from nearest barrack. Sufficient for surface water. Artillery barracks not drained. Refuse fluid runs down slope into fields. Old ditch of fort, 2½ miles distant, extremely foul. Eight houses in European lines are the focus of fevers and cholera. Two recent cases had to be removed from them for treatment.</p> <p>No drainage. Rain water which does not find its way through the barrack wall is left to stagnate, evaporate, or sink into the subsoil. Holes dug in the ground, and consequently a mass of mud and filth, receive the cook-house drainage, and are emptied twice a day. Privies not drained. Everything carried away. "With a native population of 70,000 souls, there must be an immense deal of filth; but every means are taken to prevent it."</p> <p>No sewers. Surface drains. Sufficient for surface water, but not for cook-houses. Fluid refuse partly sinks into subsoil, and is partly carried away. Cesspits for privies, about 6 feet square; cleaned daily.</p> <p>Surface drains; only flushed by water from bath rooms and by rain. Insufficient, as the drains are frequently filthy. Contents carried to a very short distance from barracks and hospital, and allowed to sink into the soil. A foul ditch close to the outer wall of hospital; being rectified. Refuse from privies, &c., carried away daily.</p> <p>A project of pipe drainage has been submitted to Government. Drains for surface water being constructed. In the meantime, nightsoil and refuse conveyed in covered carts to cesspits a mile distant.</p> <p>Natural drainage down the slope. Fluid refuse taken down the hill. Privies and urinals built on the edge of the hill, which acts as a natural drain.</p> <p>No sewerage. Drainage insufficient. East wing of barracks damp in consequence. All fluid refuse "soaks into the subsoil, where it falls." Foul ditch surrounds the fort, which encloses the hospital; has been reported over and over again, without result.</p> <p>A masonry drain surrounds barrack, receiving smaller ones from lavatories, baths, &c. Outlet on a piece of waste ground, 150 yards from barrack. Privies and urinals have cesspools fitted with tubs; removed twice a day to a distance.</p> <p>Fig. 6 shows the arrangement.</p>
	<p>FIG. 6.—PRIVY, WITH CESSPOOL, JAULNAH.</p>  <p>SECTION ON G H.</p>
RANGOON.	Open drains for surface water. Not sufficient where the ground is low, and on which water stands till it evaporates. Barracks and hospitals damp in monsoon. Contents of privies removed to a distance in boxes daily.
TONGHOO.	Drainage natural. "No sewage required." Drainage of bath houses requires improvement. Privies very bad; only a cesspit. No means of cleaning them. Charcoal and lime used for purifying them.
X. WATER SUPPLY. FORT ST. GEORGE.	Water brought in pipes from Seven Wells, two miles distant, to covered cisterns in the fort. Native supply from wells and tanks. Some of it brackish, especially in Black Town. Almost all tank water has a disagreeable smell. Quality said to be "good." No chemical analysis.
SECUNDERABAD.	Water from numerous wells; generally abundant; scanty after dry weather; in colour almost clear, sometimes slightly opaque. Analysis of five wells and one tank given, showing from above 10 grains to above 119 grains of solid matter per gallon, and from above 2½ grains to about 30 grains of organic matter per gallon. Such water apparently not considered unhealthy, although the most fatal diseases at the station are those, of which bad water is known to be a predisposing cause. Water is raised for use in a skin bag, by a rope over a pulley, hauled up by bullocks, and discharged into a reservoir, whence it is conveyed by masonry conduits or skins (the usual way) to its destination.
VIZAGAPATAM AND WALTAIR.	From wells and tanks, former said to be clear and good. A tank near native infantry parade ground "very foul and bad." Amount of water very limited. Water raised from wells by rope and hand. Supposed that an unlimited supply might be brought in iron pipes from a distance of five miles. No analysis.

STATIONS.	REPLIES.
BELLARY.	Principally from wells. Two tanks; one dry for seven months, emitting unpleasant smells. Natives prohibited from bathing in one tank, but do so nevertheless. Quantity not known. Two wells, described as clear and pleasant, contain animalcules. Another said to contain none, contains a considerable quantity of vegetable matter. No analysis. Present supply uncertain; sometimes fails, as it did last year. It would be better to bring water 50 or 60 miles, which can be done.
VELLORE.	Colourless and inodorous, but in most of the wells brackish. The harder water causes diarrhoea among new comers. Plenty of water for lavatory purposes. Water "too near the surface to require any mechanical contrivance for raising it."
BANGALORE.	Wells and tanks, but water not stored. In monsoon time, all tanks full; become smaller in dry weather. All used by natives both for drinking and bathing. Ulsoor tank, used for drinking, is the outlet for the whole drainage of the most filthy bazaar, of the cavalry, infantry, and horse artillery barracks, and of the greater proportion of station. A great nuisance in dry season. Respecting this tank, the Commander-in-Chief remarks, "The disgustingly filthy nature of the source from which the water used at Bangalore is taken has been brought to notice scores of times by me within the last 4½ years, but, as usual, nothing has been done to remedy this most crying evil." Water for Europeans is taken from wells, which are open, and "when they get dirty are cleaned." It is raised by hand or bullock labour, and carried on bullocks and water carts. To remedy these evils, it is proposed to bring a water supply 36 miles. No analysis.
CANNANORE.	From wells; generally free from impurities; quantity ample near some parts of the cantonment; in some seasons little or none near infantry lines; puckallies and bullocks employed for raising and distributing it; said to be "good;" no analysis.
TRICHINOPOLY.	Chiefly from wells, every one of which is more or less impregnated with lime. Water partly stored in open tanks, in some of which, used for drinking in town, natives bathe. Quantity abundant; quality, clear, but most wells slightly brackish; some few sweet. Tank water neither clear nor good. Raised and distributed in the usual way. No analysis.
KAMPTEE.	All from wells, of which there are several hundred; quality various; mostly good, pure, and inodorous. River turbid during rains, foul and polluted with the refuse and filth of bazaar in dry season; used for cattle and for washing. No analysis. No better supply, except by damming the river.
ARCOT.	Water derived from wells; tank not used for drinking; "probably produces malaria, and is a nuisance." Wells sufficient for present supply; quantity sometimes runs short in hot season; quality, "clear, wholesome, and without smell," but no chemical or microscopic analysis. Supply raised by leather buckets and distributed by water carriers.
ST. THOMAS' MOUNT.	From wells, not liable to pollution; supply abundant; water in some wells brackish, excellent in others; no analysis; raised for use by windlass and bucket. Tanks outside station, full in rains, probably producing malaria in dry weather.
WELLINGTON.	About 9 cubic feet a second, distributed by pipes from a reservoir with a head of 70 feet; no analysis; soft.
RAMANDROOG.	From a large tank and springs; tank used for bathing and drinking; it is supplied by the drainage of the adjacent country, and is a receptacle for everything the waters may carry down. Amount and chemical composition unknown; quality "excellent;" distributed by bullocks with leather bags.
POONAMALLEE.	From wells; unlimited in quantity, and "good;" contains alkaline carbonates; no analysis; raised and distributed for use "in country earthen pots."
JAULNAH.	From wells, Seo nullah and Koondulka river, and tank. River and tank water "good and wholesome;" many wells brackish and saline, containing lime and nitre; no analysis; some wells good; supply scarce in dry weather; raised by manual labour and bullocks.
RANGOON.	Wells and tanks. Never dry, and brim-full during rains. Quantity ample, except in hot months. Quality "most excellent." When drawn, it is of a whitish colour, but soon deposits sediment and becomes comparatively clear. Requires filtration. No analysis.
TONGHOO.	From river and wells. Ample and "very good," but hard. Turbid in monsoon, and requires filtration. No analysis.
XI. ABLUTION AND BATH ACCOMMODATION.	
FORT ST. GEORGE.	"Excellent and abundant baths and wash-houses:" 82 baths and two lavatories for men, and 19 baths and two lavatories for women and children. Water laid on. All well drained through latrines to sea. Fig. 7 shows this bathing establishment, which is the best in India.
	<p>FIG. 7.—BATHS, FORT ST. GEORGE. (See plan of barrack, Fig. 1.)</p> 
SECUNDERABAD.	Lavatories have tubs, shelves for basins, and grated floors; also plunge baths. There are altogether 20 lavatories and five plunge baths. Water raised by bullocks and puckallies. At two barracks water runs off by drains. At Trimulgherry, with three baths and 10 wash-houses, there is no drainage.
BELLARY.	Nine lavatories and one large bath for men. Water obtained by channels from a well; the lavatories are drained into cisterns, whence the water is removed by hand.
VIZAGAPATAM AND WALTAIR.	No information.
VELLORE.	None.
BANGALORE.	No information.

STATIONS.	REPLIES.
CANNANORE. TRICHINOPOLY.	Six lavatories. Water supplied by puckallies. Waste water runs off into barrack drains. Four washing tubs a company; kept in verandah and filled by puckallies. Two wash-houses, drained by an open channel. Artillery barracks have no lavatory, but a plunge bath filled from a well and drained into adjoining paddy fields.
KAMPTEE.	Lavatories supplied with water from wells by carriers. Baths will be built. No proper drainage as yet; refuse water conducted by channels to openings in barrack yard wall, and thence flows away as it best can.
ARCOT.	No baths or lavatories. Men use tubs filled by water carriers.
ST. THOMAS' MOUNT.	Each lavatory has a tub, filled with water by a bheestie, in which men wash. Should be abolished, and basins supplied instead.
WELLINGTON.	Plunge bath, 70 feet by 20 feet by 6 feet; water flowing continually through it. No information as to ablution accommodation, but the following excellent lavatory plans accompany the report. There are fixed basins, properly drained, with water laid on; the plans show the kind of arrangement required for all barracks and hospitals.

FIG. 8.—PLAN AND SECTION OF WASHING ROOMS WITH BASINS, WELLINGTON.



RAMANDROOG.

POONAMALLEE.

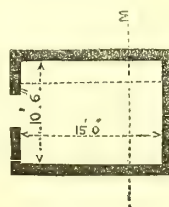
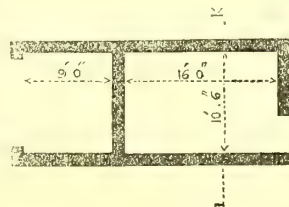
JAULNAH.

Wash-houses built on the edge of the hill; admit of easy drainage from their position. Water supplied by puckallies. No bath-house; want much felt.

Two bath-houses, one for men, one for women; also tubs. Stone trough at each corner of barracks for washing. Water supplied by puckallies.

Two lavatories to horse artillery; deficient in size and commodiousness; supplied by puckallies with water. No plunge bath, only a bath room. Figs. 9 and 10 show the arrangements for cleanliness at Jaulnah and Palaveram, and by comparing the rude construction they present with the lavatory and bath plans at Wellington and Fort St. George, the difference between what ought *not* and what *ought* to be the provision for cleanliness in barracks will be self-evident.

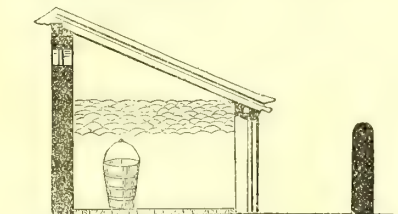
FIG. 9.—LAVATORY AND BATH ROOM, JAULNAH,



SECTION ON L M.



FIG. 10.—LAVATORY AT PALAVERAM.



RANGOON.
TONGHOO.
XII. DIET AND
COOKING.

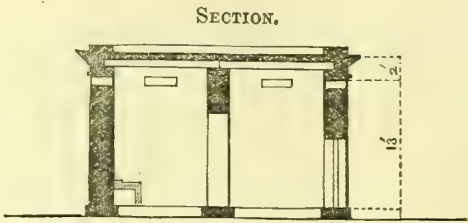
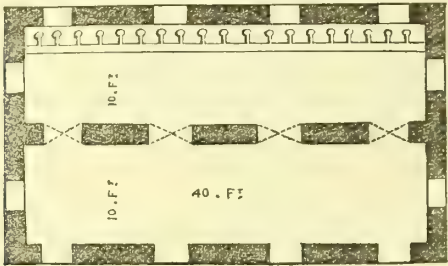
"There are lavatories, but no baths."

Ten wooden wash-houses for men (one per company). Water supplied by bheesties.

The ration in Madras Presidency consists of 1 lb. meat, 1 lb. bread, 1 lb. vegetables, 4 oz. rice, $1\frac{3}{4}$ oz. coffee or $\frac{5}{7}$ oz. tea, 2 oz. sugar, 1 oz. salt. The value is 3 annas 4 pice. The same ration is issued at all seasons and at all stations, irrespective of climate. The vegetables vary according to season. Potatoes seem to be most preferred by troops, but are not always to be had. Beef and mutton are issued at different intervals.

The usual Indian cooking apparatus is used, and the kitchens are often of a very rude character. Little complaint is made of the cooking, but notwithstanding this, improved cooking apparatus has been successfully tried at Fort St. George. The following Fig. 11 shows a common arrangement of barrack cook-houses in Madras Presidency.

FIG. 11.—PLAN OF ONE OF THE COOK-ROOMS ATTACHED TO THE BARRACKS, BELLARY.



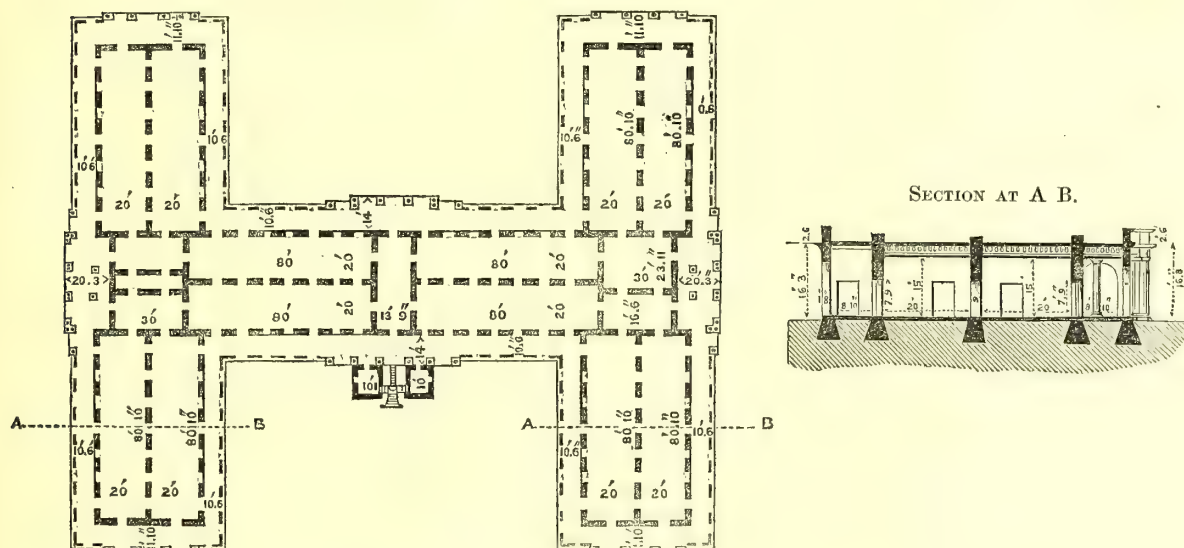
STATIONS.	REPLIES.
XIII. INTEMPERANCE. FORT ST. GEORGE.	Troops usually temperate. Few confirmed drunkards. Spirits sold in canteen. Each man allowed two drams a day without porter, or one dram a day with one quart porter. Many do not drink spirits; some only a portion, and only after dinner. Consumption of spirits, as a general rule, considered injurious; but it would be prejudicial to prohibit sale in canteen; men would get worse spirits elsewhere.
SECUNDERABAD.	"Average number of confirmed drunkards varies." In one regiment 7 per cent., in another 1 in 30 of the force. Admissions to hospital caused <i>directly</i> by intemperance, 1 in less than 24; <i>indirectly</i> , 25 out of 26 (1 in $1\frac{68}{1551}$). Arrack and brandy sold in canteens. Spirits certainly injurious to health. Amount is not so injurious as the authority and sanction given to spirit drinking, and the desire it creates for more. Present indiscriminate issue "most pernicious." Sale should be abolished; beer, tea, and coffee used instead.
VIZAGAPATAM AND WALTAIR.	Temperate, with few exceptions. Three confirmed drunkards out of 77 men in European light infantry. In European veterans, 10 per cent. 21½ per cent. of admissions to hospital from "ebrietas;" 729 per cent. from delirium tremens. Spirits sold in canteen, and "a worse description of liquor" sold to the men within a few yards of the barracks. One dram arrack, one pint beer, or two drams arrack, may be purchased daily at canteen. Spirits most injurious to health. "The habitual daily two drams ruin the health and habits of the soldier, who thinks that, as long as he takes only what the Government allow him, he cannot go wrong." "The sale should be altogether discontinued by Government." "The habit of spirit drinking, which it establishes, is what should be avoided." Malt liquor advantageous. "But health, efficiency, and discipline would be materially improved by tea and coffee in preference to spirits and malt liquor;" "as has been proved when neither spirits nor malt liquor could be procured." The only objection against this is that men, partial to spirits, would obtain it elsewhere. Committee propose that spirits be diluted with water, as one step to total abolition of spirit drinking.
BELLARY.	Spirits sold in canteens. The less consumed, the better for health. Malt liquor or wine much less hurtful. Would be highly advantageous to abolish spirits in canteen and bazaar, restricting their use to particular occasions. "The habit for spirits is maintained by their authorized use."
VELLORE.	Light wines and malt liquor at cheap rates "would be an incalculable boon to the soldier, and a saving to the state." The taste for spirits, "not easily acquired by young soldiers," would die away.
BANGALORE.	Soldiers usually "temperate;" largest number of confirmed drunkards in artillery, 5 per cent. It appears that of one-year soldiers 1 per cent. is a drunkard; after two years the proportion rises to 2 per cent., and increases with length of residence, showing the evils of bad acquired habit. In artillery, 12½ per cent. of the strength admitted annually to hospital, directly or indirectly from drinking. In India temperance is the exception and intemperance the usual habit of European soldiers, arising mainly from their idle, listless, objectless lives. "But Government is much to blame. It places the poisoned chalice to the lips, bids them drink freely," and when the habit is confirmed, "denounces them as a disgrace to their country, their religion, and their humanity." "Drinking to excess of ardent spirits is directly or indirectly literally the root of all evil in the army." It causes nine-tenths of the crime, and destroys health and morals. "Unfortunately spirits are sold in canteens," "but any quantity can be obtained in the bazaar." "It is the part of a civilized Government to devise means to check and not to pamper this morbid appetite." "The fear of punishment, but no moral control, checks the consumption." Probably "not three men in five go to bed perfectly sober," and when pay is issued, not two in five. The witnesses, while all admitting the greatness of the evil, differ as to the possibility of entirely prohibiting the sale. All prefer malt liquor to spirits, but any suppression should include sale in bazaars as well as in canteens. Spirits might be issued under particular circumstances. All agree as to the necessity of providing proper amusements and occupations for the men, to keep them from drink.
CANNANORE.	"Very temperate;" only four admissions from drink out of 1,037. Arrack sold in canteen, but not allowed in bazaar; good malt liquor or wine decidedly preferable, but it would be injurious to suppress spirits, as men would find inferior intoxicating drink.
TRICHINOPOLY.	"Usually temperate." In artillery, 6 to 8 per cent. of the men undergo confinement during the month for drunkenness. 12½ per cent. of admissions are directly or indirectly from intemperance. Spirits injurious to health, efficiency, and discipline; sale should be abolished in canteens, bazaars, and within a circle of 10 miles round barracks. Spirits are an irritant poison; should be abolished in toto; wine and malt liquor are better, being cordials. Tea and coffee best of all.
KAMPTEE.	A considerable number of intemperate men in artillery. Two per cent. confirmed drunkards in infantry. Two drams spirits per diem taken by five-eighths of artillery. Present manner of issue undiluted, injurious. Better to suppress sale of spirits in canteens and bazaars, and to substitute beer, tea, coffee, &c.
ARCOT.	Soldiers "temperate." In 11 months, out of 229 admissions, 2 from delirium tremens and 2 from ebrietas. Each man allowed two drams a day; injurious; should be abolished if malt liquor could be supplied.

STATIONS.	REPLIES.
ST. THOMAS' MOUNT.	Spirits not sold in canteen, but in bazaar; not to Europeans. Soldiers draw two drams arrack daily at station; not hurtful in moderation, but would be better to abolish it if malt liquor could be issued. Canteen funds are insufficient "to provide amusements to keep the men from drinking."
WELLINGTON.	About 1½ per cent. confirmed drunkards; no admissions from this cause during this year. Distilled spirits sold in canteen; average consumption per man daily, $\frac{5}{8}$ dram spirits, and rather less than one pint malt liquor. Spirits decidedly not conducive to health; malt liquor preferable in every respect; desirable, if practicable, to prohibit sale of spirits. At this station, where men are sent for health, canteen regulation is as follows:—Canteen open from 2 to 3 p.m.; arrack one dram per man. Canteen open from 5.30 to 6.30 p.m.; porter or beer one pint per man. Canteen open from 6.30 to 7.45 p.m.; arrack one dram per man. Soldiers of battalion permitted one pint of porter or beer per man with dinner.
RAMANDROOG.	No intemperance here as a rule. Arrack sold in canteen. Three serjeants consume 3½ drams a day among them; 30 privates 1½ dram each per day. Some men take none; others draw 2 drams. Serjeants "allowed as much as they want." Never given to convalescents. Spirits in moderation not injurious to men accustomed to them; otherwise injurious: malt liquor preferable.
POONAMALLEE.	A good deal of intemperance; sometimes necessary to try men for habitual drunkenness. 1 in 51 admissions caused directly, 1 in 124 indirectly by intemperance. Each man allowed 2 drams spirit at canteen, and can obtain more in cantonment. Old soldiers all take a dram before breakfast. Malt liquor necessary to health; spirits injurious, "as they are invariably abused by the men." Sale should be altogether suppressed.
JAULNAH.	"Temperate" on the whole. 14 confirmed drunkards in Royal Irish detachment. Spirits sold in canteen and bazaar; 2 drams a day allowed to artillery, 1 dram a day to Royal Irish. From 3 to 6 oz. of arrack given as a ration to convalescents. Use of spirits, as at present, detrimental; would be decidedly advantageous to suppress spirits and substitute beer.
RANGOON.	Generally temperate; no confirmed drunkards; spirits sold in canteen. Average consumption per man in Madras Artillery, 1½ drams per diem. In Her Majesty's 68th Light Infantry $\frac{1}{2}$ dram. Considers moderate use not injurious; immoderate, injurious to health, efficiency, and discipline. Malt liquor and wines much better. Objects to suppression of sale of spirits: that the soldier would obtain them elsewhere. Government should afford every aid in establishing good coffee rooms, as far as possible from the canteen. All amusements should be near them. Coffee rooms to be independent of canteens.
TONGHOO.	"Sickness, mortality, and crime occasioned by intemperance" are "so trifling" that no statistical data can be given. Daily allowance per man, one quart malt and one dram arrack, or two drams arrack. Quantity of spirits drawn "conducive to health." Total abstinence "not considered beneficial." Suppression of spirits "not recommended."
XIV. INSTRUCTION AND RECREATION. FORT ST. GEORGE.	Ball court; skittle ground. Schools, library, and reading room; temperance room. "No space for soldiers' gardens." No gymnasium nor workshops. A theatre permitted in a barrack room. Men confined to barracks from 7 a.m. till 5 p.m.. No sufficient shade for exercise.
SECUNDERABAD.	Ball courts, skittle alleys. Schools; splendid library and reading room, "at present occupied as a barrack." Another library and reading room, said to be very insufficient and not well lighted at night. Three regiments have gardens. No workshops. There are theatres, and two gymnasia. Means not sufficient for occupation; for want of it, men go out during the day, in search of liquor. Workshops for trades much required, also large recreation sheds, for exercise and games. Present shade not sufficient. Men only prohibited leaving barracks during extreme heat of day.
VIZAGAPATAM AND WALTAIR.	No ball courts. At Waltair, skittle ground. At Waltair, garrison and regimental library, also a school; no day room. No gardens; no workshops; no theatre; no gymnasia. At Vizagapatam, no place of recreation, but canteen; no shade nor covered place for exercise; "a sad want."
BELLARY.	Ball court under construction; skittle ground; theatre; no day room. School, library, and reading room will shortly be constructed. No gardens, no workshops, no gymnasia, no covered place for work or exercise. All very desirable. No restriction on the men exposing themselves to sun or rain when off duty. More trees wanted.
VELLORE.	No information.
BANGALORE.	Ball courts and skittle sheds (uncovered and useless for part of the day); no gardens; no workshops; no gymnasia. Reading rooms and a regimental schoolmaster; also libraries; "day rooms, soldiers' clubs, workshops, theatre, gymnasia, and gardens are things unheard of." "Regimental library has no attractions for men who read with difficulty." "Immediately the noonday gun announces that the canteen is open, a rush is made for the raw spirit dram." "The canteen and the cot divide the hours unoccupied by the daily routine of petty duties." "Alcohol and unrefreshing day sleep contribute to engender disease and accelerate mental and physical decay."
CANNANORE.	Men allowed to leave barracks during the day. They do not expose themselves so much as formerly, but are not more healthy. They were more hardy formerly. The witnesses recommend increased means of exercise and occupation. One ball court; one skittle ground; a few gardens; no workshops, no gymnasium. School; cantonment library; theatre; but no reading room, day room, nor soldiers' club. Any extra expense incurred in increasing the means of recreation and exercise would be more than repaid by increase of health.
TRICHINOPOLY.	Men confined to barracks from 8 a.m. to 4 p.m. No shade except verandahs. Ball court and skittle ground; soldiers' garden, worked by the men. No workshops, except an armourer's; no theatre, no gymnasia. School; garrison, and regimental library; coffee rooms. Trades should be encouraged. Many men, such as shoemakers, tailors, mechanics, &c. would go steadily to work, if they had shops.
KAMPTEE.	One ball court for artillery; skittle alleys; gardens. No workshops; no theatre; no gymnasia; but there are theatricals in barracks.

STATIONS.	REPLIES.
	Schools; a good library, not open at night; day rooms. Means not sufficient. A large building proposed to contain shops; coffee rooms; game rooms, and reading room.
ARCOT.	No shade for exercise. Want of amusement makes restriction to barracks very wearisome. Skittle ground; no ball court; no gardens; no workshops; no theatre; no gymnasia; no library, but "plenty of books, which can be read till 8 p.m. when all lights are put out."
ST. THOMAS' MOUNT.	School and day rooms. No sufficient shade at barracks. "But there is at the infantry depôt barrack, which is the hospital of the European corps, when quartered at the barracks." ‡
WELLINGTON.	Ball courts and skittle grounds; but no workshops, theatre, nor gymnasia. Schools, library and reading room, lighted at night; but no day room or club. No sufficient shade. No restriction on the men exposing themselves to sun or rain. One ball or raquette court; four skittle grounds; a soldiers' garden.
RAMANDROOG.	No workshops. Theatre and gymnasia. School, library, and reading room; one coffee room.
POONAMALLEE.	Ball court; skittle ground; soldiers' garden, but no means of keeping it up; no theatre. Workshops and gymnasium very much wanted. No library; no reading or day room.
JAULNAH.	Church, a miserable thatched mud building, very damp in monsoon, and must be injurious to health. Ball courts and skittle grounds. No day room; no soldiers' gardens; no workshops; no gymnasia. Occasionally temporary theatre.
RANGOON.	Schools and garrison library open twice a week. Ball court; skittle ground. No gardens; no workshops; no theatre; no gymnasia. Libraries. No schools; no day rooms. Means of instruction and recreation altogether insufficient.
TONGHOO.	No shade for exercise. Tree planting required, also a large shed for exercise; and a swimming bath. At this station there is a ball court; skittle grounds; schools; three libraries; day rooms; soldiers' gardens; and shops for trades; two theatres; no gymnasium. Though the means are considerable, they are not sufficient. Lofty open sheds for gymnasia are required.
XV. DRESS.	No ball court or skittle ground. No soldiers' clubs. No workshops. School, library, and reading room. Also a theatre. Men grow a few vegetables. No gymnasium. Cricket, quoits, boxing gloves, rifle matches recommended.
XVI. DUTIES.	The evidence from all the stations, as regards dress, is that the changes introduced have been very important, and that the present dress is suitable as a whole. Several improvements in detail are suggested; such as improved helmets, a more uniform dye for the khakee dresses, the shades of which are so various that "no two soldiers are alike," flannel shirts, &c. But there appears to be little to complain of as regards dress at present, at least as a whole.
XVII. PERIOD OF SERVICE IN INDIA.	The duties are very much alike at the stations. Drills, parades, &c. early in the morning and in the evening. Guards at varying intervals according to the strength and the number of posts. Roll calls at various periods of the day, and occasionally at night when considered necessary for discipline. There is no evidence of men suffering in health when duties are properly carried out. Even night guards are not observed to injure health, provided the guard rooms be not overcrowded and be sufficiently ventilated. All concur in advising the thorough drilling of recruits at home, as recruit drilling in India is almost uniformly carried on at the cost of health, efficiency, and life.
XVIII. HILL STATIONS.	The recruiting age for India should according to the reporters lie between 20 and 25 years. One reporter advises 3 years' home service before sending the soldier to India at the age of 25. There is a difference of opinion as to whether soldiers should be sent out direct to India, or in the first instance to an intermediate station. A majority of the reporters advocate the latter course, or sending recruits on landing to the hills. The minimum period of service in India recommended is 10 years; but the reporters generally recommend 12, 15, or even 20 years' service. One reporter considers that with improved conditions as to health, soldiers can serve as long in India as anywhere else.
FORT ST. GEORGE.	Unquestionably approve. Troops should be located on hills, with short periods of service on plains.
SECUNDERABAD.	Most highly approve of hill stations for troops, but experience is still wanting as to the best manner of taking advantage of them.
VIZAGAPATAM.	Less loss of life on hills than plains; no objection so far as health is concerned to locating troops on plains, with short visits to the hills to restore health.
BELLARY.	No experience of hill stations.
VELLORE.	The lower hill stations in Bengal are unhealthy at some seasons. Hill sanitarium admirably adapted for convalescents and ill-formed soldiers; but once acclimatized, inclines to the opinion that service on plains, under improved sanitary conditions as to stations, would be better than hill residence.
BANGALORE.	Hill stations, such as the Neilgherries, better adapted as a sanitarium than for troops. Troops on returning to the plains are more liable to liver disease, dysentery, &c. Men on going to the Neilgherries and other higher stations, are very apt to suffer from diarrhoea and febrile attacks. Best altitudes 3,000 to 6,000 feet above the sea.
CANNANORE.	No experience of hill stations.
TRICHINOPOLY.	Approve; but service should be on the plains, with short intervals spent on the hills; 6,000 feet altitude, best adapted for this latitude.
KAMPTEE.	Advisable to locate troops on the hills, with short period of service on plains; 4,000 to 7,000 feet the best elevations. Men on going to hill stations are occasionally liable to febrile attacks.
ARCOT.	No experience, but approve of hill stations for troops.

STATIONS.	REPLIES.
ST. THOMAS' MOUNT.	Never in charge of troops on hills, but is of opinion that long hill residence predisposes men to disease on the plains, and would prefer service on the plains, with short service on the hills.
WELLINGTON.	Strongly approve. Troops should have short periods of service on the hills and plains alternately.
RAMANDROOG.	Limited experience, but considers an elevation of 4,000 feet would preserve troops efficient.
POONAMALLEE.	Hill stations preferable.
JAULNAH.	No experience, but consider that troops might advantageously spend the hot season on the hills. A two years' residence on first arrival would be good for troops.
RANGOON.	Highly beneficial for European troops. The longer they are on the hills the better.
TONGHOO.	No experience.
XIX. HOSPITALS.	
FORT ST. GEORGE.	<p><i>Site.</i>—Half a mile from fort; very densely populated village on opposite side of road; open to S.E. and well exposed to sea breeze, to which the Commander-in-chief adds,—“if the vile stinking river Kooom were not under the very noses of the patients.” River Kooom on south and west sides, receives town drainage, and gives off most unpleasant odours.</p> <p><i>Water supply.</i>—Hospital well water, brackish and unfit for drinking. Good water has to be brought in barrels from a well two miles away.</p> <p><i>Drainage.</i>—Two drains, outlet in Kooom river, 100 yards from hospital. No provision for carrying away roof water. No surface drainage.</p> <p><i>Construction.</i>—Twelve wards, containing 16 beds each (192), at 1,397 cubic feet, and 101 square feet per bed. Wards double, and communicate by 7 arches along the side. Materials brick in chunam. Floors raised one foot above the ground; they are of brick. No ventilation beneath. All wards on ground floor. Wards back to back with four rows of beds between the opposite windows. Verandahs 10 feet wide.</p> <p>Fig. 13 shows the construction of this defective building.</p>

FIG. 13.—PLAN OF THE GENERAL HOSPITAL, FORT ST. GEORGE.



Ventilation by doors and windows. No roof ventilators. Air cooled by punkahs.

Cleansing and limewashing twice a year, or oftener if necessary.

Latrines.—Placed to windward “unfortunately.” “Tubs only are used.” No urinals or water-closets. Privy washed daily, and “charcoal burned in it;” “not offensive.” An opinion in regard to which the Commander-in-chief says,—“a year ago, it was odiously offensive.”

Lavatory and bath.—Three rooms with brass basins and stands. Baths are large tubs for cold and warm water. Shower bath and douche.

Storage sufficient; but considerable improvements might be made with advantage.

Bedding.—Wooden and iron cots. Bedding of good quality.

Cooking.—Similar means to those recently introduced in barracks, promise to act well.

Attendance.—Hospital serjeant, male coolies, orderlies when required, “sufficient.”

Convalescents.—No wards. Not sufficient exercising ground. Men conveyed in doolies and bullock carts to the sea beach, morning and evening.

Female hospital.—A detached ward. Midwifery cases taken to lying-in hospital. Arrangements not satisfactory.

Sanitary state “good.” Cases of cholera have appeared, when disease was in Madras. Ulcers have once in five years shown tendency to gangrene, when whitewashing has been neglected.

SECUNDERABAD.

Site.—Three hospitals for Europeans, five for natives scattered all over cantonment.

Water supply.—Abundant and wholesome.

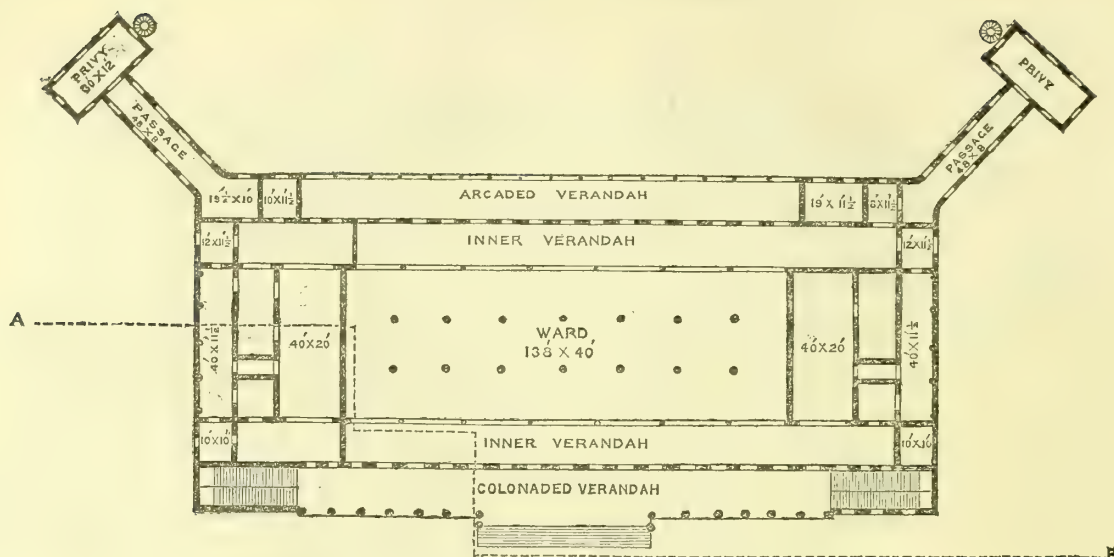
Drainage.—No drains or sewers; only surface drainage. Impurities removed daily. Small cesspools at some native hospitals.

Construction.—Wards raised 1 foot to 1 foot 10 inches above ground. No ventilation beneath. Roof water sinks into subsoil, or runs away on surface. Trimulgherry hospital is upper storied. Madras artillery is abominable, and frightfully hot. It is condemned. All have front and rear verandahs.

Accommodation in European hospitals, 10 wards, 775 beds, at from 1,000 to 1,052 cubic feet, and from 24 to 75 square feet per man. Two of the new wards at Trimulgherry hold each 228 sick, apparently in six rows between the windows. In this hospital, 486 sick have no more than 24 square feet each. The wards are no less than 42 feet high, and out of the whole number of sick in all the hospitals, only 118 have more than 46 square feet.

A plan of one of the floors is given in fig. 14, showing the large wards completely enclosed by other rooms, cutting off the ventilation.

FIG. 14.—HOSPITAL AT TRIMULGHERRY.



STATIONS.	REPLIES.
<p>VIZAGAPATAM AND WALTAIR.</p>	<p><i>Ventilation.</i>—All the hospitals are exposed to prevailing winds. Ventilation only by doors and windows.</p> <p><i>Cleansing</i> and limewashing whenever required.</p> <p><i>Latrines</i> not drained. Tubs with metal linings used; removed by hand. Three of native infantry hospitals have cesspools.</p> <p><i>Lavatory and bath.</i>—Madras artillery hospital has a portion of front verandah cut off, not sufficient, keeps front of hospital damp and dirty. Old barrack hospital has four bath-rooms, each with a ledge and gutters for holding basins, "sufficient for sick." At Trimulgherry, a bath-room on each floor, inadequate. Some sick have to wash in verandahs. Baths consist of nothing but bathing tubs, "amply sufficient and convenient."</p> <p><i>Hospital washing</i> by dhobies.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding.</i>—Cots, iron and wooden.</p> <p><i>Cooking.</i>—Copper tin vessels, frying pans, earthen pots, &c., sufficient and satisfactory.</p> <p><i>Attendance.</i>—Hospital serjeant for each regiment. Nurse for female wards. Comrade allowed for "very sick men." Native females for women's wards. Native males for men in ample numbers.</p> <p><i>Sanitary state</i> generally good, with one exception. The old artillery hospital small, ill-ventilated, badly planned. Old infantry partakes of objectionable site of barracks. In one native infantry hospital, hospital gangrene frequently occurs from overcrowding, from the cachectic state of the patients, owing to the unhealthy character of their lines, and a cess-pool in the hospital enclosure. The latter being remedied.</p> <p><i>Convalescents.</i>—No wards; very much needed at this station, especially when dysentery and hepatitis prevail, and when diet and regimen require care. Exercise taken in sick carts and doolies. Fenced ground with shaded walks and seats much needed.</p> <p><i>Female hospital.</i>—One attached to every European hospital. Satisfactory; but one of them requires out-offices.</p> <p><i>Vizagapatam.</i>—<i>Site.</i>—400 yards from barracks; houses on three sides; a marsh on fourth side, from which unpleasant effluvia arises. Upper wards used for men, lower wards for women and children; shut in and in every way objectionable. Native infantry hospital in a low spot, nearly on a level with the swamp, badly placed; air shut out by hedges and gardens.</p> <p><i>Waltair.</i>—<i>Site</i> admirable; perfectly open to sea-breeze.</p> <p><i>Vizagapatam.</i>—<i>Water supply</i> abundant for bathing, but for all other purposes water is brought from a distance.</p> <p><i>Waltair</i> has excellent water from well in hospital compound.</p> <p><i>Vizagapatam.</i>—<i>Drainage</i> by open drains into a marsh. At native infantry hospital and at Waltair, no drainage.</p> <p><i>Vizagapatam and Waltair.</i>—<i>Construction.</i>—Brick and mud, tiled roofs, and verandahs. Floors raised above the ground. No ventilation beneath.</p> <p><i>Vizagapatam.</i>—<i>Accommodation.</i>—Ten wards for Europeans; 54 beds, at from 660 to 962 cubic feet, and from 58 to 74 square feet per bed.</p> <p><i>Waltair.</i>—<i>Accommodation.</i>—Four men's wards; 29 beds, at about 900 cubic feet and 64 square feet per bed.</p> <p><i>Ventilation</i> by doors and windows only. No means of cooling.</p> <p><i>Cleansing.</i>—Limewashing on requisition.</p> <p><i>Latrines.</i>—Tubs removed twice a day.</p> <p><i>Abtution and bath room.</i>—Baths, tubs, and towels in a separate room; quite sufficient.</p> <p><i>Bedding.</i>—Wooden bedsteads, sadly infested with bugs. Iron required.</p> <p><i>Cooking</i> generally good. Commissariat responsible for this. In native hospitals men cook their own diets. When too ill to do so, an orderly friend is detailed for the purpose.</p> <p><i>Attendance</i> sufficient.</p> <p><i>Sanitary state</i> bad, both of garrison and native infantry hospitals. But there has been no hospital disease in them.</p> <p><i>Convalescents.</i>—No wards. Take exercise on sea beach.</p> <p><i>Female hospital.</i>—Wards are set apart and attended by a nurse. Confinements are attended in hospital. Satisfactory.</p> <p><i>Site.</i>—A new hospital under construction. Healthy as regards elevation, natural drainage, absence of malaria, &c.</p>
BELLARY.	

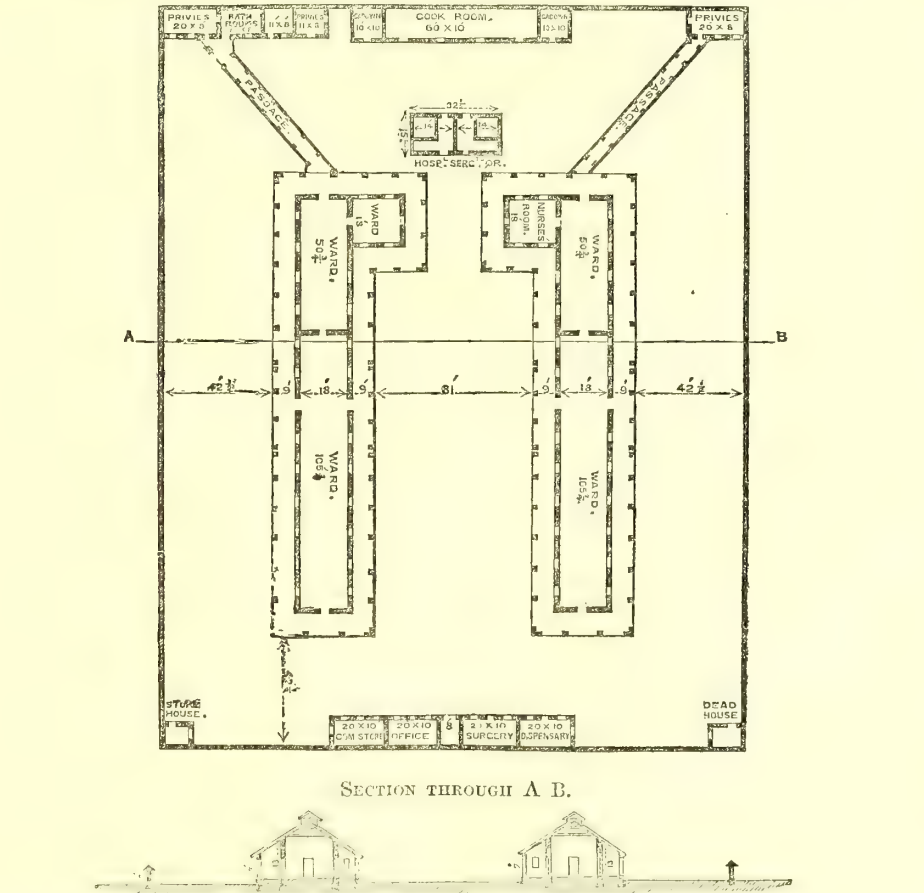
STATIONS.	REPLIES.
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VELLORE.

BANGALORE.

Water supply.—Wholesome, but not very abundant.
Drainage.—None: yet under consideration.
Construction.—Lowest wards 3 feet above ground. No ventilation beneath. Materials, granite and chunam. Double verandahs. Building two stories high.
Accommodation.—Seven wards for men, two for women. Total beds, 174; 1,440 to 1,714 cubic feet; 72 to 86 square feet per bed.
Ventilation by doors and windows only, said to be “sufficient.” Punkahs used for cooling. Two fireplaces for warming.
Privies 45 feet from hospital. Communication by ventilated corridors. No drainage. Everything carried away. “If properly attended to, ought not to be offensive.”
Lavatory under consideration. Bath room with necessary apparatus.
Convalescents.—No wards. A separate ward and separate messing very desirable.
Information very defective. Hospital surrounded by other buildings. Ventilation very imperfect. Floor raised 18 inches, but without air beneath. Radiation of heat from arsenal walls very great. Windows only 3 feet by 2 feet; too small for any fresh air or coolness, for which there is no other provision. Materials, brick and chunam. Narrow verandah. No winds, save eddying currents, can touch the building.
Four hospitals, one for each corps.
Sites of artillery hospitals good, open, and healthy; of cavalry hospital too close to latrines, sick horse lines, and tank; also partly enclosed by buildings. The infantry hospital is surrounded by high walls and the barrack, interfering with ventilation.
Water supply.—Water for horse artillery hospital obtained from Ulsoor tank, which receives sewage of cantonment. “Tank just now not very clean.” Water for cavalry hospital brought in puckallies from wells into which Ulsoor tank drains. “Water cannot be the “purest.” “Hundreds of bullock loads of impure matter deposited in this tank are re-“moved year after year, when the tank is low, and the smell from it is most offensive.” Infantry hospital supplied from same source.
Drainage.—Horse artillery hospital drained by an open ditch into Ulsoor tank, whence it derives its water. Foot artillery hospital open-drained to some low ground 340 feet distant. Cavalry and infantry hospitals have no drainage, except the cook-room of the latter.
Construction.—Horse artillery hospital of brick and chunam. Walls much too low; insufficient for sick; “has been over and over again condemned.” Foot artillery hospital of brick and chunam. Cavalry, brick and mud. Verandahs: those of cavalry occasionally used for sick. All one floor. Floors solid, more or less raised above the ground. No passage of air beneath. Of cavalry hospital it is said, “one of the flags in one of the wards having sunk, and the “wards smelling disagreeably, I had it removed to ascertain the cause, and the smell from “the opening was so offensive that the apothecary and myself were obliged to run away “from it quickly.” Roof water mostly sinks into subsoil.
Fig. 15 is a plan of the infantry hospital, showing its construction and arrangement, the position of administrative offices, privies, baths, &c.

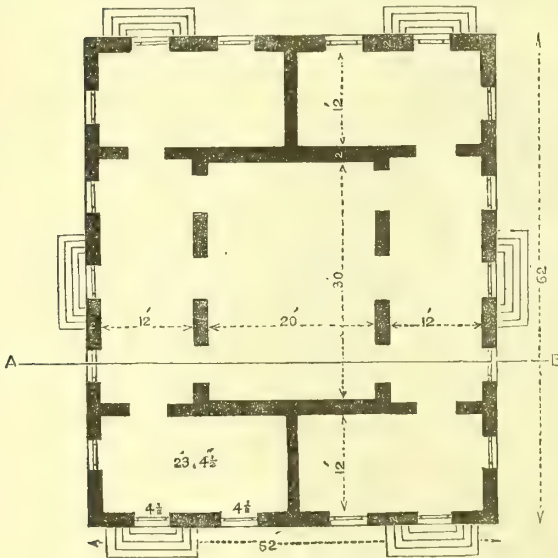
FIG. 15.—PLAN AND SECTION OF THE EUROPEAN INFANTRY HOSPITAL, BANGALORE.



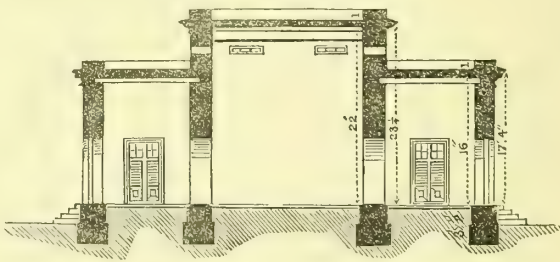
Accommodation.—Horse and foot artillery, 3 wards; cavalry, 5 wards, 77 beds, at 1,001 to 1,395 cubic feet, and 62 to 91 square feet per bed; infantry, 6 wards, 86 beds, at 1,000 cubic feet per bed.
Ventilation.—Artillery hospitals receive benefit of prevailing winds; others do not. Ventilation by doors and windows; very imperfect, subjecting wards to disagreeable draughts and

STATIONS.	REPLIES.
	requiring doors and windows to be closed in rain. In artillery hospital, openings in roof. No means of either cooling or warming.
	<i>Cleansing.</i> —Limewashing once a year, or oftener. Ceilings of cavalry hospital “seldom or “never whitewashed.”
	<i>Privies.</i> —No drainage. Only tubs are used. Rather offensive. A cesspool attached to foot artillery hospital. “Are not more offensive than is unavoidable.”
	<i>Lavatory and bath.</i> —The artillery hospitals use part of verandah for lavatories. The others have separate bath rooms. The cavalry ones small and badly ventilated. Tubs are used for bathing. All water has to be carried.
	<i>Hospital linen</i> washed by dhobies; “badly done and injured by the men employed.” At cavalry hospital two tailors constantly employed mending the linen “from this cause.”
	<i>Storage</i> at all hospitals insufficient.
	<i>Bedding.</i> —Wooden bedsteads, with difficulty kept free from vermin.
	<i>Cooking.</i> —Royal artillery cook-house too small, too close to wards. Cooking sufficient. Cavalry hospital diets cannot be sufficiently varied for want of proper cooking ranges. Infantry good and sufficient.
	<i>Attendance.</i> —The usual number of attendants. Of cavalry hospital it is said that the assistant apothecary has been changed 5 times in 2 years, the second dresser 8 times, the senior apothecary has just been taken away at a day’s notice. System does not work well. Permanent subordinates much required.
	<i>Sanitary state.</i> —Horse artillery good, but site too low, and accommodation insufficient. Foot artillery hospital has been abandoned. Cavalry hospital has been recently altered to improve it; “of very little use.” A number of men were attacked in it with acute rheumatism, and 9 were invalided. Much worse for this, and for dysentery, since the alterations. Infantry: no epidemic disease, but hospital too small, and such disease may be expected on increase of sick. Artillery hospital has wards too narrow to hold dining tables. No wards for serious cases. No covered places for exercise, “except the covered way to the latrines.” No nurses’ or apothecary’s quarters, some of whom live a mile from the hospital, and “have “to go backwards and forwards all the day long.” No way of regulating the temperature. Sick have to go down two steps to the close stools in the closed verandah. Hospital overcrowded. Scarcely raised above ground. Always damp in wet weather. It is so inferior that sick men are reluctant to come into it from barracks. “I have found that convalescents “come round more quickly in the barrack room than in this bad hospital.” Infantry hospital, 2 wards, used as nurse’s quarters and female ward; exposed to men, and leading to indecency.
	<i>Convalescents.</i> —No wards. No suitable grounds for exercise. Bullock convalescent carts allowed for artillery and cavalry hospitals.
	<i>Female hospitals.</i> —A ward in artillery hospital. A female hospital building for cavalry, of one ward, enclosed by verandah all round; partitioned off into four small rooms for lying-in patient and female nurse. Too small and badly planned. In infantry hospital two men’s wards occupied. Objectionable in every way. Fig. 16 shows the female hospital, with the ward enclosed by other rooms.

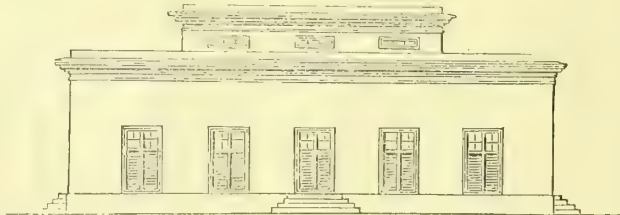
FIG. 16.—FEMALE WARD, BANGALORE.



SECTION THROUGH A B.



FRONT ELEVATION.



CANNANORE.

With regard to the cavalry hospital, the Commander-in-Chief remarks that, though not a first-class building, it is not altogether so objectionable as represented, and that a new one cannot be built in the present state of Indian finance.

Site.—On a cliff; open to sea; healthy.

Water supply.—Abundant and wholesome.

Drainage.—By surface only. Over the cliff, about 110 yards from hospital.

Construction.—Wards raised 1½ to 4 feet above ground. No passage of air beneath. Walls of laterite stone. Verandahs on all sides. One of them used for sick.

Accommodation.—14 wards, 104 beds, at 988 to 1,359 cubic feet, and 62 to 97 square feet per bed.

Ventilation.—Hospital receives full benefit of prevailing winds. Doors, windows, and openings in the walls. Always sufficient, except sometimes at night. Punkahs used; not liked by men. No means of warming required.

Cleansing and limewashing once a year.

Privies.—At a distance from wards. No drainage. Tubs used. Deodorized with charcoal, and removed at night.

Lavatory and bath.—One for each ward. Tubs for lavatory. No means of bathing, except tubs.

Storage.—Sufficient, but damp in wet season.

Bedding.—Bedsteads of wood. Iron ones preferable.

STATIONS.	REPLIES.
TRICHINOPOLY.	<p><i>Cooking</i>.—Ample and sufficient.</p> <p><i>Attendance</i>.—Hospital serjeant, coolies, native servants, a nurse for sick women. Comrades allowed when necessary.</p> <p><i>Sanitary state</i>.—"In every respect satisfactory."</p> <p><i>Convalescents</i>.—One ward. A compound for exercise, but no trees or shaded walks. A hospital cart and dooly allowed.</p> <p><i>Female hospital</i>.—One ward in hospital. Stoppage for women, 1½d. a day. None for children. Satisfactory.</p> <p><i>Sites</i>.—Garrison hospital a private house. European regimental hospital, 314 yards from barracks. Cavalry hospital, 66 yards from horse lines. Shengcolum hospital on open ground. Pootoor hospital close to the bazaar. All on tolerably open positions.</p> <p><i>Water supply</i>.—Just sufficient, and for the hospital "good."</p> <p><i>Drainage</i>.—"The sewage is removed in casks by scavengers to a distance."</p> <p><i>Construction</i>.—Floors raised from 6 inches to 3 feet 8 inches; paved with granite. Materials brick in mud or in chunam. Verandahs. No roof gutters. Rain water sinks into the soil, or is conveyed by a trench to the nearest road trench.</p> <p><i>Accommodation</i>.—There appear to be 16 wards. Number of beds per ward not given, consequently not cubic space.</p> <p><i>Ventilation</i>.—No ventilators; only doors, windows, and upper fanlights. Cooling by kuskus tatties.</p> <p><i>Cleansing and limewashing</i> about once a year.</p> <p><i>Privies</i>.—Garrison hospital has none. Other three hospitals have privies without seats. All are cleansed by scavengers, and kept pure by burning salt in them. "Arrangements admit "of improvement."</p> <p><i>Ablution and bath room</i> attached to end wards; "sufficient." Portable baths used when necessary.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding</i>.—Bedsteads, wooden frames with tape webbing.</p> <p><i>Cooking</i>.—"Complete and sufficient."</p> <p><i>Attendance</i>.—"Sufficient."</p> <p><i>Sanitary state</i>.—"Very healthy." No epidemic or hospital disease.</p> <p><i>Convalescents</i>.—Part of a ward used. Exercise taken in doolies and sick carts. No exercising ground, except regimental parade.</p> <p><i>Female hospital</i>.—An old ward fitted up. "Better arrangements are in progress."</p>
KAMPTEE.	<p><i>Sites</i>.—Not very good. Not free of malaria. Many small nullahs near.</p> <p><i>Water supply</i>.—Abundant and good.</p> <p><i>Drainage</i>.—None. Only surface gutters, which convey the water only outside the enclosures.</p> <p><i>Construction</i>.—Walls brick, tiled roofs, verandahs. Floors raised 3 or 4 feet, but no ventilation below. Roof water collected by guttering, and allowed to run into hospital enclosure.</p> <p><i>Accommodation</i> of artillery hospital only given. 1 large and 1 small ward. 26 beds at 1,505 cubic feet and 108 square feet per bed.</p> <p><i>Ventilation</i>.—Doors, windows, and ventilators in ridge; insufficient. Thermantidote for cooling.</p> <p><i>Cleansing and limewashing</i> every week.</p> <p><i>Latrines</i>.—24 yards from hospital. Not drained. No water supply; merely swept and cleansed by sweepers morning and evening. Contents deposited in pits, three-quarters of a mile distant. Arrangements offensive.</p> <p><i>Lavatory and bath</i>.—Under construction. None hitherto.</p> <p><i>Storage</i>.—None. Hospital stores kept at a distance.</p> <p><i>Bedding</i>.—Bedsteads of wood; tape bottoms, 18 inches from the ground, much too low. Bedding consists of quilts, blanket, pillows. "Sheets not allowed by regulation, except in dysenteric "and fever cases."</p> <p><i>Cooking</i>.—Cookhouse opposite privy; of rudest construction. No means of roasting. Cooking well done, so far as means admit.</p> <p><i>Attendance</i>.—As usual.</p> <p><i>Sanitary state</i>.—Not good. Subject to malaria. Too low. Too far from barracks. Badly ventilated. Ill constructed. No surgery or reception room, except verandah. No lunatic ward. "Privy a disgrace to the 19th century." Kitchen requires re-construction. No quarter for medical attendant nearer than three-quarters of a mile.</p> <p><i>Convalescents</i>.—No wards. Would be a great advantage. No provision for exercise, except a rough vehicle, ill calculated for convalescents. No shaded walks or seats.</p> <p><i>Female hospital</i>.—None for infantry. A sick ward in male hospital used; objectionable. Artillery have a separate hospital; sufficient.</p>
ARCOT.	<p><i>Site</i> open, freely ventilated, and healthy.</p> <p><i>Water supply</i> "abundant and wholesome."</p> <p><i>Drainage</i>.—Refuse water and impurities "removed by hand-carriage to a distance of 30 yards "from the hospital."</p> <p><i>Construction</i>.—Materials, brick and chunam; tiled roof; verandahs. No passage for air beneath floor.</p> <p><i>Accommodation</i>.—Two European wards, 34 beds each, at 1,000 cubic feet and 35 square feet per bed. Four infantry depôt wards, 5 beds each, at 1,000 cubic feet and 105 square feet per bed.</p> <p><i>Ventilation</i> by windows and ventilators in upper part of wall. Cooling by punkahs and kuskus tatties.</p> <p><i>Cleansing and limewashing</i> when considered necessary.</p> <p><i>Privies</i> 30 yards from hospital. No drainage. Cleansed by hand.</p> <p><i>Lavatory and bath</i>.—Sick wash in earthen bowls. No means of bathing.</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedding</i>.—Painted iron or wooden cots, with tape bottoms. Usual bedding.</p> <p><i>Cooking</i> sufficient.</p> <p><i>Attendance</i>.—"Any patient can have a separate orderly on requisition of the surgeon."</p> <p><i>Sanitary state</i> "good."</p> <p><i>Convalescents</i>.—No ward. Sick carts the only provision for exercise.</p> <p><i>Female hospital</i>.—None. Sick treated in quarters. "Satisfactory, as families are so limited in "number."</p>
ST. THOMAS' MOUNT.	<p><i>Site</i> open but imperfectly ventilated, owing to surrounding walls and outhouses. Also too close to Mount.</p> <p><i>Water supply</i> abundant and wholesome.</p> <p><i>Drainage</i>.—No sewers; only surface drains to another drain outside precincts.</p>

STATIONS.	REPLIES.
WELLINGTON.	<p><i>Construction</i>.—Lowest wards raised 5 feet above ground. No passage for air beneath. Materials, brick and chunam. Jalousied verandah 10 feet wide; sometimes used for sick. A surface chunam drain for carrying away roof water.</p> <p><i>Accommodation</i>.—Four wards of 18 beds each, 2 wards of 4 beds each, 995 to 1,178 cubic feet per bed; superficial area about 50 square feet per bed.</p> <p><i>Ventilation</i>.—Windows and ventilators in wall; sufficient. Cooling by punkahs and tatties.</p> <p><i>Cleansing</i> and limewashing once a year.</p> <p><i>Privies</i> in small out-houses, over cesspits. Bed stools for bad cases.</p> <p><i>Lavatory and bath</i>.—Out-house containing a bath; "quite sufficient."</p> <p><i>Storage</i> sufficient.</p> <p><i>Bedsteads</i>.—Wood and iron.</p> <p><i>Cooking</i> by pots and pans. No apparatus.</p> <p><i>Attendance</i>.—"Sufficient."</p> <p><i>Sanitary state</i> "good." No epidemic disease.</p> <p><i>Convalescents</i>.—No wards. Exercise in sick carts and doolies. Seats in verandahs, and on top of hospital.</p> <p><i>Female hospital</i>.—Sick treated in military hospital; "satisfactory."</p> <p><i>Site</i> open and healthy.</p> <p><i>Water supply</i> by pipes; plentiful and good.</p> <p><i>Drainage</i>.—Sewage emptied into Wellington stream, 600 yards from privies. Sewers flushed several times daily.</p> <p><i>Construction</i>.—Built of brick and mortar. Closed and open verandahs; former occasionally used for sick; roof water carried away in drains; floors raised, with free ventilation below.</p> <p><i>Accommodation</i>.—When completed, 10 large wards, at 22 beds per ward, 1,145 to 1,513 cubic feet and 57 to 75 square feet per bed.</p> <p><i>Ventilation</i> by windows, ventilating windows and openings; sufficient; wards warmed by fireplaces.</p> <p><i>Cleansing</i> and limewashing once in six months, or oftener.</p> <p><i>Privies</i> properly drained.</p> <p><i>Lavatory</i> "good and sufficient." A bath-room attached to each ward. A good sized wash-house for the sick who can walk about, supplied with water troughs, chatties, bathing tubs.</p> <p><i>Storage</i> not sufficient. Purveyor's store used for convalescent depôt patients.</p> <p><i>Bedsteads</i>.—Wood, with tape bottoms; straw palliasses, sheets, blankets, pillow cases, quilted covers. Coir mattresses recommended.</p> <p><i>Cooking</i>.—Two kitchens; means sufficient, but iron ranges desirable.</p> <p><i>Attendance</i>.—As usual; but five European orderlies have been employed, which has "answered admirably."</p> <p><i>Sanitary state</i>.—"Perfect," but accommodation should be increased. At present only 84 beds for 1,200 men, and no special wards.</p> <p><i>Convalescents</i>.—No wards; desirable but not necessary; plenty of ground about the hospital for exercise, but not enclosed.</p> <p><i>Female hospital</i>.—A ward with nurse's quarters attached to hospital. Complete as to accommodation, but separate building would be better.</p>
RAMANDROOG.	<p><i>Site</i> very healthy.</p> <p><i>Water supply</i> "abundant and wholesome."</p> <p><i>Drainage</i>.—None, except the hill slope, down which the bath water is emptied by natives, by upsetting the tubs at a short distance from the building.</p> <p><i>Construction</i>.—Floors granite, 2 feet above ground. No passage of air beneath. No surface drainage. Verandahs on both sides.</p> <p>No account of <i>accommodation</i>.</p> <p><i>Ventilation</i> by windows; ventilators near ceiling; doors with Venetians, admitting damp in damp weather; stone floors become damp; bad for bowel disease; ventilation "sufficient," warming by fireplaces.</p> <p><i>Cleansing</i>.—Floors once a week, walls and ceilings once a year.</p> <p><i>Privies and urinals</i>.—None, only night stools; would be very offensive if there were many men in hospital; removed by natives.</p> <p><i>Lavatory</i>.—Two shallow earthenware pie-dishes, placed on a form in a room adjoining the ward where the night-stools are; "sufficient, but decidedly inconvenient." Two tubs in same room for bathing. Hot water carried from cook-room. After being used, tubs carried out by natives and water thrown away. In damp and cold weather the room is very chilly.</p> <p><i>Storage</i>.—None; only a small room at end of the building. "Insufficient by one half, and not dry."</p> <p><i>Bedsteads</i>.—Low cots, with tapes. Cotton quilts and blankets.</p> <p><i>Cooking</i>.—Done in part of barrack cook-house. Native cooks very ingenious in cooking with very meagre supply of utensils. "Sufficient."</p> <p><i>Attendance</i>.—"Sufficient."</p> <p><i>Sanitary state</i>.—"Satisfactory;" but in cold damp weather convalescents from dysentery and bowel affections liable to relapses.</p> <p><i>Convalescents</i>.—All the men are. Plenty of shady walks for exercise.</p> <p><i>Female hospital</i>.—None. Very few women and children. Treated in their own quarters; but a hospital is sanctioned.</p>
POONAMALLEE.	<p><i>Site</i>.—Not good. Surrounded by fort wall, excluding air; a dirty stagnant ditch, with shelving mud banks, outside.</p> <p><i>Water supply</i>.—Good.</p> <p><i>Drainage</i>.—None.</p> <p><i>Construction</i>.—An oblong square, floors on level of the ground, simply bricked over. No surface drainage; no guttering. Materials, brick; tiled roof. Verandahs.</p> <p><i>Accommodation</i>.—7 wards, 92 beds, at 480 to 600 cubic feet, and 48 to 60 square feet per bed.</p> <p><i>Ventilation</i>.—Imperfect. Hospital does not receive prevailing winds. Windows have no glass, only shutters, like doors. Cooling by punkahs.</p> <p><i>Cleansing</i> and limewashing has not been done for 12 months.</p> <p><i>Privies</i>.—Small pukka buildings with wooden boxes.</p> <p><i>Lavatory</i>.—Not at all sufficient. Hip baths and some basins.</p> <p><i>Storage</i>.—Insufficient.</p> <p><i>Bedsteads</i>.—Wooden cots with cotton web bottoms.</p> <p><i>Cooking</i>.—Kitchens much too small. No ranges. No means of roasting or baking.</p>

STATIONS.	REPLIES.
JAULNAH.	<p><i>Attendance.</i>—One hospital serjeant and 8 natives, or 1 to every 10 men. “Indifferent, and “unsuited to European sick.” “European nursing, in part at least, would be very “desirable.”</p> <p><i>Convalescents.</i>—No wards, but their necessity apparent. Exercise in doolies and sick carts, and walking in shady walks.</p> <p><i>Female hospital.</i>—A portion of one of the hospital wings used. More space and accommodation necessary.</p> <p><i>Site.</i>—Unobjectionable.</p> <p><i>Water supply.</i>—By puckallies.</p> <p><i>Drainage.</i>—Impurities carried away by sweepers; surplus water drained away.</p> <p><i>Construction.</i>—One story, floor of stone, raised 3 feet. No ventilation below. Walls, brick in chunam; pantile roof. Open verandahs; end ones being formed into native wards, dispensary, &c. Verandahs sometimes used for sick.</p> <p><i>Accommodation.</i>—Two wards, 1,000 cubic feet, and 60 square feet per man.</p> <p><i>Ventilation.</i>—Doors, windows, side and ridge ventilators; sufficient. Cooling by punkahs and tatties.</p> <p><i>Cleansing</i> and limewashing as often as necessary.</p> <p><i>Privies.</i>—Contents removed.</p> <p><i>Lavatory.</i>—A small bathing room and tubs; defective.</p> <p><i>Storage.</i>—None. Building used as a female ward.</p> <p><i>Bedding.</i>—Iron and wooden cots. Straw palliasses; straw and cotton pillows.</p> <p><i>Cooking.</i>—Done in the usual native cook-house; “sufficient.”</p> <p><i>Sanitary state.</i>—“Good;” but more accommodation required, and hospital should be enclosed.</p> <p><i>Convalescents.</i>—No ward; such would be advantageous. No conveyance for exercise. No fenced ground. No shady walks or seats.</p>
RANGOON.	<p><i>Female hospital.</i>—None. A small building adjoining men’s hospital is used.</p> <p><i>Sites.</i>—Artillery hospital on high ground, 100 yards from barrack. Infantry hospital on a high plateau, 180 yards from barrack. Two native infantry hospitals on low ground, one on high ground; sites open.</p> <p><i>Water supply.</i>—Not abundant in hot season. Filters absolutely necessary, but not generally used.</p> <p><i>Drainage.</i>—“Defective in every instance;” merely trenches made without reference to slope.</p> <p><i>Construction.</i>—Wood; thatch and shingle roofs; floors raised on posts, with free ventilation below.</p> <p><i>Accommodation.</i>—Infantry, 2 wards; artillery, 1 ward; cubic feet per man 1053 to 1874, square feet per man 124 to 126. In native hospitals very deficient; 360 to 455 and 826 cubic feet per bed.</p> <p><i>Ventilation</i> interfered with by buildings and position of hospitals. Windows and doors “considered sufficient,” but roof ventilation advisable.</p> <p><i>Cleansing.</i>—Only one hospital has been limewashed till lately.</p> <p><i>Privies.</i>—Contents removed nightly, but not far enough away; thrown on the surface, vitiating the atmosphere. One has “never been cleaned out.” Charcoal and lime used for disinfection, without success. Built of masonry; for native regiments, of matting, “which is most objectionable, as allowing the escape of noxious effluvia.”</p> <p><i>Lavatory and bath</i> differ in different hospitals. Insufficient. Bathing accommodation “totally insufficient,” “hitherto nothing but a tub of water, without basin, soap or towel.”</p> <p><i>Hospital linen</i> washed by commissariat. In monsoon, aired over large baskets by means of charcoal fires.</p> <p><i>Storage</i> damp and insufficient.</p> <p><i>Bedding.</i>—Wooden cot frames; straw mattresses. Iron cots and coir should be substituted.</p> <p><i>Cooking</i> indifferent and not sufficiently varied. “Cooks ignorant of the art of cooking.” Utensils of a primitive kind. Cooking range required.</p> <p><i>Attendance</i> usual establishment; with native corps very inefficient. Comrades allowed on requisition. “Native servants, as a rule, are very inattentive, and require great supervision, and Europeans are averse to be waited on by them.”</p> <p><i>Sanitary state</i>, “on the whole, good.” The sick in hospital have no eating or drinking utensils but what they bring themselves from barracks, (an old custom disused by regulation).</p> <p><i>Convalescents.</i>—Doolies for exercise, if necessary. “The convalescents usually resort to the public gardens.” No convalescent wards.</p>
TONGHOO.	<p><i>Female hospitals.</i>—Detached wards; satisfactory.</p> <p><i>Sites.</i>—No European hospital. Two barracks so used; well ventilated and healthy.</p> <p><i>Water supply</i> abundant and wholesome.</p> <p><i>Drainage</i> same as of barracks.</p> <p><i>Construction.</i>—Floors 7 feet above ground. Ventilation beneath.</p> <p><i>Accommodation.</i>—42 beds, 2,302 cubic feet, and 131 square feet per bed.</p> <p><i>Ventilation</i>, by windows; “sufficient.”</p> <p><i>Cleansing</i>; whitewashing not used.</p> <p><i>Privies</i>, temporary; cleansed twice a day; not good.</p> <p><i>Lavatory and bath</i>, temporary; tubs filled with water for bathing.</p> <p><i>Hospital washing</i> by dhobies.</p> <p><i>Storage</i> sufficient and dry.</p> <p><i>Cooking</i>; a good cook-house, with range; sufficient.</p> <p><i>Attendance</i> according to regulation.</p> <p><i>Sanitary state.</i>—Good.</p> <p><i>Convalescents.</i>—Discharged to barracks.</p> <p><i>Female hospitals.</i>—None.</p>
XX. BURIAL OF THE DEAD.	<p>The burial-grounds are much in the same condition as in the other presidencies. They are generally described as being properly kept, not injurious to health, and giving rise to no nuisance. In several instances they are overcrowded, and at times offensive, for want of sufficient area and depth of graves.</p> <p>Complaint is made in one return that camp burial-grounds are not properly regulated; that interments are too near to the boundary, and that new comers are apt to be injured by the practice of their predecessors.</p> <p>The dead of natives are disposed of according to caste, by burying or burning, and apparently without injury to health. One tribe, however, is accused of burying its dead within houses or compounds, a practice so directly injurious to public health that it should be put a stop to.</p>

BOMBAY PRESIDENCY.

ABSTRACT OF SANITARY DETAILS IN RETURNS FROM PRINCIPAL STATIONS WHERE IS ACCOMMODATION FOR EUROPEAN TROOPS.

Returns have been received from 30 stations in this presidency. Of these 18 have accommodation for British troops; in most cases, conjointly with native troops.

The lowest of the stations is *Bombay*, which is at the level of the sea.

The loftiest (occupied by British troops) is *Sattara*, the elevation of which is 2,320 feet above the sea.

The comparatively healthy stations, *Poona* and *Kirkee*, have an elevation of from 1,800 to 1,900 feet.

There is barrack accommodation for 2,945 men at *Baroda*, *Kurrachee*, *Hyderabad*, and *Surat*, at an elevation of less than 100 feet above the sea level.

About 1,400 men are barracked at elevations of between 100 and 1,000 feet, chiefly at *Deesa* and *Aden*.

There is accommodation for 6,722 men at elevations between 1,000 and 2,000 feet, including the large stations of *Nusseerabad*, *Mhow*, *Ahmednuggur*, *Kirkee*, and *Poona*.

At *Belgaum* and *Sattara* there are 1,500 men at elevations of above 2,000 feet, the highest, as already stated, being *Sattara*.

Dharwar a native station on the Ghauts, is the loftiest

position occupied by troops in this presidency, and is 2,482 feet above the sea level.

The more important stations are situated along the line of the Ghauts, and west coast, at a distance of about 60 miles from the sea.

Kurrachee is on the sea shore.

Mhow and *Hyderabad* are inland, and most of the small native stations are on the sea shore.

Most of the stations are situated on ground overlying trap or other igneous rock. The surface soils are generally sandy, porous, or dry. At some stations there are black loams and black cotton soil. In a few instances there are laterite and red soils. The surface of the country is generally undulating, sometimes flat. There is not much wood or vegetation, and in most cases the surrounding country is uncultivated, and not unfrequently barren.

At two or three stations the adjacent country is overflowed during monsoon.

In the following pages an abstract is given of the chief sanitary points, bearing on the health of the troops, at each of the more important European stations.

I. TOPO-
GRAPHY.—
MOR-
TALITY.

Stations.	Elevation above		Accommodation for British Troops.	Actual Occupation.	Mortality per 1,000 per annum British Troops.		Topographical Remarks.	
	the Sea.	surrounding Country.			Total.	Miasmatic Diseases.		
Hyderabad	-	Feet.	40	1,000	380	35·85	26·62	Undulating ; sandy ; dry ; alluvium ; calcareous hills.
Kurrachee	-	27	—	1,573	1½ regt.	33·94	21·32	Dry bed of a river ; sandy ; blue clay over conglomerate ; salt swamp of 5 square miles adjacent.
Neemuch*	-	1,476	0	109	932	30·3	11·1	Undulating ; rocky ; red soil ; trap ; black soil.
Aden	-	123	123	490	521	16·17	4·28	On a volcanic crater ; overlooking sea.
Baroda*	-	90	0	240	400	42·3	14·1	Flat ; sandy ; cultivated ; swampy in monsoon.
Deesa	-	400	0	800	1,112	26·41	13·21	Flat ; sandy ; sloping to north ; river Bunnass bounds station.
Poona	-	1,800	0	1,728	1,685	26·43	15·24	Barren ; dry ; undulating ; Moola river, ¾ mile off ; trap formation.
Kirkee†	-	1,900	0	608	1 regt.	19·20	12·5	Barren ; dry ; undulating ; river Moola half a mile distant.
Nusseerabad*	-	1,500	55	786	1,647	37·8	12·4	Sandy plain ; large tank half a mile distant ; overflows at monsoon.
Sholapore*	-	1,821	0	75	75	20·9	12·5	Undulating ; gravelly soil ; over sandstone.
Surat*	-	33	0	132	176	51·7	11·3	Flat ; swampy during monsoon ; black soil on clay.
Mhow*	-	1,862	150	temp. bks.	2,100	28·4	11·5	Undulating ; black soil and pebbles resting on trap.
Belgaum	-	2,200	0	984	1½ regt.	18·43	10·15	Undulating ; laterite trap.
Kolapore	-	1,797	60	468	—	—	—	Black soil ; undulating ; trap rock ; red earth.
Malligaum	-	1,300	20	116	128	—	—	Flat and dry ; black loam ; trap rock.
Bombay	-	+	+	1,073	693	{ 58·6 45·68	{ 40·29 25·83	On sea shore ; with muddy estuaries ; trap with shell beaches.
Colaba	-	+	+					
Asseerghur*	-	800	+	100	1 regt.	13·5	—	Ravines with water ; trap rock.
Ahmednuggur*	-	1,900	+	1,200	910	27·2	10·4	Hilly ; black soil overlying trap.
Kulladghee	-	1,750	0	—	—	—	—	Low hills, with brushwood ; river Gutpurbah close to station.
Dharwar	-	2,482	0	—	—	—	—	Undulating ; mica schists ; black cotton soil.
Sattara*	-	2,320	0	520	640	18·9	11·17	Hilly ; black soil resting on trap.
Ahmedabad*	-	320	0	—	—	20·8	10·4	Flat ; cultivated ; flooded in monsoon ; otherwise sandy and dry.

STATIONS.	REPLIES.

II. LOCAL CLIMATES.

HYDERABAD (SINDE).

The local climates and their effect on health vary considerably, and are dependent on elevation, exposure, latitude, and the nature of soils and subsoils.

At *Hyderabad* (in *Sinde*) the thermometer rises in May and June to 99° F. The rain-fall is of very limited amount; the atmosphere exceedingly dry; evaporation rapid for seven months in the year; weather pleasant and bracing in December and January; depressing and exhausting in hot season; predisposes Europeans to disease, but is not an exciting cause; changes of season unhealthy; malarious fevers, with lassitude, debility, and chronic abdominal affections, prevail on the change from cold to heat; same diseases of inflammatory type on the change from heat to cold.

KURRACHEE.

At *Kurrachee* the climate is good. Maximum heat, 86° to 94° F. in May and June. December, January, and February are the cold months; other months variable; fogs at times.

NEEMUCH.

The climate at *Neemuch* is cold, dry, and bracing from the middle of November to the middle of February. Heat increases till the middle of May, the mean maximum of the month being 84° F. Fierce hot winds prevail. Great diurnal variation of temperature.

* The mortality at these stations is taken from Inspector-General Rooke's report (Appendix), and includes that of Queen's troops and European troops of the Indian Army. The mortality at the other stations is that of Queen's infantry, given in the Statistical Tables (Appendix).
† Cavalry.

STATIONS.	REPLIES.
ADEN.	<i>Aden</i> has a moist sea climate, equable throughout the year, with a mean temperature in May, June, and July of from 90° to 94° F. Dust storms occasionally. May and September are the most unhealthy months.
BARODA.	The climate of <i>Baroda</i> is moist and very damp in the rains; fogs in the end of November; hot winds and dust in the hot season; climate deleterious to the troops. From November till June is the most healthy period; the remainder of the year unhealthy.
DEESA.	At <i>Deesa</i> the mean maximum temperature is above 105° F. in May; heat and dryness extreme; atmosphere often loaded with dust; little rain. Climate must be considered as rather healthy, but becomes exhausting after two years' residence. The healthy months are from November to April inclusive; remaining months unhealthy.
POONA AND KIRKEE.	At <i>Poona</i> and <i>Kirkee</i> the climate is very favourable to health. The mean temperature of the hottest months, April, May, and June, varies from 83° to 88°; but the mean maximum temperature is nearly 95° F. in April. Rain-fall moderate. There is almost total freedom from fogs; dampness in a mild degree only observable during rains. Great sensible variation of temperature between day and night. The unhealthy months are October, November, March, April, May, and June.
NUSSEERABAD.	The climate at <i>Nusseerabad</i> is dry during the hot and cold season; moist during the monsoon; fogs rare; dust storms very frequent in hot season. In May, June, and July the thermometer in the barracks ranges from 102° to 103° F. During the monsoon it is from 78° to 86°. The cold during the cold months is very sensibly felt. Europeans may be all day in the open air without injury from the sun. September to December inclusive are the unhealthy months.
SHOLAPORE.	At <i>Sholapore</i> the climate is warm and dry during the greater part of the year. The mean maximum temperature in April and May is 93°; the lowest minimum is between 69° and 70°; daily range from 7° to 12°. Rain-fall, variable, from 13 to 40 inches. Atmosphere pure. High winds at certain seasons. Climate, one of the healthiest in India. Unhealthy months, July, August, December, and January.
SURAT.	The climate is decidedly moist for nine months of the year, the sea being about 10 miles distant. Mean maximum temperature, above 100° F. in March and April; mean minimum in January, 59°. Little or no fog. Occasional dust storms. October till the middle of December is the unhealthy season.
MHOW.	The climate of <i>Mhow</i> is good; dry and cool. The mean maximum temperature of April and May is 92° to 95°; the mean minimum in December and January is 65° to 67°. Rain-fall, from 18 to 24 inches. Little dust. Health of troops affected during changes of season. Monsoon month the most unhealthy.
BELGAUM.	The climate is generally good, but variable. There is no excess either in dryness, moisture, heat, cold, fog, or damp. Dust storms occasionally. General influence of climate on health, good. Most healthy months, January, February, September, August, October, and July.
KOLAPORE.	Climate of <i>Kolapore</i> generally very temperate. Dry from November to February. Early mornings moist and fresh. In March, April, and May there is more moisture. Mean maximum temperature varying from 87° to 88°. Cool and refreshing breezes after sunset. Climate agreeable, though damp and cool during the rains. Altogether one of the healthiest in the Presidency. Diseases most prevalent in September, October, and November.
MALLIGAUM.	Climate is generally dry; very hot during May and June, when the mean maximum ranges from 100° to 104° F. Mornings agreeable to 10 a.m. Cold weather pleasant, with very few fogs. Air pure; dust storms very rare. Troops generally healthy. October most unhealthy month.
BOMBAY.	<i>Bombay</i> has a sea climate, generally more or less moist, in the rainy seasons particularly so, and very debilitating, except in December, January, and February. Mean temperature highest in April, May, and June, ranging from 84° to 85°. Annual rain-fall, about 78 inches on 102 rainy days. Evaporation almost equals average rain-fall. From January to June is the most healthy period; remainder of year unhealthy.
ASSEERGHUR.	Climate excellent; moderately dry and not very variable. Its influence on health of troops, excellent. Third quarter of year is the most unhealthy.

III. PREVAILING DISEASES AMONG NATIVE POPULATION, AND THEIR CAUSES.

HYDERABAD.	Fevers (malarious), with spleen disease, small-pox, measles, calculus. <i>Causes</i> .—Poverty, filth, alternate inundations and drying of soil.
KURRACHEE.	Sickness occasional at beginning and end of hot season. Diseases, fevers, spleen, bowel, scurvy, ulcers. <i>Causes</i> .—Swampy margin of sea; bad drinking water, causing scurvy and diarrhoea.
NEEMUCH.	Fevers prevail.
ADEN.	Ulcers; small-pox; fevers.
NUSSEERABAD.	Fevers; guinea worm; small-pox; dysentery; diarrhoea; spleen; cholera occasional.
SHOLAPORE.	Diseases, quotidian, intermittent fevers; diarrhoea; dysentery; guinea worm; cholera; small-pox. <i>Causes</i> .—Neglect of sanitary precautions; impure water; alternations of temperature; improper and insufficient food; abuse of intoxicating drugs.
SURAT.	Station, district, and native population generally unhealthy. Prevailing diseases, spleen, small-pox; cholera. <i>Causes</i> .—Want of cleanliness; filthy habits; imperfect drainage.
AHMEDNUGGUR.	Intermittents; cholera; small-pox.
MHOW.	Fevers; spleen; small-pox; cholera.
BELGAUM.	Fevers, intermittent; bowel complaints; ulcers; bronchial disease; cholera; small-pox. <i>Causes</i> .—Imperfect ventilation; want of cleanliness of person and of dwellings; errors in diet; disregard of all hygienic laws.
KOLAPORE.	Intermittents, remittents; guinea worm; tape, round, and thread worm, and itch; cholera, small-pox, measles.
MALLIGAUM.	Fevers; rheumatism; cholera.
BARODA.	Cholera; intermittents; small-pox; leprosy; spleen disease. <i>Causes</i> .—Want of cleanliness; bad drainage; too many trees. The villages in Guzerat are excessively filthy; no cleansing; water stagnant in every hollow till it evaporates.
SATTARA.	Fevers, chiefly mild intermittent; sub-acute rheumatism; guinea worm; spleen disease rare; cholera.

STATIONS.	REPLIES.
BOMBAY.	Small-pox ; measles ; cholera, epidemic and sporadic. <i>Causes</i> .—Filth, and almost entire want of circulation of air.
ASSEERGHUR.	District and native population essentially unhealthy ; cholera and fever. <i>Causes</i> .—Excessive filthiness ; total absence of all sanitary measures.
DEESA.	Diarrhœa ; fever, intermittent, remittent ; spleen disease not common ; cholera "visited many villages in surrounding districts ;" small-pox occasional ; but "natives generally healthy" from "dry climate," sandy soil, and good water, absence of vegetation and of sudden changes of temperature.
KIRKEE AND POONA.	Fevers, intermittent and remittent, prevailing at beginning and end of rainy season ; spleen disease rare ; bowel complaints ; eruptive fevers ; small-pox ; chicken-pox ; measles prevailing in hot season ; catarrh and rheumatism in cold season. Population generally healthy, from elevation, trap subsoil, freedom from alluvial deposits, sea breezes, good water.

IV. PREVAILING DISEASES AMONG EUROPEAN TROOPS.

HYDERABAD.	Prevailing diseases among the European troops are,—fevers, quotidian, intermittent, remittent, dysentery, rheumatism, hepatitis. They are most prevalent in autumn. European troops at Hyderabad have never suffered from epidemic cholera. Strict attention to all sanitary measures is required. There should be no overcrowding of barracks.
KURRACHEE.	Prevailing diseases : fevers, intermittent, remittent, and continued ; dysentery and rheumatism occasionally. These give 45 per cent. of the total admissions, and 33 per cent. of the total deaths. Hepatic diseases at the rate of about 3 per cent., caused by heat and the use of spirits ; but also accompany severe fevers and dysentery. Pure air, disuse of spirits, proper clothing, and exercise, are the prophylactics required against hepatic diseases. Twenty per cent. of the sick of European regiments suffer from venereal disease. Prostitutes should be expelled from bazaars and marriage extended. No lock hospitals required. About 10 per cent. of recruits landed at Kurrachee from England suffer from scurvy ; attributed to bad water and food, and inferior accommodation on voyage.
NEEMUCH.	Prevailing diseases at this station are, fevers, intermittent, remittent ; rheumatism, dysentery, and small-pox. Zymotic diseases are most prevalent during the hot weather and rains. No unusual atmospheric conditions have been observed to accompany them.
ADEN.	The most frequent diseases among Europeans here are not those observed at other stations. Fevers, dysentery, rheumatism, cholera, happen occasionally, but in much smaller proportion than elsewhere. The fevers are chiefly ephemeral and intermittent ; they are most prevalent, together with diarrhœa, and dysentery, in September.
BARODA.	Fevers are very prevalent at this station ; the continued form frequently occurs. Diseases of the stomach and bowels, including dysentery and diarrhœa, are not so frequent ; but epidemic cholera has been prevalent. Fever appears about October, when vegetation is decaying, and there is moist muggy heat. Cholera appears about the end of the hot season, and seems connected with the eating unripe fruit by the troops. Hepatitis occasionally occurs ; small-pox and rheumatism not common.
DEESA.	The prevailing diseases here are, fevers, intermittent and remittent. Dysentery is not common. Diarrhœa most frequent in wet weather. Cholera excessively fatal. In the wet seasons fevers assume the above-mentioned types ; and in the hot dry months the types are ephemeral or continued. Liver disease is very common, and is attributed to excessive heat and sedentary habits. Venereal disease amounts to from 13 to 25 per cent. of the admissions.
NUSSEERABAD.	At this station fevers afford the largest proportion of admissions. They are intermittent, remittent, and continued, acute and chronic dysentery, distinct and confluent small-pox, and acute and chronic rheumatism also prevail. Cholera is comparatively rare. Precautionary measures required are, cleanliness of cantonments ; abundance of pure water ; sufficient accommodation for troops to prevent overcrowding ; care as to rations, &c. The principal causes of hepatic disease are, intemperance ; atmospheric changes ; exposure to draughts during perspiration after exercise. The preventive measures are, temperance ; cool atmosphere ; careful diet ; avoidance of draughts. Guinea-worm prevalent, from drinking water containing ova. Five-eighths of cases in hospital are venereal.
POONA AND KIRKEE.	The most frequent diseases at these stations are, fevers, ephemeral and intermittent. Remittent are less prevalent. At Kirkee the tertian type is the prevailing one ; dysentery, diarrhœa, cholera, rheumatism, syphilis, eruptive fevers also prevail, the latter chiefly at Poona. Acute dysentery is the result of chills, sometimes of intemperance. At the time of their prevalence, the atmosphere is generally close, muggy, and loaded with electricity. Hepatic disease also occurs, the result of climate and intemperance. Flannel next the skin, moderate exercise, and a limited use of intoxicating drinks are required. Hepatitis is almost entirely absent from the native army, on account of their abstinence from spirituous liquors and their simple diet. Fourteen per cent. of total sick in hospital are venereal. Lock hospitals recommended.
SHOLAPORE.	Prevailing diseases, fevers, quotidian, intermittent, some liver disease, and dysentery, but little cholera ; some venereal disease. Lock hospitals <i>not</i> recommended.
SURAT.	Prevailing diseases, fevers, intermittent, remittent, continued ; diarrhœa and dysentery ; very little venereal disease, or liver disease.
AHMEDNUGGUR.	Prevailing diseases, fevers, ephemeral, remittent, continued, in the hot months, and intermittent after the monsoon. Dysentery occasions a large proportion of the mortality. Cholera occasional, rheumatism frequent. These, with diarrhœa, catarrh, throat affections, are the common diseases ; liver disease prevalent also. Twelve and a half per cent. of total admissions are venereal ; after fevers, it is the most common disease. Lock hospitals, to be of use, must have suitable establishments attached to them. Fevers are most prevalent in hot months and after the rains. Liver disease, during the hot months. Almost every epidemic in this cantonment has its origin in the crowded, ill-ventilated, and dirty village of Bhingar. It would be an immense advantage to have it removed. Want of occupation, leading to drink, lays the seeds of disease among the troops ; for one man occupied in a barrack, there are six idle. Too great exertion cannot be used to furnish legitimate amusements and occupations. When men are actively engaged in the field in hot weather, there is little sickness or epidemic disease among them.
MHOW.	Fevers, intermittent, remittent, continued, are the most prevalent diseases ; dysentery and cholera also occur ; rheumatism occasionally ; liver diseases frequent ; stimulating food and drink are predisposing causes. Prophylactics : improve the vegetable proportion of the ration, and substitute malt liquor for spirits. Epidemic disease always aggravated

STATIONS.	REPLIES.
BELGAUM.	by irregular habits, crowding in barracks, and inferior accommodation. Venereal disease from 60 per cent. of the sick down to 8 per cent. Lock hospitals and a good conservancy police should be established. The troops here suffer from fevers, intermittent, remittent, continued, ephemeral, eruptive; dysentery, acute and chronic; cholera, sometimes mild, but often most severe; small-pox, mild and virulent; rheumatism, acute, chronic, idiopathic, syphilitic; catarrh affections frequently severe; zymotic diseases most prevalent in hot season, and beginning of monsoon, when weather is hot, close, and oppressive, with frequent calms. Bazaar and native dwellings greatly wanting in cleanliness and ventilation; houses close, crowded, confined, and drainage bad, or very indifferent. European troops at present too crowded; their habits of exposure to sun, frequenting the bazaar, their irregularities and intemperance, tend to excite these diseases. To prevent them, the troops should have more space and ventilation; they should be provided with reading-rooms, and means of occupation and amusement to keep them out of the bazaars. The sanitary state of cantonment, bazaar, and native population should be improved; streets widened, dwellings ventilated; impurities removed; vaccination extended. Liver disease prevalent, occasioned by variable climate, exposure to sun, intemperance. Temperance, regularity, suitable clothing, avoidance of exposure, are requisite for preserving health. Venereal disease forms 11 per cent. of constantly sick. Lock hospitals, with proper police measures, might be useful; without these, lock hospitals have been useless, and generally abolished.
KOLAPORE.	The more frequent zymotic diseases are intermittent, remittent fevers; epidemic cholera; small-pox; measles; the former occur mostly at the termination of the rains; cholera and small-pox generally in hot weather. Liver disease occurs occasionally, and arises from continued exposure to high temperature and great change; addiction to spirits is a cause of the disease, malt liquor should be used instead. More active habits and daily swimming baths; lock hospitals recommended; the more varied and agreeable a soldier's occupations, the better his health; indulgence in intemperance is a cause of disease; present cesspools and urinals should be entirely abolished on account of nuisance.
MALLIGAUM.	Prevailing diseases: fevers of the common types, and diseases of stomach and bowels, intermittents most common; muggy hot damp weather predisposes to them. Causes among the troops: exposure to variations of climate, excess of duty, overcrowding of barracks. Prophylactics: daily bathing; flannel next skin; ventilation of barracks; keeping from exposure to sun. Liver disease not so common here as elsewhere; to avoid it are required, spare diet; no beer or spirits, little wine; exercise; flannel next the skin. Venereal disease $2\frac{1}{2}$ per cent. of sick; lock hospitals, with police supervision, recommended.
BOMBAY.	Prevailing diseases: ephemeral, tertian, quotidian, remittent fevers; small-pox; measles; cholera; dysentery. Fevers most frequent in August, September, and October; cholera from March till June. Sanitary condition of station very indifferent; barracks built in low damp positions; bad drainage; crowded filthy natives' dwellings close at hand; regimental lines and bazaars should be kept thoroughly clean. A complete system of drainage is required; sheds for shelter and workshops for the men. Hepatic disease frequent; venereal varies. Lock hospitals abolished.
ASSEERGHUR.	Most common diseases: intermittent, remittent, common continued fevers; acute and chronic dysentery; acute rheumatism; hepatic disease, 4 per cent. of the cases; said to be attributable to the climate. Very little venereal disease. Prophylactics: efficient cleansing of station and vicinity, good drainage, cleansing of water tanks, prevention of overcrowding in barracks.

V. CANTONMENT BAZAARS, AND THEIR SANITARY STATE.

HYDERABAD.	Drainage of bazaar principally natural; water bought by residents; no crowding; kept clean by sweepers; no dung-heaps permitted; no nuisance in barracks from bazaars; native houses generally good. Native town of Hyderabad adjoins station.
KURRACHEE.	No drainage in bazaars; filth removed daily, kept as clean as limited number of sweepers will allow. Bazaar very crowded; more sweepers required. Native houses mostly good, with cesspits, but contents removed daily. No nuisance in barracks from bazaar. Town of Kurrachee, with 22,000 inhabitants, $2\frac{1}{2}$ miles distant.
NEEMUCH.	Sanitary condition of bazaar tolerably good, ventilation and drainage imperfect; water from wells good and sufficient; latrines too close to houses, not used for lack of a proper establishment to keep them clean. People obliged to resort to surrounding country; bazaar sweepers paid by inhabitants; bazaar superintendent maintains "strict supervision," and "punishes the inhabitants." Latrines should be moved to a distance, with a sanitary police to attend to them; native houses more or less dirty, dung-heaps close to them; but not sufficiently near station to produce ill effects. Barracks "at east end of camp exposed to disagreeable emanations" from bazaar. "Could be prevented by removing bazaar or by building new barracks at west end." Town of Neemuch, with 8,000 to 10,000 inhabitants, half a mile distant.
ADEN.	No drains near sudder bazaar, "not required, ground being elevated and dry." Ventilation good, water from wells; one privy; no nuisance permitted "in unauthorized places." "Peons see to this." Houses not crowded; "sanitary condition" of bazaar "could not be improved." No nuisance in barracks from it. Town of Aden, with 25,000 inhabitants, close to military limits.
BARODA.	Bazaar well drained; badly ventilated; much crowded; streets clean, but very narrow for want of space. Inhabitants required to keep their premises clean, sweepings removed daily. Four peons allowed; sufficient for sanitary police; no nuisance to station. City of Baroda, $1\frac{1}{2}$ miles distant.
DEESA.	Bazaar a single street along river bank; surface drainage only; ventilation of houses defective on account of structure and position; water abundant and good. Cleanliness defective except in main street, no latrines; natives resort to nullahs and river bank. Crowding in proportion to poverty. People ill-fed, worse clad; general cleanliness enforced in bazaar. Dung-heaps, a "never-failing condition of native life in India." Whether cesspits are in use or not "depends on nature of ground and weather." Nuisance in native lines from wind coming over native dwellings. Sudder bazaar, with 9,000 inhabitants, inside cantonments and extending outside.
KIRKEE AND POONA.	Kirkee.—Drainage of bazaar less objectionable than in most; no crowding; "little fault" in ventilation; water sufficient, from river; bazaar clean; latrines needed for bazaar people;

STATIONS.	REPLIES.
	<p>"chowdrie" inspects bazaar daily, "conductor" four times a month; dust carted to jungle; native houses of average construction; no dung-heaps or cess-pits; no nuisance.</p> <p><i>Poona</i>.—Bazaar not well drained, nor can it be without more water; ventilation pretty good; crowding; water insufficient; bazaar tolerably clean; no latrines; "poorer classes have to go to a distance;" one havildar, one naique, and 20 peons superintend cleansing; filth and rubbish removed daily; establishment far too small for a population of 27,000; vegetation kept under, and drains cleaned; houses generally good, or being improved; no dung-heaps; no regularity of streets or houses; bazaar close to officers' quarters; nuisance in barracks from villages of Ghorepoore and Wanowrie; cholera occurred first in Wanowrie, 100 yards from officers' lines; village of Kirkee so near that it is a nuisance—"should be removed;" city of Poona in a hole—(population 80,000)—three-quarters of a mile to windward of station of Poona.</p>
SHOLAPORE.	Bazaar clean, well drained, and ventilated; water from wells not deficient; regulations as to cleanliness sufficient; but no paid establishment for the purpose; no dung-heaps or cess-pits; town of Sholapore, with 60,000 inhabitants, a mile distant.
SURAT.	Bazaar drainage and ventilation "as good as possible," water from wells; bazaar very small, kept clean under regulations; few native houses; no dung-heaps or cess-pits; "when wind blows over native town, it is considered unhealthy;" north wind comes over bank, from which there are "noxious vapours;" south-west, the only healthy quarter; large and populous city of Surat forms north-east boundary of camp.
NUSSEERABAD.	Station bazaar contains 15,000 people; main and cross streets have covered drains, emptying into nullah on west; part of bazaar much crowded; ventilation bad; 25 latrines kept clean by sweepers; only one scavenger's cart allowed (for 15,000 people), five required; drinking water chiefly from tanks; 30 wells in bazaar, but only six contain drinkable water; in very dry seasons no drinking water procurable within a mile; each inhabitant responsible for cleanliness of street opposite his house; refuse collected in basket and removed by cart; no nuisance.
AHMEDNUGGER.	Surface drainage said to be "good;" water supply abundant; cleanliness said to be "strictly enforced," but no latrines; no crowding; "two carts and two pairs of bullocks carry away the refuse daily, which is thrown from baskets into the cart, as it passes;" town of Ahmednuggur, with 36,000 people, skirts the camp; suburb of Bhangar, with 3,000 people, is a continuation of the camp; inhabitants of both "permitted to answer the calls of nature on the very boundary of the camp;" when wind blows over dwellings to cantonment, "smell of ordure very perceptible;" removal of filth from native privies not duly attended to.
MHOW.	Drainage of bazaar said to be "good," and water plentiful; external ventilation not good, because streets not well arranged; houses said to be generally good; no dung-heaps or cess-pits; no nuisance experienced; "conservancy carts" remove refuse.
SATTARA.	Sanitary state of bazaar said to be in every point good; no native houses near; no nuisances; city of Sattara, with a population of 30,000, two miles distant.
BELGAUM.	Bazaar said to be "well drained;" ventilation, "as in all station bazaars," deficient; houses low and crowded; water said to be "good;" refuse removed by sweepers and carts, and burnt; "no want of cleanliness;" "public privies and cesspools at times very offensive;" native houses near station generally low, mean, and dirty looking, with dung-heaps and cess-pits near them, and within the enclosures. Shahpoor about a mile from the station; town of Belgaum, with 18,000 inhabitants, between fort and camp; native town affects general health of station, from "bad conservancy," but "no want of cleanliness."
KOLAPORE.	Cantonment bazaar said to be "clean, sufficiently drained, and not overcrowded;" sanitary police under the bazaar superintendent; filth and refuse collected in baskets and taken away to be burnt by Government carts; "one sweeper maintained by Government," who collects filth and throws it into a nullah, 400 yards from camp, where "the bazaar people resort for the purposes of nature;" "stagnant water" removed by sweepers every morning; "two peons" prevent nuisance being committed in camp "from 4 a.m. to 10 a.m. daily," and all offenders are "fined." These arrangements have hitherto proved sufficient. Kolapore, with 50,000 to 60,000 inhabitants, is about one mile, and Bhovra (a village) about half a mile from station.
MALLIGAUM.	Drainage and ventilation of bazaar said to be good, and water abundant; streets tolerably open, and cleansed by sweepers under the superintendent; no latrines; town of Malligaum three-quarters of a mile distant.
ASSEERGHUR.	Sanitary condition of bazaars said to be "satisfactory;" "well ventilated, well supplied with water, and kept clean" by sweepers; but "a policeman ought to be entertained to enforce the regulations in the fortress bazaar;" native houses "built in all shapes and all sizes" in the "pettah;" no nuisance.
BOMBAY.	Station close to town, which contains from 400,000 to 600,000 inhabitants; native town very defective in drainage, &c.; water can be obtained from Vehar waterworks; municipal commission, consisting of deputy commissioner of police, officer of Bombay engineers, and an European inhabitant; the first and last elected by bench of magistrates; engineer appointed by Government superintends the sanitary police; native houses generally in a filthy condition; much ordure within precincts of buildings, where it has been accumulating for years; nuisance is experienced in town barracks and Fort George, by wind blowing over native houses; butchers' shambles and public necessities half a mile distant; site of slaughter house as bad as can well be, close to a proverbially unhealthy native town; sea breeze cut off by bazaars, large buildings, &c.; washermen's tanks particularly obnoxious.

VI. BARRACK CONSTRUCTION.

HYDERABAD.	There are ten barrack rooms, holding 96 men each; with 1,849 cubic feet, and 86 superficial feet per man; each barrack has two non-commissioned officers' rooms at each end, with a lavatory projecting from the centre; double verandahs and three rows of beds between the opposite doors and windows; verandahs 8½ feet wide; barracks constructed of pukka-brick and lime; floors partly of brick, partly of stone, raised 2½ feet above ground; would be a great improvement for barracks to be raised on arches, "from the well-known habit of malaria, in keeping towards the surface of the earth;" barracks "cleansed and limewashed twice a year."
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STATIONS.

REPLIES.

Figs 1, 2, and 3 show a plan, internal elevation, and section of the barracks; with three rows and space for four rows of beds between the opposite windows; these figures illustrate the general construction of this class of barrack.

Construction.

Foundations and superstructure are of burnt brick and lime.

Floor of large bricks set in lime.

Roof consists of teak trusses, purlins, rafters, battens, matting plastered over with mud and straw and single tiles on top.

Doors (each 4 ft. by 10 ft.) are partly venetian and partly glazed.

Windows (each 4 ft. by 2 ft.) are fixed venetians.

Each roof is provided with three ventilators, 11 ft. long and 6 ft. broad.

FIG. 1.—PLAN AND SECTIONS OF ONE OF THE EUROPEAN BARRACKS AT HYDERABAD (SINDE).

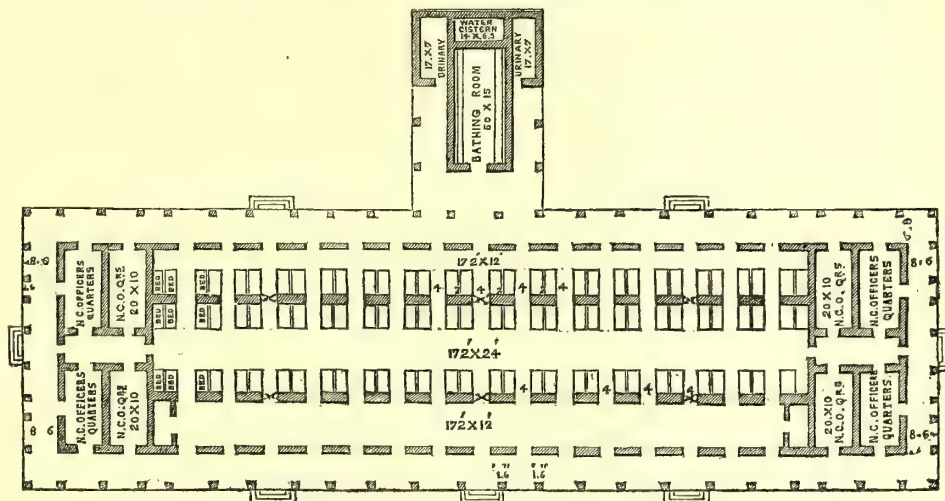


FIG. 2.—LONGITUDINAL SECTION.

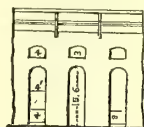
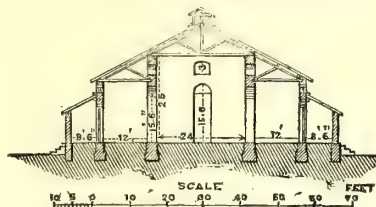


FIG. 3.—CROSS SECTION.



KURRACHEE.

Twenty-two European barrack rooms; ten contain 100 men each, nine contain 47 men each, three contain 50 men each; cubic feet per man from 1,175 to 1,604; superficial feet per man from $65\frac{1}{4}$ to $114\frac{1}{2}$; each barrack has a verandah 10 feet wide and two rows of beds between opposite doors and windows; barracks constructed of stone and lime; floors of cut stone in permanent barracks, chunam and earth in others; floors raised from 3 feet to $3\frac{1}{2}$ feet above ground, no passage of air beneath; walls and ceilings cleansed and lime-washed every six months; bedsteads consist of boards on iron trestles.

NEEMUCH.

One room for 100 men, giving 1,008 cubic feet and 48 square feet per man; windows on opposite sides; verandah 10 feet wide; floors raised one foot above the ground, of stone, laid on rammed earth; no passage of air beneath; temporary barrack.

SHOLAPORE.

Two barrack rooms for 40 men each, giving 984 cubic feet and 42 square feet per man; verandah (open) along one side and end of each; doors and windows on opposite sides; beds in two rows; floors raised above ground; no passage of air beneath; where not paved with stone, the floors are of clean gravel and sand, rammed; surface plastered once a week or oftener, with cow-dung; windows are ordinary plank shutters; bedsteads iron, or planks on iron trestles; buildings of burnt bricks and lime, with thatched roofs.

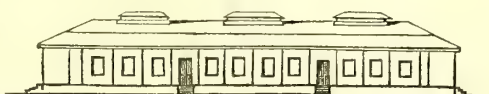
ADEN.

Six rooms for European soldiers, containing 46 men each, at from 1,346 to 1,452 cubic feet per man, and from 60 to 62 square feet per man; the Isthmus barracks are built of rubble and chunam, over an arched basement 12 feet high; front Bay barracks built of wattle and daub, and floors paved and raised two feet nine inches above ground; no passage of air beneath; whitewashing twice a year; barracks have verandahs; two rows of beds between opposite doors and windows.

BARODA.

Four temporary barracks for 60 men each; 933 cubic feet, 66 square feet per man; built of burnt brick and mortar, sun-dried brick and mud. Floors, some of brick, some of chunam, raised 4 feet above ground. No passage of air beneath, verandahs all round. Two rows of beds between opposite windows; walls and ceilings washed, whenever required. Figure 4 shows the general construction of the temporary barracks at this station and elsewhere in the Presidency.

FIG. 4.—TEMPORARY BARRACK AT BARODA.

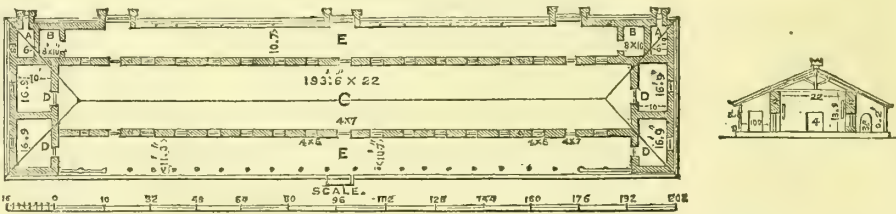


SATTARA.

Thirteen barrack rooms, for forty men each at 735 cubic feet and 50 square feet per man. Temporary wattle and daub walls; grass thatched roofs; floors of beaten earth, raised one to five feet according to slope. No passage of air beneath. Verandahs all round.

DEESA.

Eight barrack rooms contain 70 men each, and 3 containing 80 each, with from 1,100 to 1,200 cubic feet and 59 square feet per man. Space between windows for two beds $6\frac{1}{2}$ feet wide.

STATIONS.	REPLIES.
KIRKEE AND POONA.	<p>Verandahs 10 feet wide on all sides; used by soldiers to sleep in at their discretion; 2 rows of beds between opposite doors and windows; materials, burnt brick and mortar; floors concrete, raised 2 feet above ground. No passage for air beneath. Limewashing done at no stated period. Bedsteads, iron trestles and boards.</p> <p><i>Kirkee.</i>—Sixteen barracks containing 36 men each, with from 1,034 to 1,487 cubic feet and 64 square feet per man. Open verandah to each barrack, 5 feet to 9 feet wide; never used as sleeping quarters, except on emergency. No glass windows, only wooden shutters; materials of new barracks, burnt brick and lime; of others, burnt brick and mud; floors of the former paved; floors of the latter mud; floors of old barracks not raised above ground; new barracks raised 3 feet, but no passage of air beneath. Floors should be raised 14 feet above the ground.</p>
AHMEDABAD.	<p><i>Poona.</i>—Thirty-two barrack-rooms containing 40, 42, 84, and 96 men per room, at from 902 to 1,314 cubic feet and from 57 to 76 square feet per man. Some barrack rooms have closed verandahs; windows and doors on opposite sides. Closed verandahs sometimes used as sleeping quarters; materials brick and lime plastered; some floors are paved and raised 3 feet above ground; no passage of air beneath. Some of the barracks have upper stories.</p> <p>Twelve barracks, 50 men each, at 756 cubic feet, 55 square feet per man; temporary, of sun-dried brick and mud; chupper roofs, doors and windows of matting, nailed over jungle-wood frames; mud walls plastered and white-washed inside and out. One barrack, 100 men, at 990 cubic feet, 56 square feet per man, of burnt brick and mud, glass windows, half-glazed doors. Floors earth and broken brick, raised one to 2½ feet above ground. No passage of air beneath.</p>
NUSSEERABAD.	<p>Barrack accommodation, temporary, consists of 9 rooms, each containing 80 men, with 1,000 cubic feet and 50 square feet per man. Barracks have a single open verandah; windows and doors on opposite sides, beds being arranged in two rows between them. Foundations, plinth, and main walls stone and lime, plastered outside. Floors of flag stone, chunam, and moorum, raised from 1½ to 2½ feet above ground; no passage of air beneath; verandahs occasionally used as sleeping accommodation. Bedsteads of wood and of boards and trestles; cotton mattresses, which get damp during monsoon; bedstead harbour bugs.</p>
SURAT.	<p>Three barrack rooms, one for 63 men, and two for 25 men each; 480, 540, and 685 cubic feet, and 58 and 60 square feet per man. Windows on opposite sides; beds ranged between. Barracks of stone, or brick masonry; floors raised from 13 to 20 feet above ground; passage for air, but no thorough draught; no verandahs; floors, chunam and teak planks; bedsteads, wood. Barracks limewashed twice a year.</p>
AHMEDNUGGUR.	<p>Twelve permanent barracks for artillery, 50 men in each, at 1,135 cubic feet and 51 square feet per man. Twelve temporary barracks for infantry, 50 men in each, at 807 cubic feet and 57 square feet per man. Majority of buildings have windows on opposite sides; beds arranged between them; verandahs 10 to 13 feet broad. Part of the broader verandahs taken in to barrack-room. Permanent barracks of brick; temporary, of wood framing, wattle and daub walls; floors of moorum, raised 1 to 2 feet above ground; no passage of air beneath; walls limewashed once in six months, or oftener if necessary. Bedsteads, boards on iron trestles.</p>
MHOW.	<p>Barracks temporary. New stone barracks about to be built, apparently on the regulation plan. Two floors; windows and doors on opposite sides; each barrack to contain 264 men; distance between opposite windows, 50 feet; two intervening rows of piers and arches. Four (4) rows of beds between opposite windows. Construction bad as regards ventilation, agglomerating numbers together, and as to small superficial space.</p>
[BELGAUM.	<p>Twenty-eight barrack rooms, for from 36 to 72 men per room, at from 813 to 1,430 cubic feet, and from 59 to 89 square feet per man. Barracks long and narrow, with verandahs; windows and doors on opposite sides, two rows of beds between. Built of laterite and lime; double tiled roofs; raised from 0 to 8 feet above ground, but without passage for air beneath. Limewashed at no stated intervals. Fig. 5 shows the construction of the infantry barracks, and generally of the more simple forms of barracks in the Presidency.</p>
<p>FIG. 5.—PLAN OF INFANTRY BARRACKS IN CAMP (9 of this sort).</p> 	
ASSEERGHUR.	<p>New barracks in process of construction.</p>
KOLAPORE.	<p>Two artillery barracks for 56 men each, with 811 cubic feet and 58 square feet per man; six infantry barracks for 54 men each, with 792 cubic feet and 56 square feet per man. Barracks, simple construction; one long room, with a serjeants' room at each end; windows and doors opposite; open verandahs, 11 and 12 feet broad. Barracks built of timber framework; space (between posts) burnt brick and mud; roofs single tiled; floors moorum, 2 feet above ground; no ventilation beneath. Bedsteads, some iron; some iron trestles with wooden boards; some of wood; last greatly disliked for the bugs.</p>
MALLIGAUM.	<p>Two barrack rooms, one for 90 men, with 1,170 cubic feet and 61 square feet per man; one for 26 men, with 643 cubic feet and 44 square feet per man. Barracks temporary; built of sun-dried brick; roof double tiled; floors moorum, raised one foot, but no passage of air beneath; windows on opposite sides; two glazed shutters; verandahs on both sides and at ends, 10 feet wide. Limewashing when required.</p>
BOMBAY.	<p>Three barracks, viz. :— <i>Town.</i>—Five rooms (on two floors), two of 71 men each, at 1,518 cubic feet and 132 square feet per man; three of 106 men each, at 1,415 cubic feet and from 107 to 126 square feet per man. Buildings, three sides of a square. Plan and arrangements very bad; privies, bath rooms,</p>

STATIONS.

REPLIES.

ablution rooms, cook-house, in close proximity to men's rooms, some under their verandahs; arched doorways on inner side on ground floors; iron bars with wooden shutters in outer walls; venetian shutters on upper floors; ground floor of stone flags, one foot above ground; no passage for air beneath.

Fort George.—Six rooms (on two floors; no windows, only doors) of 44 men each, at from 900 to 1,148 cubic feet and from 77 to 80 square feet per man. Verandahs, 11½ feet wide; ground floor, flags, 4 feet above ground; no passage for air beneath.

Colaba.—Six rooms of 53 men each, at 1,075 cubic feet and 89 square feet per man. Long narrow rooms, with verandahs; windows and doors on opposite sides; glazed shutters on the west, plank shutters on the east side; three barracks have mud floors; three have stone floors, 1½ feet above ground; no passage for air beneath. *Depôt Barrack* at Colaba.—One centre room, completely enclosed by other rooms, without any direct communication with external air. Floors of all barrack rooms should be raised 14 feet above ground.

VII. MARRIED QUARTERS.

HYDERABAD (SINDE).
KURRACHEE.

"Quite sufficient."
"Sufficient."

NEEMUCH.
ADEN.

Sufficient for present requirements of station.

Twelve married quarters for infantry; 24 more to be added; 12 for artillery at Front Bay, and 12 at Ras Tarshyne; 24 for infantry also there.

BARODA.
DEESA.
KIRKEE.

"Plenty."

84 for European regiment; 14 for troop, Horse Artillery.

"Sufficient, but extremely bad in construction, except part of superior non-commissioned officers' quarters."

POONA.
NUSSEERABAD.
SHOLAPORE.

"Sufficient."

Not yet quite sufficient, but will be provided.

"Such quarters as exist are not creditable to the Government. Suitable buildings have been estimated for, but no steps appear likely to be taken for securing the erection of the buildings."

SURAT.
AHMEDNUGGUR.
MHOW.
SATTARA.
BELGAUM.

Sufficient only for three married non-commissioned officers or men.

Eighty separate quarters for artillery; none for infantry in temporary barracks.

In temporary patcheries.

Separate quarters.

"Not sufficient; some of the end verandah rooms occupied by married men, separate from the unmarried."

KOLAPORE.
BOMBAY.

"Sufficient, but of temporary description, and damp in monsoon."

No separate quarters in town barracks; lower story generally used. In Fort George, sufficient in the front and rear verandahs. At Colaba and depôt barracks, sufficient.

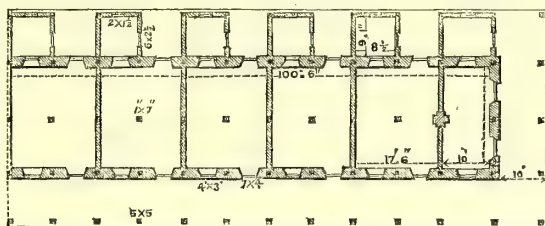
ASSEERGHUR.

"None whatever." "Two married people of 28th Regiment, and one of 95th Regiment, occupy barrack rooms with single men."

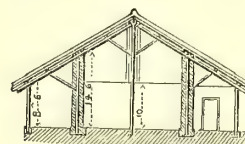
MALLIGAUM.

"Ample and good." The following, Fig. 6, shows their usual construction:—

FIG. 6.—BARRACK FOR MARRIED MEN AT MALLIGAUM.



TRANSVERSE SECTION.



PRISON CELLS.

At three or four stations the cells are well situated, have sufficient space and ventilation, and are said to be "healthy." At all the others the sites are more or less unhealthy, the cubic contents too small for the climate, the ventilation insufficient, as also the means of discipline. Many of this latter class of cells are "bad," or "very bad." At Bombay the military prison is part of a native gaol, situated in an unhealthy locality, and badly ventilated. The prisoners are subject to outbreaks of dysentery and cholera.

VIII. VENTILATION OF BARRACKS.

HYDERABAD (SINDE).

Barracks, guard-room, &c. have ventilators in roof, sufficient to keep air pure night and day; admitted air cooled by punkahs and tatties.

KURRACHEE.

Ventilation by openings in roofs and fixed venetians in walls, by wind shafts, and by open doors and windows; sufficient for day and night. Sea breeze ample for coolness.

NEEMUCH.

Ventilators in side walls under wall-plate in barracks; guard-rooms, openings in roof. When barrack doors and windows shut, ventilation insufficient; air cooled by wet tatties.

NUSSEERABAD.

Ventilation by doors and windows; small apertures in wall near floor; similar apertures 5 feet above each window; sufficient for night and day, but method objectionable on account of draughts in monsoon and cold weather. Air cooled by punkahs and tatties.

ADEN.

Ventilation by teak wood trellis-work in the walls over each door and window; also openings in roof; sufficient for day and night; sea breeze sufficient for coolness. Punkahs recently erected, on account of excessive sickness in a regiment recently arrived from unhealthy Indian stations.

BARODA.
DEESA.

Ventilation by openings in roof of barracks, sufficient; air cooled by punkahs and tatties.

Ventilation of barracks by punkahs, doors, windows, and ventilators in roof; scarcely sufficient for crowded barrack.

KIRKEE AND POONA.

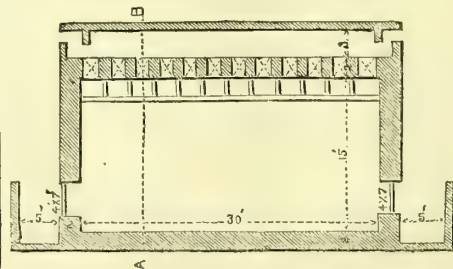
Kirkee.—In old barracks, including all, except two, there can scarcely be said to be any ventilation. Pigeon-holes in roof, but during rains, when ventilation most needed, they have to be covered with tarpauling. New barracks ventilated by louvre boards on sides; holes of insufficient size in upper part of walls; louveres in roof; on the whole good. Ventilation not sufficient to keep air pure by night; huts and guard-rooms, no ventilation whatever, except doors and windows; no means of cooling air.

STATIONS.	REPLIES.
	<i>Poona</i> .—Ventilation by doors and windows. Ensures “some degree of ventilation.” Wanowrie barracks, upper story ventilated along ridge; other barracks have cowls, objectionable from leakage during rains; weather side has to be “dammed up” during monsoon. Ventilation in all barrack rooms insufficient; guard rooms ventilated by doors and windows. Arrangements independent of these required both at Kirkee and Poona.
SHOLAPORE.	Ventilators of different descriptions fixed in ridge of roof of barracks and guard room. Sepoys ventilate their own huts. Air cooled by tatties.
SURAT.	Ventilation by doors and windows; not sufficient. Air cooled by punkahs.
AHMEDNUGGUR.	Ventilation in permanent barracks by cleristery windows at top of high walls. Temporary buildings have metal and wooden ventilators in ridge. Where walls low, ridge ventilation generally employed. Means sufficient, night and day. No means of cooling air required.
MHOW.	Ventilation by openings in roof, sufficient by night and day for temporary barracks. No means of cooling air required.
SATTARA.	No means of ventilation for barracks; insufficient, unless windows always open. No means of cooling air.
BELGAUM.	Small ventilators in ridge; sufficient when barracks not crowded. No means of cooling air.
KOLAPORE.	Ventilation as follows:—Outer walls only 6 feet high; space between top of wall and roof fitted with bamboo mat frames; sufficient by night and day, from the strong breezes prevailing. No means of cooling air. Native infantry huts have no ventilation.
MALLIGAUM.	Ventilation by openings in roof; sufficient for day and night, when windows always open. No means for cooling air.
BOMBAY.	Town barracks ventilated by iron cowls on ridges; Fort George barracks by wooden cowls; also by openings high up in walls. Colaba barracks have lofty continuous ventilators with glazed shutters. Depot barracks have cowls. Ventilation generally sufficient; “at least, there are no complaints.” Improvement imperative. Air cooled by punkahs.
ASSEERGHUR.	In new barracks open ventilator in roof, and open arches into verandah; “decidedly sufficient” for day and night. No other means of cooling air.

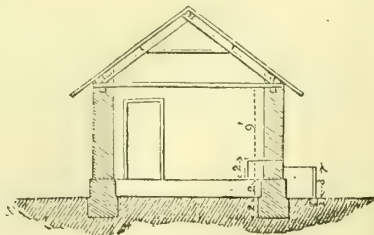
IX. DRAINAGE.

HYDERABAD.	No drains or sewers for barracks; surface and other drainage conveyed into cesspools close to the buildings; emptied as soon as filled. Cesspits, 2 feet diameter, 3 feet deep. No drainage in the bazaar; all filth carried away in carts to the kilns and burnt. Every house has a cesspit, emptied daily. Drainage of native lines “in every respect satisfactory;” received into cesspits; cleaned out every night; “contents carried in skins on bullocks’ backs to a distance.” Privies cleaned twice a day. In native lines, contents of cesspits are “thrown about in close vicinity to cesspits.” “Anything edible is immediately picked up by birds or dogs.” “Great room for reform” in native latrines; cleansing of which consists mainly in the liquid “sinking into the subsoil, so that the earth is thoroughly saturated, and a noisome odour pervades the atmosphere.” “On the whole, the sanitary condition of the station is satisfactory” !!
MHOW.	No drainage or sewerage. Drainage received into cesspits 50 feet from nearest quarters, and removed by carts and bheesties.
NEEMUCH.	Drainage quite insufficient and of the very worst description; drainage of privies and urinals only on the surface. Lavatories have percolating cesspools; but soil does not admit of free percolation. These cesspits are within 15 yards of men’s quarters. Cook-houses have only surface drainage; fluid refuse of barracks daily carried away by sweepers; bazaar drainage imperfect; <i>latrines too close to the houses, and are not used at present for lack of a proper establishment to keep them clean.</i> People obliged to resort to the surrounding country for the purposes of nature.
ADEN.	All drainage from barracks allowed to sink into subsoil,—very absorbent; contents of urinals and wash-houses received into cesspits, 10 ft. diameter, 6 or 7 feet deep; soil absorbs contents. Sudder bazaar not drained.
BELGAUM.	No drainage; fluid refuse received into cesspits; cleared out when necessary; latrines cleansed daily.
BARODA.	Roof water carried off by shallow ditch excavated round buildings; no other drainage; fluid refuse of barracks received into cesspits in rear of cook-houses, 40 yards from barracks. Nullahs with stagnant pools on all sides of station, averaging 400 to 500 yards from barracks; lavatory drainage goes into an open ditch 7 or 8 yards from the room; latrines cleaned by sweepers.
KOLAPORE.	No drains or sewers; fluid refuse received into cesspits; emptied by sweepers, and purified by lime; small cesspits attached to each bathing room, urinal, or privy. To each married man’s quarters there is a bathing room, with cesspit.
DEESA.	Barracks drained by small square underground drains into circular cesspools, 2 feet diameter and 10 feet deep; emptied as found necessary. Drainage not sufficient; fluid refuse of barracks sinks into subsoil; bazaar has open channels or surface drains; no bazaar latrines.
AHMEDNUGGUR.	No drainage; night soil and all fluid refuse collected in cesspits, 3 feet by 3, at the end of each barrack, and removed daily.
KIRKEE AND POONA.	<i>Kirkee</i> .—No arrangements for draining barracks or for carrying away refuse water from wash-houses, cook-houses, privies, &c.; all waste water, filth, &c., removed to a specified locality by sweepers. In two new barracks, two small cesspits at end of each building; emptied daily; in other barracks, refuse water runs into tubs. Barracks and hospitals wet and damp during 3 rainy months. <i>Poona</i> .—No drainage; barracks and hospitals damp during rains; other arrangements, same as at Kirkee; bazaar not drained; no latrines in bazaar. Fig. 7 shows the usual latrine arrangements in barracks.

FIG. 7.—PLAN, ELEVATION, AND SECTION OF THE REGIMENTAL PRIVY AT KIRKEE.



SECTION ON A B.



STATIONS.	REPLIES.
NUSSEERABAD.	None but surface drainage; always damp during monsoon. Each wash-house, cook-house, and urinal has its own cesspit; contents removed when required. Hospital cesspit 125 yards from men's quarters; barrack cesspit not 20 yards from quarters, 97 feet from hospital. Bazaar streets have covered drains, emptying themselves into a nullah west of bazaar.
SHOLAPORE.	No sewers or drains whatever in vicinity of barracks; all refuse carried away; refuse water from men's lavatories thrown on surface, and evaporates.
SURAT.	Barracks drained by 4-inch tiles or 8-inch brick and chunam sewers, to river from 100 to 350 feet distance. Latrines not drained. Contents carried away by hand.
MALLIGAUM.	No drainage, except surface drainage into nullahs. Drainage of lavatories and urinals insufficient; received into a cesspit 40 feet from the men's quarters.
BOMBAY.	Town barracks drained by sewers 250 feet long (to sea), $1\frac{1}{2}$ feet broad, 5 to 12 feet in depth. At Fort George, latrines not drained except into open ditch, always in a foul state. Main drain of Colaba barracks 2 feet square, flat bottom. Great nuisance. At Byculla stench at times <i>unendurable</i> . Drainage of native town very defective.
ASSEERGHUR.	"Construction of sewers and drains has not as yet been considered. Sewage will probably be removed by hand." One of the tanks, west side of fort, unsavoury at certain seasons. Refuse in all cases thrown over fort wall. Open space of ground near mainguard and parade, used as a latrine, always offensive, ready to nurture epidemic disease.

X. WATER SUPPLY.

HYDERABAD.	Water supply derived principally from wells filled by the Indus during the inundation. Some wells brackish; majority good. A few wells during the hot weather become dirty and offensive from not being properly attended to. In others less used, pure water is always attainable. Chemical composition not known; water soft; dissolves soap readily. " <i>No doubt it swarms with animal life.</i> " Supply abundant; stored in an open tank; full during inundation, almost dry during May and June. Not used for bathing.
KURRACHEE.	Water derived from wells; supply never known to fail. It is rather dull in colour, and has an earthy taste, but no smell. It contains chloride of sodium, sulphate of soda, sulphate of lime, sulphate of magnesia, carbonate of magnesia, carbonate of lime (quantities not given). The best wells contain nearly $\frac{1}{2000}$ of saline matter; quality not good; injurious to health; quantity sufficient; raised by Persian wheels and hand-buckets, and distributed by water-carriers in skins and by casks in carts; there are two or three tanks filled by rain; seldom full, often dry. Water should be brought from the Mulleer river or the Indus.
NEEMUCH.	There are 39 wells, the water is hard, but good; the amount sufficient; it is raised and distributed by water-carriers; the wells not liable to pollution. (No analysis.)
MALLIGAUM.	Water derived from river and wells; quantity unlimited; colour clear and good; tastes slightly of vegetable matter; no chemical analysis; most of water hard; raised and distributed by hand-buckets.
ADEN.	Supply derived from wells; amount of drinking water limited; will be shortly increased by a condensing machine; it is raised by bullock power and distributed on donkeys and camels. The composition of four wells shows a large amount, apparently from 60 to 80 grains per gallon, of impurity from chloride of sodium, chloride of magnesium, chloride of calcium, sulphate of soda, nitrate of lime, carbonate of magnesia; there are also storage tanks.
BARODA.	Water from well; supply unlimited; clear, without taste or smell; soft, good quality, and contains no lime salts. The solid contents are mostly chloride of sodium, carbonate of soda, bicarbonate of soda, and a faint trace of lime. (No detailed analysis.) It is raised in leather buckets by manual and bullock labour, and distributed by water-carriers.
ASSEERGHUR.	Water derived from tanks; same tank used for drinking and bathing. "For the former natives slightly clear away surface. Water, in the sweet well, for Europeans, is good; that in the tanks very bad." No chemical analysis. Water raised and distributed by "mus-sacks" of water-carriers.
DEESA.	Water, from wells, abundant, clear, agreeable, devoid of smell. Chemical composition not known. Drawn for use in leather bags, lowered over rollers, and pulled up by bullocks and distributed by bullocks and carriers.
BOMBAY.	Water, derived mostly from wells, contains for the most part a large quantity of lime and brackish sea salt in addition. (No detailed analysis.) Said not to be unwholesome; raised by ropes and buckets and Persian wheels, and distributed by water carts, puckallies, and bheesties. Vehar lake water, which has been conveyed to Bombay, could be laid on.
KIRKEE AND POONA.	At <i>Kirkee</i> , water supplied from seven wells, averaging 50 feet in depth; wells totally insufficient, often run short (water has to be carried from the river, half a mile distant), contains from 6 to 8 grains of organic and inorganic matter in solution, sometimes as much as 14 grains of organic matter in suspension. Inorganic impurities consist of chlorides of sodium, magnesium, lime, sulphates of soda, magnesia, lime, nitrates of magnesia, lime, carbonates of magnesia, lime, silica; well water raised by leathern buckets and carried in leather skins by bheesties on bullocks. In cold weather Government pays 433 rupees, and in hot weather 617 rupees monthly to water-carriers. "No such thing as a pump known at Kirkee," and "all the arrangements are what they may have been 1,000 years or more ago." At <i>Poona</i> water obtained from aqueduct, three tanks, and the river, from which it is forced by pumps into camp. In hot weather aqueduct dry, and has to be fed from wells; some water stored in tanks not drinkable. 280,450 square feet of camp tanks. No precautions against drainage or surface impurities getting into tanks. During the hot weather water is insufficient in quantity; better supply absolutely necessary; well water raised by common leathern buckets, distributed in leathern skins by bullocks, and on the backs of bheesties. "Each individual has his bheestie, and each regiment its set of bheesties."
NUSSEERABAD.	Water derived from wells and tanks; 2,899,125 square yards of tank surface within half a mile of station; nearly all tanks dry at end of hot season; European troops obtain drinking water from village wells $1\frac{1}{4}$ miles from barracks; 8 other wells in camp, water from which contains so large a proportion of salts as to be unfit for use; water is clear, but brackish; "flavour varies according to quantity of salts," amount varying remarkably at different times. Several times water pronounced wholesome by natives was found to contain $\frac{1}{2000}$ of saline and vegeto-animal impurity, chiefly chlorides and sulphates (no detailed analysis). Water is raised by ropes and buckets, and is distributed by bheesties in "mus-sacks," and also by water carts.
SHOLAPORE.	Water derived from wells, fed by percolation from tanks, liable to dry up. Houses along the tank margins become most unhealthy; amount of good water limited, contains about 30 grains solid matter per gallon (no detailed analysis); raised and distributed in leathern vessels by bheesties.

STATIONS.	REPLIES.
KOLAPORE.	Water derived from wells; not liable to pollution; amount too limited in the dry season; quality of well water (with one or two exceptions) good and wholesome; no chemical analysis; water raised by buckets and distributed by bheesties.
SURAT.	Not a well containing good drinking water in station; all more or less salt; some very foul, with sulphureted hydrogen gas. Two brackish wells beyond camp contain best water; no chemical analysis. "No one thinks of drinking the camp water." Raised and distributed by hand in leathern buckets.
BELGAUM.	Water from wells liable to pollution both from leaves and other matters falling into them; water good; no unpleasant taste or smell; no chemical analysis; indications under tests of chlorides and sulphates of lime or magnesia, carbonic acid, and iron; quantity limited; raised in leathern skins by bullocks, emptied into troughs, and thence conveyed by water carriers.
AHMEDNUGGUR.	Water from aqueducts brought from foot of hills; said to be good, wholesome, and sufficient; no chemical analysis; water discharged from aqueducts into wells and reservoirs, and raised thence by bheesties.
MHOW.	Water from wells, not plentiful but good; composition varies, but pure wholesome water can always be procured; no chemical analysis. Drawn and distributed by bheesties in usual manner.

XI. ABLUTION AND BATH
ACCOMMODATION.

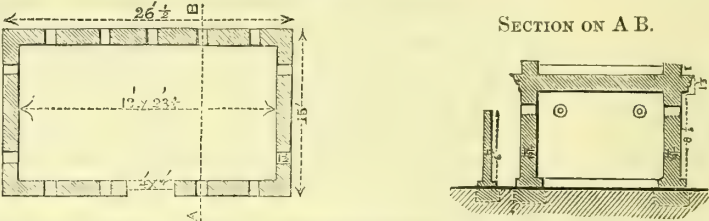
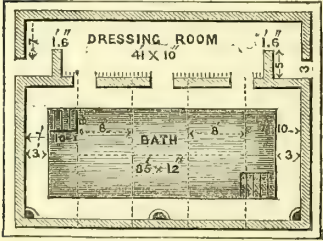
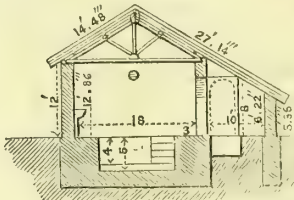
HYDERABAD (SINDE).	To every barrack is attached a "bathing room," with benches and a water cistern. No bath.
KURRACHEE.	Plunge bath, 36 feet long, 14 feet wide, 5 feet deep. Smaller bath in horse artillery barrack.
NEEMUCH.	Lavatory attached to each barrack, with two baths, one for artillery and the other for infantry; water supplied by duct, from well outside; and drained away by pipe to open watercourse; lavatory appears to have no fittings. Fig. 8 shows the usual nature of this class of ablution accommodation.
FIG. 8.—PLAN AND SECTION OF A WASHING ROOM, NEEMUCH.	
	
ADEN.	No bath accommodation; men bathe in sea; there are washing rooms, without fittings, in basement.
BARODA.	Long narrow wash-house, with a sink extending its whole length; a tub is used for washing; water carried by bheesties, and drained away into open ditch, 7 or 8 yards from room.
DEESA.	Each barrack has an ablution room, but no convenient fittings for washing. Two plunge baths, 50 feet by 20, for European regiment; one smaller bath for horse artillery.
KIRKEE AND POONA.	Kirkee.—Lavatories merely open, paved, verandah rooms, with tubs "amply supplied with water." Waste water runs into tubs placed outside. Two lavatories generally to each barrack. Poona.—Lavatory arrangements the same. No baths.
NUSSEERABAD.	Ablution rooms supplied with tubs; water brought daily by carriers.
SHOLAPORE.	No lavatories; men wash in one end of the barrack verandah. Plunge bath, 30 feet by 20, supplied from reservoir, emptied by drain to nullah, 100 yards off.
SURAT.	No lavatories; men wash on ground floor; five tubs, supplied daily by bheesties. Drainage carried through walls into river.
AHMEDNUGGUR.	A small washing room, 8 feet by 6, attached to each barrack; water, after flowing off washing bench, passes through urinal into cesspool.
SATTARA.	Washing house divided into separate rooms about 8 feet square; no fittings. Water runs into cesspits behind. No baths.
MHOW.	Three washing rooms, called baths, drained into cistern behind. No fittings.
BELGAUM.	One or more washing rooms to each barrack; water in casks, filled by water carriers, from which the men help themselves. One plunge bath in fort; two plunge baths in camp, supplied with water from wells. Waste water allowed to run by a drain on to the surface of lower ground. Fig. 9 shows the usual construction of these plunge baths.

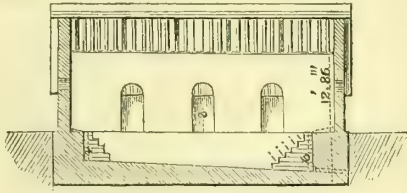
FIG. 9.—INFANTRY PLUNGE BATH,
BELGAUM.—PLAN.



SECTION.



LONGITUDINAL SECTION.



KOLAPORE.	Washing places outside barrack verandahs; stone-paved floors; raised masonry platforms for hand basins; water kept in casks supplied by bheesties; waste water runs through urinal to a cesspool, emptied by sweepers; no baths; "lavatory arrangements altogether very defective."
MALLIGAUM.	Lavatory, with common basins and tubs for washing and bathing; water supplied by bheesties; waste water passes through urinals by covered drain to covered cesspit.
ASSEERCHUR.	Lavatories supplied with water by hand, and drained into cesspool near building.
BOMBAY.	Town barracks; lavatory has stone floors, and water supplied by bheesties. So also at Fort George and Colaba. It is put into barrels; drained away after use.

STATIONS.

REPLIES.

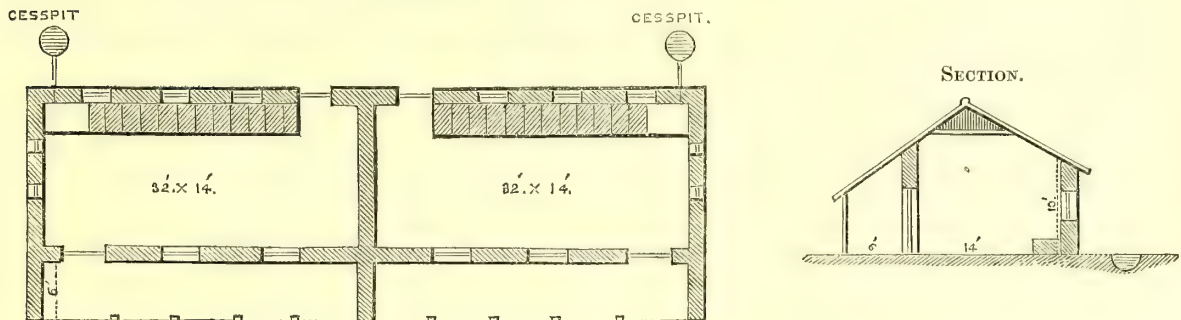
XII. DIET AND COOKING.

At all the European stations of the Bombay Presidency a complete ration is issued as follows :— Bread, 1 lb.; meat, 1 lb.; rice, 4 oz.; sugar, $2\frac{1}{2}$ oz.; tea, $\frac{5}{8}$ oz., or coffee, $1\frac{3}{4}$ oz.; salt, 1 oz.; vegetables, 1 lb.; firewood, 3 lbs. The stoppage is 3 annas 4 pice daily (about 5d.), which is the sum a married soldier receives if he does not draw his ration. Beef is the usual meat ration, but where good mutton can be obtained it is served out twice a week. The vegetables vary with the station and season. The supply of potatoes is in general too limited; sometimes they cannot be had. Cauliflowers, cabbage, and pumpkins constitute the ordinary vegetables; a small quantity of onions sometimes issued. Ration considered excellent as to quality, and is regularly inspected; but no change in the constituents is made to suit climates or seasons. Soldier is allowed to add additional meat and other things, often of very inferior quality. He has three meals a day, breakfast, 7 to 8 a.m.; dinner, 1 p.m.; tea, 5 p.m.; has often meat at all three, or fish and eggs at breakfast, and meat at the other two, and this in the hottest hours of the day.

Kitchens generally small outhouses, with native fire-places and native utensils; no chimnies; lighting and ventilation often defective; no water supply; all water has to be carried by hand; no drainage, refuse water either escaping into cesspits or sinking into subsoil. Cooking by native cooks; meat is boiled, fried, stewed, and made into various messes; not always very wholesome. Cooking seldom complained of, but might be improved, both as regards apparatus, economy, and the results. The use of tea or coffee before a march varies in different regiments, in some being given, in others not.

Fig. 10, showing a plan and section of the cook rooms at Kolapore, will give a good general idea of the nature of the barrack kitchens and their drainage.

FIG. 10.—PLAN OF THE COOK ROOMS, KOLAPORE.



XIII. INTEMPERANCE.

HYDERABAD (SINDE).

Soldiers "temperate;" "few confirmed drunkards;" "drunkenness always punished;" spirits sold in canteen and bazaar; in canteen "good," in bazaar "very bad;" "a cunning man may procure any amount;" "morning dram" depends on commanding officer, quite unnecessary; spirit drinking can be "done without;" is not conducive to discipline; abolition of spirit ration advised, as also restriction of sale in canteens; abolition of it in bazaars; beer or wine not so deleterious, nor coffee, tea, lemonade, &c.; drunkenness should always be punished, and sufficient recreation and amusement provided for men.

KURRACHEE.

Soldiers "temperate;" about 1 per cent. confirmed drunkards; 1 per cent. of admissions into hospital from delirium tremens; drunkenness punished; spirits sold in canteen and bazaar; prohibited to European soldiers in latter; spirit no part of ration; morning dram not allowed; spirits "not conducive" to health or discipline; certainly often injurious; difference of beer and wine over spirits only one of degree (on health); sale of spirits should be prohibited in canteen; only beer, coffee, tea, &c., should be permitted; should be done gradually, beginning with recruits; "no more than one dram" of spirits or one quart of malt liquor allowed per man at one issue at present.

NEEMUCH.

Soldiers "temperate;" "few confirmed drunkards;" "drunkenness always punished;" spirits sold in canteen, but not permitted in bazaar to European soldiers; one dram a day allowed; use of spirits injurious to health, and "not conducive" to efficiency or discipline; abolition of sale might be injurious to "habitual dram drinkers;" wine or beer beneficial as compared with spirits; coffee, tea, &c., beneficial; sale of spirits in canteen should be prohibited, and only beer, coffee, or tea allowed; there should be a reading room and coffee shop away from canteen.

ADEN.

Soldiers "temperate;" no "confirmed drunkards;" drunkenness "always punished;" spirits sold in canteen and bazaar; average consumption, $\frac{3}{4}$ dram per man per day; no "morning dram;" spirits in moderation "do no obvious mischief;" amount allowed too limited to do mischief; bazaar spirit bad; sale should be prohibited, but not sale in canteen, because bazaar spirits would be drunk; malt liquor good for health; tea, lemonade, soda water, &c., far better for health, efficiency, and discipline, than intoxicating drink; one dram of spirit or one quart of malt liquor per man issued at one time.

BARODA.

Men, as a rule, "temperate;" several "hard drinkers;" no confirmed drunkards; a large amount of fever cases indirectly caused by intemperance; in hard drinkers, "time after time;" drunkenness "always punished;" one dram of arrack and one quart of porter per man can be purchased per diem; spirit in moderation not injurious to health or discipline; but most of the crime attributable to it; malt liquor preferable to spirits; lemonade, soda water, &c., not used; if spirits prohibited in canteen, worse liquor would be bought secretly.

NUSSEERABAD.

Temperate; very few drunkards; drunkenness always punished; spirit sold in canteen, but not to European soldiers in bazaar; one quart porter, one dram arrack daily, allowed; or two drams arrack and no porter; spirits in moderation not injurious to health or discipline; should not be abolished altogether; effect of malt liquor or wine depends on constitution; better for men to drink wholesome canteen spirit than bad bazaar spirit.

KIRKEE AND POONA.

Kirkee, usually temperate; only 3 out of 580 men habitual drinkers; 10 others get drunk on every available opportunity; one admission into hospital in 361 caused directly by intemperance; drunkenness always punished; spirits sold in canteen, but forbidden to soldiers in bazaar; two drams per man per diem allowed; in moderation and diluted, spirits not

STATIONS.	REPLIES.
	injurious to health; but drinking interferes with efficiency; sale should be abolished in bazaars, but not in canteens; malt liquor or wine considerably less injurious; spirits produce same effect on system as elevated temperature.
SINGAPORE.	Poona.—One in 200 confirmed drunkards; one admission out of 113 (into hospital) caused directly, and 1 in 28 indirectly, by intemperance. Other information same as at Kirkee; but it is considered that "canteen system might be improved." Two (out of 76) confirmed drunkards; drunkenness always punished; spirits sold in canteen, but not to soldiers in bazaar; "a man may have either two drams of spirits or two quarts of malt liquor, or one dram of spirits and one quart of malt liquor daily;" "soldiers manage to get drink in bazaars, notwithstanding all endeavours to prevent it;" spirits injurious to health, efficiency, and discipline; would be beneficial to suppress spirits, if men could not get worse; malt liquor much better.
SURAT.	No confirmed drunkards; two drams of spirits, or one dram and one quart porter, per man per diem allowed at canteen; no proper restriction at bazaar; no morning dram; spirits decidedly injurious to health; not so coffee and malt liquor; would be beneficial to suppress spirits, and substitute beer, tea, coffee.
AHMEDNUGGUR.	No confirmed drunkards; drunkenness always punished; privilege to sell spirits in bazaar sold by auction for 19,560 rupees for natives; two drams per man per day allowed from canteen; injurious to health and should be abolished; old soldiers might feel the loss, but young soldiers would be benefited "beyond all comparison;" malt liquor preferable to spirit or wine; "the more of it, and the less of spirits used, the better for the men;" spirits should be sold in canteens "only on particular occasions."
MHOW.	A few drunken men; drunkenness punished; three quarts of malt liquor, without spirits, or two quarts with one dram of spirits, or one quart, with two drams arrack, may be purchased daily at canteen, but none by European soldiers at bazaar; spirits seldom "conducive," not rarely very injurious, to health and discipline; sale should be restricted or abolished; malt liquor or wine more beneficial; coffee, tea, soda water, better than either; soldiers obtain bazaar spirits, in spite of the above enormous quantities allowed, and in spite of all restrictions.
SATTARA.	No confirmed drunkards; spirits sold in canteen; prohibited to soldiers in bazaar; quantity varies in different regiments; usually about a dram per man per day; injurious to health and discipline, and should be abolished; malt liquor and wine less injurious; former sometimes necessary; coffee, tea, lemonade, as a rule, preferable; canteens should supply only malt liquor, &c.
BELGAUM.	One in 100 a confirmed drunkard; 14 admissions to hospital last year from intemperance; none among natives; other 15 indirectly from intemperance; spirits sold in canteens; repressed in bazaars, but not stringently enough; quantity consumed, one dram per man per diem; no more than two drams per day allowed; in moderation, not injurious to health or discipline; but would be better to abolish its use, if it could be done; malt liquor better than spirits; coffee, tea, lemonade, desirable in every respect; "keep the men from drinking other liquors;" "whatever diminishes drunkenness is beneficial to health and discipline."
KOLAPORE.	Five per cent. drunkards in artillery company; six cases delirium tremens in last two years; spirits sold in canteens; one dram and one quart porter issued per man at one time; spirits not injurious in moderation; if suppressed, men would substitute bad country spirit; delirium tremens has been produced here by eau de Cologne sold in bazaars; malt liquor greatly preferable to spirit; tea, coffee, &c., undoubtedly beneficial.
MALLIGAUM.	No confirmed drunkards; no canteen; spirits sold in bazaar; malt liquor much better adapted to climate; sale of spirits should be restricted or suppressed.
ASSEERGHUR.	Two or three confirmed drunkards; 1 per cent. admissions to hospital caused by intemperance; spirits sold to soldiers in bazaar; one dram allowed in morning before breakfast on march; hot strong coffee would be better; spirits injurious to health and discipline; malt liquor better; coffee or tea better than much malt liquor; spirits should be abolished, and beer and coffee substituted in canteens.
BOMBAY.	One per cent. confirmed drunkards; 3·7 admissions to hospital (per cent.) from intemperance; spirits sold in canteen and bazaar; one dram per diem allowed as a ration; injurious to health and efficiency; should be abolished as ration, and sale suppressed at canteen and bazaar; malt liquor better; but tea, coffee, lemonade, best; penalties for selling liquor to soldiers outside; but law almost inoperative.

XIV. INSTRUCTION AND RECREATION.

HYDERABAD (SINDE).	One ball court; one skittle ground; one school; one library and reading room; much too small and insufficiently lighted; light paid for by men; long bullets; cricket. In hot weather, men, save those who can read, "have positively nothing to do;" no restriction on exposure to sun; men always less anxious to expose themselves where no restriction; large airy workshops "would prove a boon to soldiers;" employment on public works "would also be a great boon;" work would be as cheaply done as now; it would occupy the soldier, and he would feel he was doing good; a good reading room, well lighted at night, and more suitable books, a great want; all manly games should be encouraged; savings' banks answer admirably; no shade except in north verandahs.
KURRACHEE.	Ball courts; skittle grounds; schools; library and reading room; workshops not efficient; theatre unaided by Government; means not sufficient; no day rooms, nor soldiers' clubs, nor gardens, nor gymnasia; men restricted from exposing themselves to sun; trades and gymnastics should be encouraged; restriction on marriage should be removed; savings' banks would be an advantage; no shade from trees, only verandahs.
NEEMUCH.	Skittle grounds; schools; library and reading room, former well lighted at night; day room; soldiers' garden; no workshops; no ball courts; no theatre; no gymnasia; former about to be erected; two latter would be a great addition; no shade; men kept in barracks during hot months from 8 a.m. to 4 p.m.
ADEN.	One ball court; two skittle grounds; two schools; one library and reading room; sufficiently lighted at night; no day rooms; no soldiers' clubs; no gardens; no workshops; no theatre; no gymnasia; no shelter from trees, only verandah; covered gymnasium much wanted; men kept in barracks during day; savings' banks beneficial.
BARODA.	Small library and reading room, not lighted at night; cricket; no ball court; no skittle ground; no school; no day room; no club; no garden; no workshops; no theatre; no gymnasia. Workshops, especially for carpenters, much needed; also more suitable books for library. There are savings' banks.

STATIONS.	REPLIES.
KIRKEE AND POONA.	<p><i>Kirkee</i>.—Ball courts (not covered); schools; library; reading room. The following, though much required, do not exist:—No day room; no club; no gardens; no workshops. There is no theatre; no skittle ground; no gymnasium. Persuasion and personal influence used to keep the men from exposing themselves. Foils, single sticks, &c., much required. No sufficient shade. Savings' banks are advantageous.</p> <p><i>Poona</i>.—Ball court (uncovered); skittle ground; schools; library and reading room; the latter, being attached to the schools, are objectionable, though sufficiently lighted. No day rooms; no clubs; no gardens; no workshops; no theatre; no gymnasium. The three latter much needed. Present means insufficient; men confined to barracks from 8 a.m. to 4 p.m.; savings' banks beneficial; no shade except verandahs.</p>
NUSSEERABAD.	<p>One ball court; skittle grounds. "Schools and schoolmasters exist, but schools have to be built." Libraries. No proper reading rooms; no day rooms; no soldiers' clubs; no workshops. There are gardens. A theatre, constantly used; a gymnasium; races; jumping, and other gymnastics. Workshops for trades would be a great benefit. No sufficient shade.</p>
SHOLAPORE.	<p>Ball court; skittle ground (uncovered); library (lighted at night); school (no trained schoolmaster). Gardens. No day rooms; no soldiers' clubs; no workshops; no theatre; no gymnasium. Men restricted to barracks during day. Workshops a great desideratum; also gymnasium. A large open shed wanted. Savings' banks would be advantageous if workshops for trades were established. This would keep many men from canteen. No shade. Verandahs too limited.</p>
SURAT.	<p>No ball court. A skittle ground and school. No library, nor reading, nor day room; no club; no garden; no workshops; no theatre; no gymnasium. Men confined to barracks from 8 to 5 in hot weather. No shade for exercise. Savings' banks are advantageous.</p>
AHMEDNUGGUR.	<p>Ball courts; skittle ground; schools; library; reading room; gardens; workshops; theatre. No day rooms; no gymnasium; means sufficient, but not extensive enough. There are savings' banks. Soldiers kept in barracks during day. Shade sufficient for exercise, without injury to health.</p>
MHOW.	<p>Ball courts, skittle grounds (uncovered), school, library and reading rooms. No day room, club, nor gardens; no workshops nor gymnasium. A theatre. Savings' banks answer. Shade insufficient for exercise.</p>
SATTARA.	<p>One school; theatre (barrack room); no ball court; no skittle ground; no library nor reading room; no gardens; no workshops; no gymnasium. All wanted. Savings' banks exist. Men restricted to barracks during day. No sufficient shade for exercise.</p>
BELGAUM.	<p>Ball court, skittle ground, cricket, schools, library, sufficiently lighted; no day room nor soldiers' club; some small gardens. Workshops much wanted; none properly so called. No theatre; no gymnasium. Two regiments at station; one <i>restricted</i> to barracks during day; the other under no restriction, except that the head be properly covered in going out, and men <i>discouraged</i> from exposing themselves; latter rule preferable; too much confinement is bad. Well-behaved men should be allowed to go out shooting and coursing. Not sufficient shade for exercise. Sheds wanted. Savings' banks beneficial.</p>
KOLAPORE.	<p>Skittle grounds; library, well lighted; small garden plots; station theatre; "has fallen down since the preparation of this report;" no ball courts; no adult school; no day room nor club; no workshops nor gymnasium. Artillery not restricted to barracks; permitted to expose themselves as they please, and to get up cricket matches. Infantry—men restricted to barracks, except on duty. Ball alley wanted and plunge baths, as "the men have no means of keeping themselves clean properly." Savings' banks exist; no shade except verandahs.</p>
MALLIGAUM.	<p>No means of instruction or recreation whatsoever; savings' banks would be advantageous; no sufficient shade for exercise.</p>
ASSEERGHUR.	<p>Ball court out of repair; company library; theatre in a private house; no skittle grounds; no day room nor club; no workshops nor gymnasium; men restricted to barracks during day; savings' banks "would certainly be advantageous;" no shade except verandahs.</p>
BOMBAY.	<p>No means of instruction or recreation at town barracks; at other barracks, ball courts; skittle grounds; schools; library and reading room; two barracks have no library; no workshops; theatre occasionally; cricket; men restricted to barracks till 5 p.m.; regimental savings' banks advantageous; no shade for exercise except verandahs.</p>

XV. DRESS.

Besides the usual cloth and woollen dress, the soldier is provided with light khakee tunics and trousers, and a head dress to keep out the sun; it is said to be well suited to the climate and duties.

XVI. DUTIES.

With four exceptions, the replies from European stations advise that recruits should be thoroughly drilled at home before being sent to India; one of these four recommends that recruits should be drilled in a cool climate in India. Stational duties consist of drills, morning and evening, generally before sunrise and about sunset, from half an hour to an hour or more, according to season and weather; the number of nights in bed depends on the strength, and appears to vary from four to seven successively; guards last 24 hours, and are mounted at distances off from a few yards to two miles. Except at one station, night duties are not observed to have any injurious influence on health; the number of roll calls varies in different regiments from two to seven; night roll calls are not unfrequent.

XVII. PERIOD OF SERVICE IN INDIA.

In most of the reports it is recommended that the soldier shall not proceed to India under 20 years of age. The lowest age given in one report is 18, and the highest 27. Fully drilled soldiers at from 20 to 22 years would best suit the requirements of India, as stated by the reporters. The length of service, they consider, should not exceed 10 years. In one instance, seven years are reckoned sufficient; in another, as many as 15 not too much. The Hyderabad Committee state that "a British soldier may serve as long in India as in any other part of the world. Two-thirds of the Indian stations are as healthy as any in Europe, provided the habits be adapted to the country." The stational reports concur as to the desirableness of the soldier arriving in India at the beginning of the cool season,

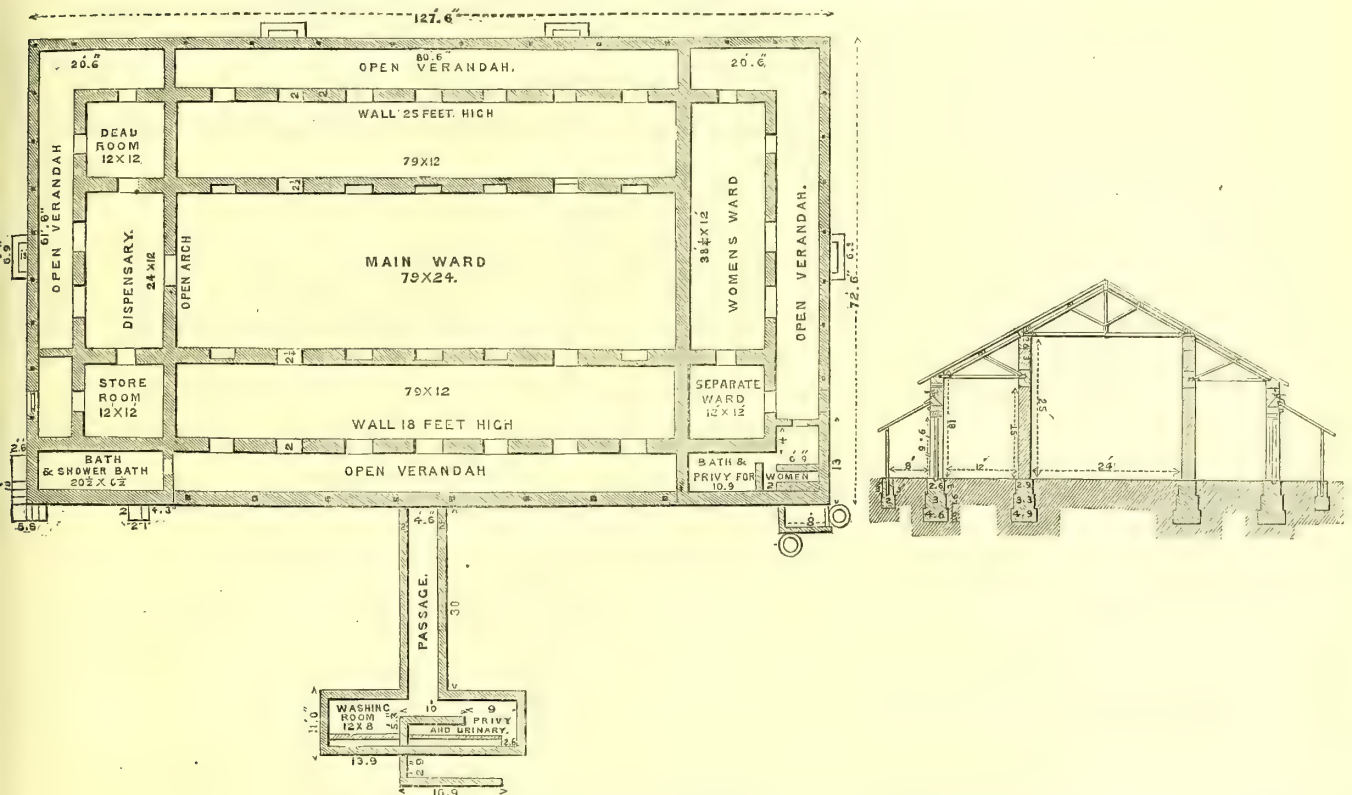
STATIONS.	REPLIES.
	and of his being sent at once to his regiment, great care being exercised to keep him from excess on landing. Invalids should leave for England so as to arrive in early summer.
XVIII. HILL STATIONS.	
HYDERABAD (SINDE).	Reporters have no experience of hill stations, but approve. Best elevation, 5,000 feet. "Acclimatization a myth, as generally understood."
KURRACHEE.	Approve. "Hill station is to the plain as the open air to the hot-house."
DEESA.	Mount Aboo, 45 miles distant, over a level sandy plain. Ascent by bridle path in about two hours; elevation, 4,000 to 5,000 feet. Climate favourable to residents and to children of Lawrence Asylum. Approve of hill stations, but they require care; scurvy, scorbutic dysentery, general cachexia, and anæmia have resulted from want of variety and deficiency of vegetables in ration. "Last year a company of men returned from Mount Aboo after a year's residence, suffering from intermittent fever, caused by bad barracks and unhealthy malarious position." The men were "reduced and anæmic from malarious poison, and somewhat scorbutic from defect in diet. Mutton was the only meat issued for 12 months." "At some hill stations there is malarious fever; others predispose to diarrhœa." Barracks and hospitals at hill stations of Kussowlie and Subathoo are defective in structure and plan. At Aboo the barracks were erected in a malarious gully.
KIRKEE AND POONA.	<i>Kirkee</i> .—Hill stations should decidedly be selected for troops, "but only as a change of climate." Amount of barrack and hospital accommodation at hill stations totally insufficient. Best elevation, 4,000 feet above sea; but no experience. <i>Poona</i> .—The same evidence.
SHOLAPORE.	No experience.
SURAT.	No experience of hill stations; but troops from hill stations are less liable to fevers, &c. on returning to plains. Weak men, on arrival at Mount Aboo, are liable to fever and diarrhœa. Better to locate troops in the hills, with short service on the plains.
NUSSEERABAD.	Advisable to select hill stations for troops; but no experience.
AHMEDNUGGUR.	Experience of hill stations very limited, but "under certain conditions, should think that hill stations would be beneficial to European troops." "There should be 12 months' residence."
MHOW.	No experience of hill stations, but "undoubtedly it would be desirable to locate troops on the hills as much as possible."
SATTARA.	No experience; but approve of selecting hill stations for troops. Considers "any period of residence in hills, beyond the acquirement of moderate toniccity, would be injurious."
BELGAUM.	No experience of hill stations; but troops, on going to hills, are liable to head attacks, hepatic affections, and rheumatism; long residence in hills and short residence on plains likely to be most conducive to health of troops.
KOLAPORE.	Residence at hill stations would lessen liability to fever, and diminish predisposition to climatic diseases of plains. Troops more liable to diarrhœa in Himalaya than at Bombay hill stations. Bowel complaints might be guarded against "by flannel, pure water, cleanliness, clearing jungle, thorough drainage, and a strict system of conservancy." Advisable that European troops be located periodically on hills, especially on high table lands. Europeans should pass one year in five in a more suitable climate.
BOMBAY.	Hill stations do well for healthy men, and for those simply debilitated from fevers, but are injurious for dysentery and structural disease. They are not beneficial throughout the year. Their peculiar diseases are, head affections, rheumatism, diarrhœa, and dysentery. Elevations above 4,000 feet are not suited to chest affections. Service in the plains, with shorter period of change to hills, might be expected to be the most advantageous to health.
ASSEERGHUR.	No experience, but approve of hill stations.
XIX. HOSPITALS.	
HYDERABAD (SINDE).	<i>Site</i> .—Open and healthy, 600 yards from barrack. <i>Water supply</i> .—Wholesome and abundant. <i>Drainage</i> .—Impurities carried away by open drains into cesspits; thence removed by hand. <i>Construction</i> .—Wards 3 feet raised above ground; no perflation of air beneath; roof water removed by open drain; material, pukka-brick and lime; tiled roof; verandahs. Built 1854-5. <i>Accommodation</i> .—Five wards; no regulation number of beds; cubic feet and superficial feet per bed not given. <i>Ventilation</i> .—No windows; doors with Venetian shutters, sufficient to keep wards cool and free of odour. In hot weather wet tatties are used, and punkahs. <i>Cleansing</i> .—Walls and ceilings limewashed yearly, or oftener. <i>Latrines</i> .—Over cesspits, cleansed and deodorized; no waterclosets. <i>Lavatory and bath</i> .—None, except a tub and hip bath. <i>Hospital linen</i> washed and dried in sun. <i>Storage</i> sufficient and dry. <i>Bedding</i> .—Wooden cots 2½ feet high, tape bottoms; beds, chopped straw. <i>Cooking</i> .—Means sufficient. <i>Attendance</i> .—Ward boys. "A comrade can always be procured, or a nurse, on requisition." <i>Convalescents</i> .—No ward and no exercising ground for convalescents. "An unwieldy and uncomfortable cart allowed" "for exercise of convalescents;" "little used." <i>Female Hospitals</i> .—One with matron for each corps.
KURRACHEE.	<i>Site</i> .—All hospitals, except one, too near to barracks; one very close to picket ground; general hospital 200 yards from bazaar. With these exceptions, sites pretty open, and "healthy as to drainage, elevation, &c." <i>Water supply</i> .—Abundant, but not good. <i>Drainage</i> .—None; all refuse removed daily by sweepers. <i>Construction</i> .—Wards, except in one hospital, raised 3 feet above ground; no passage for air beneath; roof water not carried away; sinks into subsoil; no surface drainage or guttering. Material of older hospitals, sun-dried brick; of new one, stone. General and native hospital, double roofs and walls; others, single; verandahs from 8 to 12 feet broad. In double-walled

STATIONS.

REPLIES.

hospital verandahs are inside; used for sick when wards crowded. Fig. 11 gives a plan and section of the horse artillery hospital at this station, showing one inner ward enclosed on all sides by other apartments, and having no direct communication with the open air.

FIG. 11.—PLAN AND SECTION OF HORSE ARTILLERY HOSPITAL, KURRACHEE.



Accommodation.—Three European and two native (one ward each), containing, four, 100 beds each, and one 28 beds. Cubic feet per bed in *European hospitals*, 1,362 to 1,867; square feet, 68 to 97. Cubic feet per bed in *native hospitals*, 316 to 633; square feet, 24 to 35.

Ventilation.—By doors, windows, and openings in roof; windows open vertically in halves.

Means sufficient in new hospital; not so in old; no means of cooling the air.

Cleansing.—Limewashing once in three months.

Latrines over cesspools; cleansed daily, and quicklime put in. "Not offensive, if carefully kept." "Admit of improvement."

Ablution and bath room.—Sheds with tubs; slipper baths; neither sufficient nor convenient.

Hospital linen.—Washed away from hospital.

Storage.—Sufficient and dry.

Bedding.—Iron bedsteads, but not universally so; wooden cots in European and native hospital (1 foot 2 inches to 1 foot 6 inches high); harbour vermin; straw beds and pillows; sheets, blankets, quilts, according to season.

Cooking.—Portuguese cooks. "The younger and inferior cooks, being paid less, are found in hospitals."

Attendance.—Hospital serjeant in European hospital; 10 ward boys; one added for every eight patients above 80, and one for every bed-ridden case, "and a comrade in extreme cases." Sufficient in number, inferior in kind. A havildar and comrades attend in native hospitals.

Sanitary state.—Only one hospital out of five "adequate." Phagedœna and gangrene have occurred from crowding; want of space great defect; better privies and baths and better ventilation required, also a matron to superintend cooking and distribution of diets. Suggestions of medical officers may be acted on or not by higher authority.

Convalescents.—No fenced ground, shaded walks, or seats for exercise; only vicinity of hospital, or verandah, or ambulance cart to exercise in. No wards for convalescents.

Female hospital.—Separate hospital for women and children, with matron, assistant matron, and ward women; satisfactory. No female native hospital.

NEEMUCH.

Site.—Open, on high ground, sloping away on all sides; healthy as to drainage, elevation, absence of malaria, &c.

Water supply sufficient and wholesome.

Drainage.—Refuse collected in cesspools and carried away at night; night soil removed by sweepers.

Construction.—Floors 3 feet above ground; no passage for air beneath; roof water allowed to run away by natural slope of ground; material, stone, lime, and brick; thick single walls and roofs; no verandahs; wards in two floors; originally built as a residency; rooms of various dimensions; upper floor not used for sick.

Accommodation.—One ward, 30 to 35 sick; cubic feet per bed, 1,600 to 1,870; square feet, 62 to 72.

Ventilation.—No windows; all glass doors, with venetians; no other ventilation; other smaller wards have ventilators in roof; wet tatties used for cooling.

Cleansing.—Limewashing once in three months, or as often as required.

Latrines like those of barracks; over cesspit; emptied daily.

Lavatories and baths.—Two similar to barrack lavatories, close to hospital; no bath-rooms; "ten flat baths."

Hospital linen washed away from hospital.

Storage sufficient and dry.

STATIONS.	REPLIES.
ADEN.	<p><i>Bedding</i>.—Wooden bedsteads, infested with vermin; straw mattress and pillow; two sheets, blanket, and coverlid; iron bedsteads should be substituted.</p> <p><i>Cooking</i>.—Two kitchens, close to hospital, not large enough; usual Indian utensils; cooking properly done and sufficiently varied.</p> <p><i>Attendance</i>.—Ward coolies; “every severe case allowed a comrade.”</p> <p><i>Sanitary state</i>.—“As good as can be expected in a private house.” “Would be insufficient for increase of sickness.” “Required” “cells” for insane patients, hot and shower baths, quarters for medical officers.</p> <p><i>Convalescents</i>.—No shaded walks, &c. “sick carts drawn by bullocks and elephants.” No wards for convalescents.</p> <p><i>Female hospital</i>.—A small temporary hospital for females; too small; insufficiently ventilated; otherwise unsuitable.</p> <p><i>Site</i>.—In every respect healthy.</p> <p><i>Water supply</i>.—From wells, principally brackish; better supply is being obtained.</p> <p><i>Drainage</i>, none: refuse water absorbed by soil.</p> <p><i>Construction</i>.—Floors three to four feet above ground, paved with stone; no passage for air beneath; roof water sinks into subsoil; material, rubble and chunam, wattle and daub; walls and roof single, but thick; verandahs on two sides, used for sick when hospital crowded.</p> <p><i>Accommodation</i>.—Three hospitals for Europeans; one ditto for natives; former contain in all four wards, with 10, 12, and 20 beds per ward; cubic feet, 900 to 1,872; square feet, 55 to 90 per man. In native hospital, cubic feet, 433 to 565; square feet, 38 to 51 per man.</p> <p><i>Ventilation</i>.—Hospital exposed to prevailing winds; air renewed by windows; trellis-work over doors and windows; open ventilators in roof; sufficient; punkahs used for cooling.</p> <p><i>Cleansing</i>.—Limewashing once a quarter; privies and urinals 40 to 50 feet from hospital; drained by hand; no cesspits.</p> <p><i>Ablution and bath room</i>.—One room for washing and bathing; “sufficient.”</p> <p><i>Hospital linen</i> washed and dried by washermen.</p> <p><i>Storage</i> sufficient, and dry.</p> <p><i>Bedding</i>.—Bedsteads, planks on iron trestles.</p> <p><i>Cooking</i> properly done; varied as much as possible.</p> <p><i>Attendance</i>.—European hospital serjeant, ward coolies; no nurses.</p> <p><i>Sanitary state</i> of European hospitals “good;” no epidemic.</p> <p><i>Convalescents</i>.—No convalescent ward; no provision for exercise.</p> <p><i>Female hospital</i>.—None; sick wives and children treated in quarters; sanitarium for females at Steamer Point.</p>
BARODA.	<p><i>Site</i> to leeward of station; much too close to river and horse lines.</p> <p><i>Water supply</i> abundant and good.</p> <p><i>Drainage</i>.—By a barrel drain to a nullah.</p> <p><i>Construction</i>.—Wards raised 1½ feet above ground; no ventilation beneath; no provision for carrying away roof water; hospital built of brick and mud; verandahs 8 feet broad all round.</p> <p><i>Accommodation</i>.—Four wards of 30 beds each, giving 1,042 cubic feet; 72 square feet per man.</p> <p><i>Ventilation</i>.—No winds except those passing over station; proper ventilation next to impossible; windows, doors, and ventilators in roof; sufficient as to means; punkahs in hot weather and tatties.</p> <p><i>Cleansing</i>.—Limewashing whenever required.</p> <p><i>Privies</i>, same as barracks; “properly cleansed.”</p> <p><i>Ablution and bath room</i>, “very good;” “a large room; tinned copper washing basins;” “a large tub kept constantly full by a bheestie for those men who are sufficiently well to avail themselves of it for bathing.”</p> <p><i>Hospital linen</i> washed by dhobies.</p> <p><i>Storage</i> sufficient and dry.</p> <p><i>Bedding</i>.—Iron cots 18 inches high; sacking bottoms; straw mattress; coir recommended instead.</p> <p><i>Cooking</i>.—Utensils same as barracks; “well done, and means sufficient.”</p> <p><i>Attendance</i>.—Hospital serjeant and ward boys; “serious cases have an European orderly.”</p> <p><i>Sanitary state</i> most objectionable, as being close to a nullah used as a necessary by the natives, and as a receptacle for the filth of the whole station; when cholera occurred, hospital had to be evacuated; “sanitary recommendations of medical officers always attended to.”</p> <p><i>Convalescents</i>.—No exercising ground or seats; only verandahs; no wards; “not required; convalescents live in their barrack rooms.”</p> <p><i>Female hospital</i>, one; no matron, “therefore sick women and children attended at home; present arrangement sufficient.”</p>
KIRKEE.	<p><i>Site</i> good and healthy.</p> <p><i>Water supply</i>, by bheesties, as may be needed.</p> <p><i>Drainage</i>.—No regular system, “not being allowed by Government regulation;” all refuse water and impurities carried away by sweepers.</p> <p><i>Construction</i>.—Floors three feet above ground; no ventilation below; roof water sinks into subsoil, which is porous; material, brick and lime; roof double tiled; walls single; floor paved; hospital cool; verandahs.</p> <p><i>Accommodation</i>.—Two wards for 10 sick each; two for 12 each; two for 28 each; cubic feet per bed, 1,425; square feet per bed, 86.</p> <p><i>Ventilation</i>.—Hospital receives full benefit of winds; ventilation by doors, windows, and roof ventilators; scarcely sufficient; air cooled by tatties and punkahs; stoves for dryness in monsoon required.</p> <p><i>Cleansing</i>.—Limewashing every three months or oftener.</p> <p><i>Privies</i> washed out frequently and deodorized.</p> <p><i>Ablution and bath room</i>.—Tubs and basins alone; permanent lavatories with shower baths much needed.</p> <p><i>Hospital linen</i> washed by commissariat; means of drying much wanted.</p> <p><i>Storage</i> sufficient and dry.</p> <p><i>Bedding</i>.—Iron cots, with straw mattress; cocoa-nut shreds recommended instead.</p> <p><i>Cooking</i> properly done, and sufficiently varied.</p> <p><i>Attendance</i>.—Hospital serjeant, ward boys; “sufficient.”</p> <p><i>Sanitary state</i> good; no hospital disease.</p>

STATIONS.

REPLIES.

POONA.

Convalescents.—Sufficient ground for exercise, but no shaded walks or seats; doolies used for carrying; no wards; would be desirable.

Female hospital, one (European nurse and native assistant); too small; medical officer attends sick in their own quarters; obstetric ward much wanted.

Sites generally open; freely ventilated and healthy.

Water supply abundant and wholesome.

Drainage.—"Artificial drainage not allowed; refuse water, &c., carried away by sweepers."

Construction.—Floors three feet above ground; no ventilation beneath; no surface drainage; rain and roof water sinks into porous subsoil; material, brick, mortar, and mud; thatched and tile roofs; floors of native hospital, clay; of European, flagged; no verandahs in European hospital.

Accommodation.—Two European hospitals of one ward each for 100 and 107 beds respectively, at 1,291 to 1,296 cubic feet, 72 square feet per bed; three native hospitals of one ward each for from 21 to 30 beds; at 1,267 to 1,286 cubic feet; 70 to 71 square feet per bed.

Ventilation by doors, windows, and ventilators; scarcely sufficient; buildings receive full benefit of prevailing winds; air cooled by wet tatties.

Cleansing.—Limewashing whenever required.

Privies.—Same as in barracks; washed out frequently by sweepers and deodorized.

Abution and bath room consists of tubs and basins; permanent lavatories and shower baths much needed; no bathing places for sick.

Hospital washing by commissariat.

Storage sufficient.

Bedding.—Iron frames, 1 foot 4 inches high, with tape bottoms; straw bedding; blankets and sheeting; natives use their own bedding, simply a small rug or carpet.

Cooking properly done, and sufficiently varied. *Native sick diet themselves.*

Attendance "according to regulation; sufficient."

Sanitary state, "good;" no hospital disease; verandahs required; separate wards for special cases, and accommodation for hospital serjeant and subordinates.

Convalescents.—Ground for exercise; but no shaded walks or seats; no convalescent wards; highly desirable.

Female hospital too small; very unsatisfactory; obstetric ward and residence for matron wanted; women and children have to be attended at their own quarters.

SHOLAPORE.

Site open, freely ventilated.

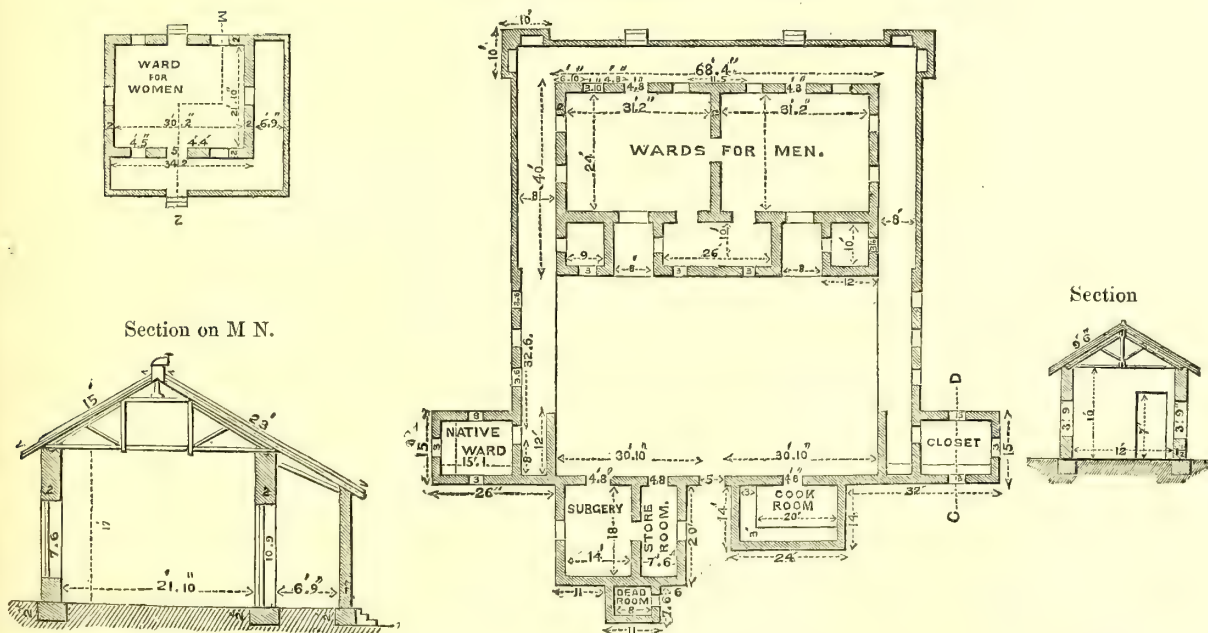
Water supply, excellent, "from a well distant half a mile, conveyed by bheesties. No necessity for improving it in this respect."

Drainage.—No drains or sewers whatever; all fluid refuse carried away by sweepers.

Construction.—Floors one foot above ground; no ventilation below; no means of surface drainage or carrying off roof water; material, burnt brick and chunam; double tiled roof; verandahs.

Fig. 12 gives a plan and section of the artillery hospital, Sholapore, to illustrate the structure and position of wards and offices, together with the plan of Deesa hospital; it also exhibits the usual hospital provision made for sick wives and children of soldiers.

FIG. 12.—ARTILLERY HOSPITAL, SHOLAPORE.



Accommodation.—Two wards, 10 beds each, at 1,150 cubic feet; 75 square feet per man.

Ventilation.—Iron cowls in ridge, doors, and windows; cooled by kuskus tatties.

Cleansing every three months, or oftener.

Privies cleansed daily by sweepers; "not more offensive than the best of such places usually are in this country."

Abution and bath room, make shift; there is a bath room; "but all apparatus entirely wanting."

Hospital washing done by dhobies.

Storage.—"Accommodation in every way susceptible of improvement."

Bedding.—Iron cots; straw mattresses.

Cooking "apparatus primitive; best adapted for Indian cook."

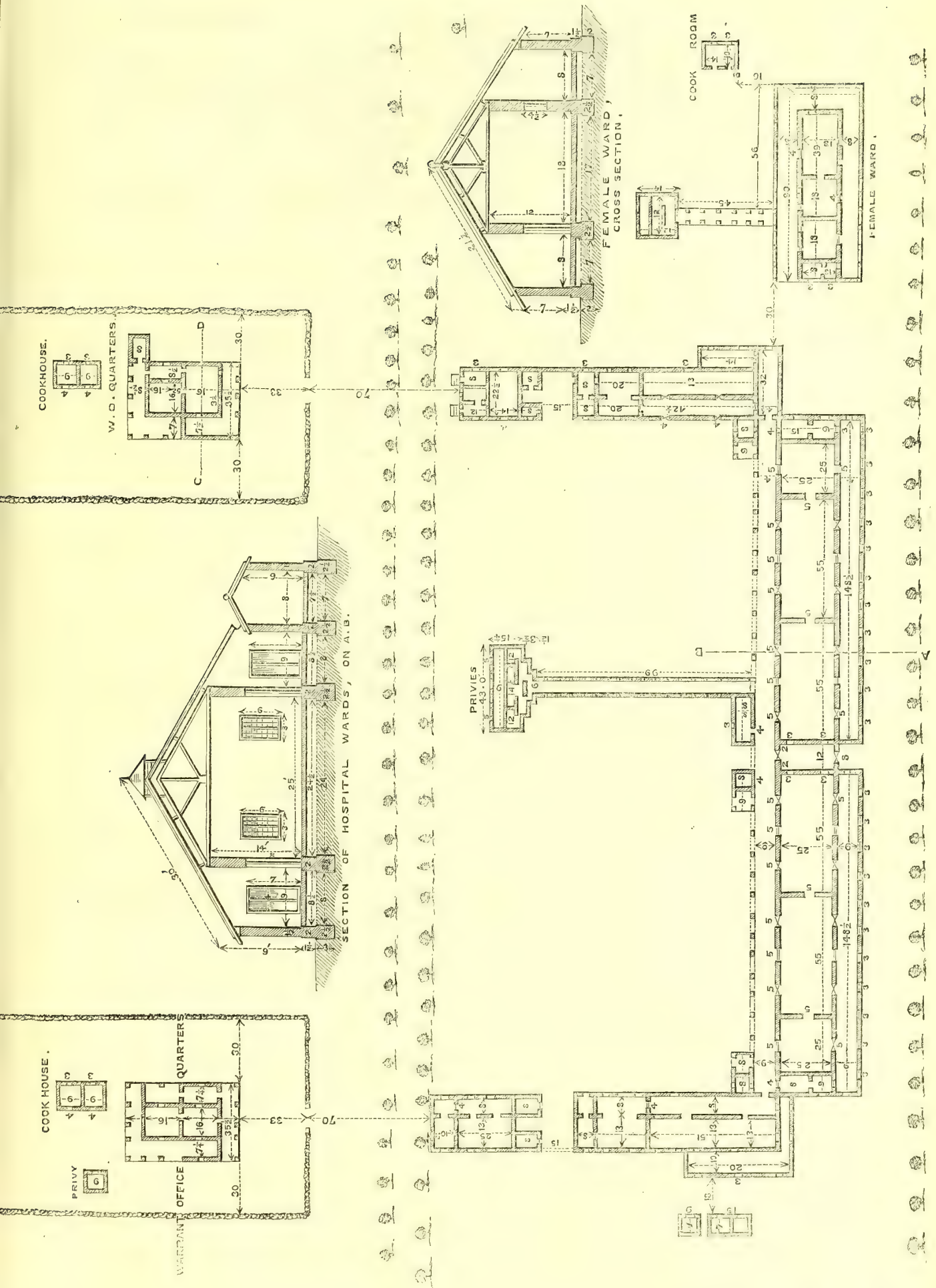
Attendance, "good and sufficient."

Sanitary state, "good;" no hospital disease.

Convalescents.—No means of exercise, except in verandahs; no convalescent ward.

STATIONS.	REPLIES.
NUSSEERABAD.	<p><i>Female hospital.</i>—One ward in regimental hospital of 8 beds, at 1,400 cubic feet ; 82 square feet per bed. Women prefer remaining in their own huts, and being attended there, with their children, by medical officer ; no resident matron allowed ; “present arrangement conducive to comfort.”</p> <p>No hospital ; only temporary accommodation in barracks and in the church bungalow ; three buildings at present used by different arms.</p> <p><i>Water supply</i>, “good ;” carried by bheesties.</p> <p><i>Drainage</i> by cesspits.</p> <p><i>Construction.</i>—Floor 1½ feet above ground ; no ventilation beneath ; roof water discharged on ground.</p> <p><i>Accommodation</i> in artillery hospital, one room, 14 beds, at 1,527 cubic feet ; 76 square feet per bed ; 4 verandahs ; all used for sick, when necessary ; 3 small “bedrooms,” 1 bed each.</p> <p><i>Ventilation.</i>—Doors, windows, and openings in walls ; exposed to prevailing winds.</p> <p><i>Cleansing.</i>—Limewashing on requisition.</p> <p><i>Privies</i> cleansed daily.</p> <p><i>Ablution and bath room</i>, “insufficient ;” four wooden tubs and four “gindees” to each, besides 40 crockery basins ; no baths.</p> <p><i>Hospital washing</i> by native washermen.</p> <p><i>Storage</i> insufficient.</p> <p><i>Bedding</i>, chiefly wooden bedsteads, some iron ; straw mattresses and pillows, cotton sheets and coverlids, blankets.</p> <p><i>Cooking</i>, “sufficient ;” sometimes want of good vegetables.</p> <p><i>Attendance.</i>—Usual regimental establishment.</p> <p><i>Sanitary state.</i>—No hospital diseases. Hospital should be larger ; better raised ; better fitted up.</p> <p><i>Convalescents.</i>—No wards ; convalescents sent to barracks and put on barrack rations ; “marched out under a non-commissioned officer for morning and evening exercise.”</p> <p><i>Female hospital</i>, none ; only two compartments of married quarters.</p>
DEESA.	<p><i>Site.</i>—Two hospitals ; European hospital on highest and best ground in cantonment, but too near officers’ quarters, which obstruct the breeze ; artillery hospital on lower ground ; ventilation similarly obstructed.</p> <p><i>Water supply</i>, abundant and wholesome.</p> <p><i>Drainage</i> by cesspools 10 feet deep ; emptied as found necessary.</p> <p><i>Construction.</i>—Ward floors 18 inches above ground ; no ventilation beneath ; no surface drainage ; roof water sinks into subsoil ; material, burnt bricks and mortar ; tiled roofs, which are hot ; verandahs all round ; sometimes used for sick. (The arrangement of parts in this class of hospitals is shown in the following, Fig. 13.)</p> <p><i>Accommodation.</i>—European hospital, two wards, six beds each ; 1,822 cubic feet per bed ; 104 square feet per bed. Four wards, 12 beds each ; 2,005 cubic feet per man ; 114 square feet per man. Horse artillery hospital, two wards, 16 and 7 beds each, with 2,387 to 1,445 cubic feet per man, 108 to 65 square feet per man.</p> <p><i>Ventilation.</i>—By doors, windows, punkahs, and ventilators in roof ; generally sufficient.</p> <p><i>Cleansing.</i>—Limewashing when required.</p> <p><i>Privies</i> over cesspits.</p> <p><i>Ablution and bath room.</i>—In infantry hospital ; sheds projecting from verandah, with tables, basins, chatties, and towels ; sheds interfere with ventilation of wards ; arrangements in artillery hospital insufficient ; means of bathing, chatties, tin baths, and basins ; not sufficient nor convenient.</p> <p><i>Hospital washing.</i>—By washermen.</p> <p><i>Storage.</i>—Sufficient and dry.</p> <p><i>Bedding.</i>—Iron bedsteads ; rice, straw, or cotton mattresses ; “hair or cocoa-nut fibre preferable ;” counterpanes, blankets, sheets.</p> <p><i>Cooking.</i>—By Portuguese ; tolerable.</p> <p><i>Attendance.</i>—“Ample and sufficient ;” orderlies from regiments employed “during epidemics or in particular cases of importance.”</p> <p><i>Convalescents.</i>—Shaded walks for exercise ; horse exercise ; no wards ; such necessary.</p> <p><i>Sanitary state.</i>—“Excellent ;” no hospital disease ; but hospitals too small ; no dead house ; no guard house ; “men on guard occupy a corner of front verandah, where they eat, drink, and smoke at their discretion.”</p> <p><i>Female hospital.</i>—One ; arrangements satisfactory.</p>
SURAT.	<p><i>Site.</i>—Castle hospital has native town on three sides ; site not healthy ; native hospital, private house ; isolated and healthy.</p> <p><i>Water supply</i> abundant, and “as good as can be got in the neighbourhood.”</p> <p><i>Drainage.</i>—“Several drains ;” all cleansed daily by sweepers ; native hospital cleansed by sweepers.</p> <p><i>Construction.</i>—Castle hospital, wards 21 feet above ground ; free ventilation beneath ; lower ward of native hospital two feet above ground ; floor, mud ; roof water falls on ground and runs away ; materials, castle hospital, brick and chunam masonry ; floors, chunam ; no verandahs.</p> <p><i>Accommodation.</i>—Castle, one ward, 10 beds ; 760 cubic feet per bed ; 76 square feet per bed ; one ward, eight beds ; 870 cubic feet per bed ; 72 square feet per bed. Native hospital, one ward, 12 beds ; 1,077 cubic feet per bed ; 83 square feet per bed ; one ward, six beds ; 989 cubic feet per bed ; 82 square feet per bed.</p> <p><i>Ventilation</i> “good.”</p> <p><i>Cleansing.</i>—Lime-washing once a quarter ; no privies in European hospital ; those of native hospital cleansed daily, but “highly offensive.”</p> <p><i>Ablution and bath room.</i>—Tubs “in sufficient quantities ;” “means of bathing convenient and sufficient.”</p> <p><i>Hospital washing</i> by native washermen.</p> <p><i>Bedding.</i>—Wooden cots ; straw mattresses ; serge blankets.</p> <p><i>Cooking.</i>—Kitchen insufficient ; cooking properly done.</p> <p><i>Attendance.</i>—Hospital serjeant ; ward boys.</p> <p><i>Sanitary state</i> “good ;” no epidemic disease ; European hospital “unfit for accommodation of European patients ;” “native hospital not sufficient ;” “new hospital should be erected.”</p> <p><i>Convalescents.</i>—No wards ; no provision for exercise.</p> <p><i>Female hospital.</i>—None.</p>

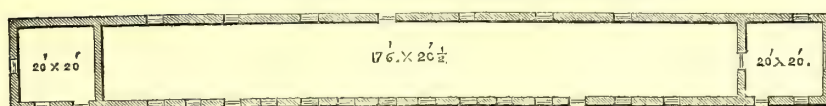
FIG. 13.—PLAN OF HOSPITAL, EUROPEAN REGIMENT, DEESA.



STATIONS.	REPLIES.
AHMEDNUGGUR.	<p><i>Site</i>.—Hospital 200 yards from horse lines ; open ; healthy as to elevation, drainage, &c. <i>Water supply</i> abundant and wholesome. <i>Drainage</i> into cesspits, whence liquid carried away by hand. <i>Construction</i>.—Floors four feet above ground ; no ventilation beneath ; roof water sinks into subsoil ; material, brick, and tiled roof ; cool ; verandahs occasionally used for sick ; part of them also used “for eating meals in, there being no rooms for the purpose.” <i>Accommodation</i>.—One ward of 20 beds ; 2,016 cubic feet per bed ; 84 square feet per bed ; two wards, 20 beds each ; 1,843 cubic feet per bed ; 77 square feet per bed. <i>Ventilation</i> by double sets of windows, one above the other ; “sufficient ;” no means of cooling, “shutting the wards up by day in hot weather being sufficient.” <i>Cleansing</i>.—Limewashing every three months or oftener. <i>Privies</i> drained into cesspools ; contents removed by sweepers ; deodorizers employed. <i>Ablution and bath room</i>.—“Bathing apparatus very simple ;” copper hand basins ; wooden tubs, with slipper baths for hot water ; rooms being enlarged. <i>Hospital washing</i> at a distance. <i>Storage</i> sufficient and dry. <i>Bedding</i>.—Iron cots ; straw mattresses ; bed clothes according to season. <i>Cooking</i> “sufficient.” <i>Attendance</i>.—Hospital serjeant ; ward boys ; “orderly comrades.” <i>Sanitary state</i>, “good ;” no gangrene or pyæmia ; “cholera has appeared in it, as elsewhere.” <i>Convalescents</i>.—Dining room required ; “anything is better than dining in the wards in India ; among other reasons, because flies, a pest of the first magnitude in India, are attracted by it ; such dining rooms are required for all hospitals ;” no shaded walks for exercise ; no convalescent wards. <i>Female hospital</i>.—One, with matron and assistant matron ; accommodation not sufficient.</p>
MHOW.	<p>No proper hospital accommodation ; present hospital will be abandoned as soon as any can be provided ; all the arrangements temporary.</p>
SATTARA.	<p><i>Site</i>.—150 yards from men’s barracks ; open ; freely ventilated ; otherwise objectionable. <i>Water supply</i> sufficient and wholesome. <i>Drainage</i>.—Surface drains ; sewage and refuse cleared away by sweepers. <i>Construction</i>.—Floors 1½ feet above ground ; no ventilation beneath ; roof water carried away by trenches ; material, wattle and daub ; grass thatch roofs ; earthen floors ; walls too thin ; verandahs on both sides ; not sufficient. <i>Accommodation</i>.—Four wards ; 12, 20, 26 beds each ; 870, 890, 960 cubic feet per bed ; 60, 61, 66 square feet per bed. <i>Ventilation</i> by windows and openings under eaves ; not sufficient ; no means of cooling. <i>Cleansing</i>.—Whitewashing three or four times a year. <i>Privies</i> cleaned by sweepers. <i>Ablution and bath room</i>.—A washing room ; “sufficient.” <i>Storage</i> sufficient and dry. <i>Bedding</i>.—Iron bedsteads ; rice straw mattress and pillows. <i>Cooking</i> “properly done.” <i>Attendance</i>.—A hospital orderly, “with occasional help of a comrade.” <i>Sanitary state</i> “good ;” no hospital disease ; hospitals, “being only temporary, are defective in many points.” <i>Convalescents</i>.—No shaded walks for exercise, nor seats ; no wards. <i>Female hospital</i>.—None.</p>
BELGAUM.	<p><i>Sites</i>.—On the whole good. <i>Water supply</i>.—Wholesome but limited, “being brought by water-carriers.” <i>Drainage</i>.—No sewers, rain-water everywhere flows on the surface. European hospitals have cesspools, emptied when necessary ; sweepers carry away solid matter daily. <i>Construction</i>.—Floors from 2 to 7 feet above ground ; no ventilation beneath ; roof water carried away in open gutters. Material, laterite and lime ; verandahs on both sides, only used for sick when necessary. <i>Accommodation</i>.—Artillery, 2 wards, 12 beds each, 843 cubic feet, 60 square feet per bed ; European infantry, 6 wards, 12 to 42 beds each, 892 to 1,598 cubic feet, 69 to 80 square feet per bed ; two native hospitals, one ward each, 32 beds, 792 cubic feet, 66 square feet per bed. <i>Ventilation</i>, doors and windows and through the roof ; sufficient when not overcrowded. <i>Cleansing</i>.—Limewashing once a quarter. <i>Privies</i>.—Cleansed once a day ; cesspools always more or less offensive. <i>Ablution and bath room</i>.—No lavatory ; a great want, only tubs and slipper baths and one shower bath. <i>Bedding</i>.—Iron cots ; straw mattress ; straw or hemp pillow ; cotton sheets ; country blankets, of a very inferior description. <i>Cooking</i>.—Kitchen arrangements sufficient. <i>Attendance</i>.—“Sufficient.” <i>Sanitary state</i>.—One ward shut out from breeze ; privy, a nuisance to the other ; epidemic disease has appeared ; sores sometimes become erysipelatous ; buildings too much crowded together. <i>Convalescents</i>.—No shaded walks nor seats ; no wards. <i>Female hospital</i>.—One ; sufficient.</p>
KOLAPORE.	<p><i>Site</i>.—Generally healthy. <i>Water supply</i>.—Generally sufficient. <i>Drainage</i>.—None ; refuse water runs off, and is either absorbed or evaporated. <i>Construction</i>.—Floors 3 to 5 feet above ground ; no ventilation beneath ; roof water falls on ground ; part runs down the slope ; material, stone and lime ; roofs double tiled, sufficient for coolness ; verandahs, partly used as dispensary and store rooms ; only used for sick in extreme cases. Figure 14 shows the construction of a native hospital at this station, with the ward offices usually provided for those establishments. <i>Accommodation</i>.—One ward, 32 beds, 1,056 cubic feet, 66 square feet per bed ; artillery ward, 16 beds, 1,100 cubic feet, 69 square feet per bed ; native infantry, 60 beds, 541 cubic feet, 60 square feet per bed ; the last originally a gun shed, then a cattle shed, lately converted into a native hospital.</p>

STATIONS.	REPLIES.
	<p><i>Ventilation.</i>—Infantry and artillery hospitals have revolving cowls in roof; rain beats in and renders wards so damp that charcoal has to be used to keep them dry; with doors and windows, cowls sufficient to allow escape of hot air.</p> <p><i>Cleansing.</i>—Limewashing every three months.</p> <p><i>Privies</i> drained into cesspool; regularly cleansed by sweepers, and lime used.</p> <p><i>Ablution and bath room.</i>—Artillery hospital, one tub, one slipper bath, one basin to 100 men; European hospital, one tub, one basin to 100 men; "insufficient;" no bath rooms; hospital originally native.</p> <p><i>Storage.</i>—Very limited.</p> <p><i>Bedding.</i>—Woodens cots; straw mattresses and pillows, cotton sheets, quilts, country blankets, bed carpet; iron cots required; wooden ones greatly disliked from bugs.</p> <p><i>Cooking.</i>—Apparatus insufficient.</p> <p><i>Attendance.</i>—No hospital orderly in infantry hospital; a matron "sanctioned only for a complete battalion of artillery or infantry."</p> <p><i>Sanitary state,</i> good; no hospital disease; better drainage required.</p> <p><i>Convalescents.</i>—No shaded walks or seats; no wards.</p> <p><i>Female hospital.</i>—None; treated in their own quarters.</p>

FIG. 14.—NATIVE INFANTRY HOSPITAL, KOLAPORE.



SECTION.



MALLIGAUM.

Site.—Healthy.

Water supply.—"Abundant and wholesome."

Drainage.—None; "no refuse water lodges in vicinity of hospital."

Construction.—Wards 1 foot above ground; flagged; no circulation of air; roof water sinks into subsoil; material, burnt brick and lime; walls, double; roof, tiled; verandahs all round used for sick and convalescents.

Accommodation.—2 wards, 40 beds each, 829 cubic feet, 50 square feet per bed; 2 wards, 8 beds each, 872 cubic feet, 62 square feet per bed.

Ventilation by jhilmils, "sufficient."

Cleansing.—Limewashing once in 6 months or oftener.

Privies over cesspits kept clean by sweepers.

Ablution and bath room.—None.

Bedding.—None allowed.

Bedsteads.—Wood.

Cooking done in a shed; all that is required.

Attendance.—Hospital orderly and cook; "a comrade if necessary."

Sanitary state, "good;" no deficiencies nor sanitary defects.

Convalescents.—No wards; take exercise in compound.

Female hospital.—None.

BOMBAY.

Sites.—Generally good, except at Colaba, where the hospital is on low ground.

Water supply.—Excellent from the Vehar waterworks.

Drainage.—Fort George, open drains into ditch, covered drains into cesspools; Colaba, open and covered drains to sea; depôt hospital, cesspools emptied when required; also into sea.

Construction.—Fort George lower ward, raised 6 feet above ground, free ventilation beneath; Colaba and depôt hospital raised 2 feet; no ventilation beneath; roof water at Fort George falls on ground; at Colaba, it is collected in tank; materials, lime and stone masonry; closed verandah, only used for sick on extraordinary occasions.

Accommodation.—Fort George, 8 wards, 3 to 15 beds, 1,788 to 2,223 cubic feet, 154 to 173 square feet per bed; 58 beds in all; Colaba, 56 beds in 8 wards of 6 and 8 beds, 1,953 to 2,082 cubic feet, 156 to 166 square feet per bed; depôt hospital, 80 beds in 4 wards of 20 each, 2,079 cubic feet, 126 square feet per bed.

Ventilation.—Fort George, doors, windows, windows in roof, and punkahs; Colaba, roof ventilators, doors, windows, punkahs; depôt hospital, the same; ventilation "sufficient;" charcoal burners used for warming in damp chilly weather.

Cleansing.—Limewashing every 3 months.

Privies.—Fort George, contents emptied twice a day into sea behind barracks; Colaba, the same; depôt hospital, cesspits emptied daily; waterclosets said to exist at all the hospitals from 10 to 30 feet from wards.

Ablution and bath room.—Fort George, 4 bathing places, "where the patients can bathe themselves from water barrels;" "sufficient." Colaba, one lavatory; patients "take water to bathe themselves from wooden trough lined with zinc;" depôt hospital, two lavatories, water supplied in barrels or tubs; "sick pour the water over themselves with a tin pot."

Storage.—Sufficient and dry.

Bedding.—Iron cots.

Cooking.—Appliances sufficient; diets should be more varied; "mutton might be allowed twice a week as a change."

Attendance.—Hospital serjeant; a nurse or native boy for each bedridden patient.

Sanitary state.—Generally good; no epidemic disease.

Convalescents.—No special provision for exercise; no wards; allowing convalescents in barracks "does not answer well;" better kept in hospital till fit for duty.

Female hospital.—Arrangements quite equal to those for the men; European female nurse or matron allowed; satisfactory.

ASSEERGHUR.

Site.—In all respects healthy.

Water supply.—One well only, "good," filtration required.

Drainage.—None.

Construction.—Floors 14 feet above ground, no air beneath; roof water sinks into subsoil; no gutters round; material, brick, mud, timber, and tiles; verandahs on 3 sides, used for patients exercising.

Accommodation.—6 wards, 1 to 8 beds each, 21 in all, 724 to 1,275 cubic feet, 60 to 100 square feet per bed.

STATIONS.	REPLIES.
	<p><i>Ventilation</i> by doors and windows, sufficient.</p> <p><i>Cleansing</i>.—Limewashing twice a year.</p> <p><i>Privy</i> close to hospital; no drainage; cleansed twice daily.</p> <p><i>Ablution and bath room</i>.—One bath room with a large tub; also a mussack, "convenient and sufficient."</p> <p><i>Bedding</i>, iron bedsteads.</p> <p><i>Cooking</i>.—"Properly done and sufficiently varied."</p> <p><i>Attendance</i>.—"Plentiful supply of ward coolies;" "comrades when required," hospital serjeant.</p> <p><i>Sanitary state</i>.—"Good," excepting the "very dirty and unwashed condition of the hospital outhouses."</p> <p><i>Convalescents</i>.—No shaded walks nor seats; no wards.</p> <p><i>Female hospital</i>.—None.</p>

XX. BURIAL OF THE DEAD.

All the stations have European burial grounds, in which burial is conducted much as at home. These grounds have generally sufficient area; they are not too near cantonments, and are tolerably well kept. The grave space and depth vary, and are under no regulation. Sometimes the graves are too shallow. The dead of natives and camp followers are buried or burned according to caste. The native burial-grounds and places of cremation are generally at a sufficient distance from cantonments. The reports concur in stating that no injury to public health arises from the present practice of disposing of the dead. Interment usually takes place within 24 hours, and during epidemics at shorter periods.

ABSTRACT OF RETURNS FROM THE MORE IMPORTANT NATIVE STATIONS.

STATIONS.	REPLIES.
<p>BENGAL PRESIDENCY. KHERWARRAH.</p>	<p>Accommodation for seven companies native infantry, one troop native cavalry.</p> <p>The station is 1,200 feet above the sea; surrounded by hills; open, freely exposed to the winds, which, when from the east, increase the frequency of intermittent fever, influenza, and chest diseases.</p> <p>Surrounding country partly cultivated and under irrigation, which affects injuriously the health of the station; but it is the abuse, not the use, of it which does so. The soil is ferruginous, rich in organic matter, overlying trap rocks.</p> <p>Water is derived from wells and from the nullah or river. Some of the wells are contaminated by leaves and percolation of foul drainage. Quantity, abundant. Quality, from native wells, semi-transparent, and "not unfrequently has a fishy taste and disagreeable organic smell." It is always safest, even with the best wells, to boil or filter the water, as guinea worm is very common. No analysis. Water very hard. Raised by hand in vessels. The well in the lines is contaminated by percolation of the foul subsoil drainage from the village and bazaar.</p> <p>Climate very hot and dry, and comparatively non-malarious from March till June 20th; thence till September 20th cooler, but loaded with malarious exhalation.</p> <p>Malarious fevers, spleen disease, &c. prevail most in the unhealthy months. But, as a whole, Kherwarrah "is the healthiest station I have seen." "But none of the stations have had fair play." "Nothing has struck me so much as the utter disregard which prevails regarding the commonest sanitary precautions. A large proportion of the sickness at Dumdum, Barrackpore, Dinapore, Ajmeer, and Kherwarrah, is owing to the absence of a properly organized and efficient executive sanitary department."</p> <p>There are no barracks; huts of mud or wattle and daub, imperfectly ventilated. Men sleep outside in hot weather. All barracks in India should be raised on arches.</p> <p>No lavatories or cook-houses. Natives cook their own food and wash their own clothes.</p> <p>There is no conservancy establishment for cleanliness: "beyond the lines, this is left very much to the jackal, vulture, and carrion crow." There are patrols to prevent nuisances, "except in specified localities." The lines are kept clean; but "the sweepings are deposited 30 yards to windward."</p> <p>The bazaar main street is kept clean. In all other places the most ordinary sanitary precautions are lost sight of. "Every family has its own cesspool." "Dungheaps close to every hut," and also holes for ordure. Huts overcrowded. "Nuisance is frequently experienced in large stations from the wind blowing over native dwellings." Animals are slaughtered to windward. The offal is thrown to dogs, jackals, and vultures. During the rains, the stench from the offal, the increasing accumulation of years, is sometimes dreadful. The native population "is decidedly unhealthy, but chiefly from causes which can be mitigated or removed," such as jungle, marshy and swampy ground, small, cramped, damp, and unventilated dwellings, defective clothing, bad food and water, sheltering cattle, sheep, and goats under the same roofs as themselves, neglected cesspools, middens, exuviae of men and animals, absence of drainage, opium eating, spirit drinking, &c.</p> <p>Prevailing diseases among natives are malarious fevers, splenic enlargement, splenic cachexia, diarrhoea, cholera, small-pox, guinea worm.</p> <p>Among the native troops hepatitis is rare, 35 cases and 1 death in 17 years. In the same period one in every six men suffered from guinea worm, caused by bad water. "Drinkers of pure water never get the disease." The troops suffer from quotidian, tertian, quartan, remittent, and typhoid fevers; acute and chronic dysentery; sporadic and epidemic cholera; simple and confluent small-pox; acute and chronic rheumatism. Fevers alone constitute nearly 40 per cent. of the admissions, and about a fourth of the deaths. Cholera has occasioned 26 per cent. of the deaths. "We shall never arrive at sanitary perfection in</p>

STATIONS.	REPLIES.
SEETABULDEE.	<p>“ Indian military stations until sanitary officers are vested with liberal, responsible, well defined executive powers.”</p> <p>The hospital is on an open site, with free ventilation and natural drainage. But malaria emanates from the nullah or river, 30 yards to windward.</p> <p>Water supply abundant, but requires boiling and filtering. No drainage.</p> <p>One ward, built of sun-dried bricks and mud.</p> <p>Tiled roof, through which hot air and radiant heat enter freely.</p> <p>A verandah surrounds it.</p> <p>There are 56 beds, at 327 cubic feet, and 25 square feet per bed. 32 beds are kept in the verandah to diminish the over-crowding.</p> <p>No windows; only doors on opposite sides, which, with openings in the tiles, afford ventilation.</p> <p>Privy of sun-dried bricks; kept clean; matter removed in earthen vessels; charcoal used.</p> <p>No lavatory.</p> <p>“ Each patient defers bathing, according to custom, till he is cured, when he retires to the nearest well, draws water, and undergoes the bath of cure.” “ It is a bad custom.” There should be a good bath room. Linen is washed and dried by caste comrades, or by the patients, when not too ill. There are wooden bedsteads. Each sepoy brings his own bedding, under direction of the surgeon. There is a kitchen, but the patients or their friends cook outside, under the nearest tree. No diet table. Dooly bearers wait on the sick, but their attendance cannot be exacted by regulation. Comrades are allowed “ in extreme cases.”</p> <p>By unremitting exertion the sanitary state of the hospital is good, but during the past two years gangrenous and spreading sores have been frequent from overcrowding.</p> <p>Sick wives and families are treated in their own huts.</p> <p>Number of native troops—</p> <p style="padding-left: 40px;">Artillery, 16 officers, 122 privates.</p> <p style="padding-left: 40px;">Cavalry, 54 officers, 480 sowars.</p> <p style="padding-left: 40px;">Infantry, 96 officers, 800 privates.</p> <p>Surrounding country hilly, basaltic, dry, 939 feet above the sea; freely exposed to winds. City of Nagpore two miles distant.</p> <p>Climate good. Hot from March till June; wet till end of September, cool afterwards.</p> <p>Fevvers prevail after rains. Hot season the most healthy.</p> <p>Water supply from wells, moderate in quantity, said to be good; raised by a rope and native bucket.</p> <p>Bazaars cleansed by sweepers. “ A sanitary police to prevent nuisance would be of great use.”</p> <p>Population at Nagpore unhealthy. Severe epidemics of cholera, biliary remittent fever, and small-pox often occur and prove fatal to large numbers of the inhabitants. Intermittent fever and dysentery also common. Causes: defective ventilation, insufficient drainage, over-crowding, want of cleanliness, drunkenness, and the use of bang and opium.</p> <p>During five years, out of 640 sick of native troops in artillery hospital, not a single case of hepatic disease has occurred. In cavalry hospital, out of 3,054 cases there were eight of liver disease; when it occurs it is usually the consequence of fever and dysentery. 8·28 per cent. of the cases in the artillery from venereal. In the cavalry nearly 3 per cent. In the infantry 1·47 per cent. Remittent and intermittent fevers are endemic among the native troops; biliary remittent, epidemic. Dysentery, endemic. Cholera and small-pox, epidemic. Intermittent fever causes 31 per cent. of the admissions and 13 per cent. of the deaths. Remittent little more than 1 per cent. of the admissions, but 6½ per cent. of the deaths. Nearly 22 per cent. of the deaths are due to cholera. Zymotic diseases occasion 45½ per cent. of the mortality. Severe night duty quickly increases the number of sick in hospital. Pre-disposition to these diseases increased by the use of bang and opium. This should be prohibited. Infantry parade ground should be drained, and the “ natives compelled to proceed to a greater distance for the purposes of nature.”</p> <p>There are three hospitals, one for each arm. Sites of cavalry and artillery good. Parade ground in rear of infantry hospital almost a swamp in rainy season.</p> <p>Accommodation consists of four wards, with 102 beds, 30 of which have 706 cubic feet per bed. The remainder have 1,080. No windows. Roof ventilators and gratings. No drainage.</p> <p>Privies cleansed by sweepers. No lavatory or bath.</p>
CHIRRA POONJEE.	<p>Head quarters of Sylhet light infantry.</p> <p>Situated on a small table land, surrounded by hills and valleys covered with dense jungle.</p> <p>Elevation 4,118 feet above the sea, 3,000 feet above a glen to the east. Surrounding country mountainous, sandy, and swampy. Station freely exposed to winds. Surface generally rocky. Subsoil sand, clay, gravel. Rainfall generally runs away, but sometimes lies on the surface.</p> <p>Barometer varies between 25½ and 26 inches. Highest mean maximum temperature 73° 83 in May. Lowest mean minimum 50° 1 in February. Diurnal variation from 4° 8 to 16° 33 F.</p> <p>Highest mean sun temperature 91° 25 in July.</p> <p>Moisture excessive during six months of the year. Recorded rainfall for one year, 1859-60, 615·26 inches. Of this amount nearly 21 feet fell in the month of June. Climate cold but invigorating. Native troops and European residents very healthy. Want of shelter and severe storms render persons who come from the plains liable to chest affections. Good shelter and warm clothing are necessary.</p> <p>The sepoy huts are built of stone and mud, thatched with leaves, and raised from 2 to 4 feet above the ground. The natural drainage good. But all the buildings are damp from the moist (not to say wet) atmosphere.</p> <p>Water is obtained from mountain torrents, said to be of the best kind. A large pond, formed from damming up a mountain stream, emits unpleasant smells.</p> <p>No lavatories. Men wash in the streams. No cook-houses. All filth washed away by the rains.</p> <p>Bowel diseases are prevalent among the Khasia Hill people. Small-pox and cholera are the chief epidemics, committing great ravages, caused by the very filthy habits in houses and persons, and by the very bad food. The native troops suffer from intermittent fever, diarrhoea, and dysentery, contracted during their periodical change of stations.</p> <p>The best seasons for residence at Chirra Poonjee are spring and autumn. Great care is necessary in the rains. Liver disease very rare among native troops. Very little venereal disease. Six out of every seven admissions from miasmatic disease are caused by intermittent fever. The sepoys are temperate. No admissions, either directly or indirectly, from intemperance.</p>

STATIONS.	REPLIES.
<p>MADRAS PRESIDENCY.</p> <p>COCHIN.</p>	<p>The hospital is 200 yards from the lines. Site good. Water abundant. Natural drainage sufficient. One ward for 50 beds, at 490 cubic feet and 17 square feet per bed. Ventilation by doors, windows, and fireplaces; not sufficient. Privy a mere mat house, with earthen pots. No lavatory or bath arrangements. Water is carried to the sick by the water carrier. Surgery and storage damp. No diet tables for the sick.</p> <p>Accommodation, 160 native troops. Surrounding country low and sandy, 4 feet above sea level, surrounded by the sea and back-water. Climate variable, moist, chilly, occasionally sultry. Occasions rheumatic affections. Water derived in part from wells, unfit for use from privy infiltration. Drinking water brought daily a distance of 18 miles. One tank used by sepoys for bathing and drinking. Sanitary condition of bazaar "as bad as it could possibly be." "Cleanliness unknown." "No drainage." "Streets used as privies without hindrance." No regulation for cleanliness attempted. Engineers' Department removed old rampart, and converted its site into a ditch, now used as a public privy. Every odd corner "<i>in the most disgusting condition.</i>" Native houses filthy. Most common diseases, elephantiasis arabum, small-pox, and cholera, attributable to the filthy condition and dirty habits of the civil population. Barracks constructed of laterite in chunam, with tiled roofs. Huts of bamboo mats, with cudjan roofs. Floors 2 feet above ground. No ventilation beneath. <i>Diseases of Native Troops.</i>—Liver, very rare; none for several years. Venereal, about 1·7 per cent. of total sick. Among 160 men there were, in 1859, 20 cases of ephemeral, quotidian, and continued fevers; two cases of dysentery; two of cholera; nine of rheumatism; together constituting 26 per cent. of total admissions. Troops temperate and cleanly in their habits. Hospital contains five beds. Water supply good. No drainage. Have been unable to get the hospital limewashed, although applied for three times in 14 months. Hospital out of repair. "If left as it is, it would probably before long be a ruin." Privy, a small room, with no place in which the excrement can go to be cleared away; its drainage passes through an opening in the wall, and sinks into the ground. The place often very offensive. Lavatory and bathing arrangements consist of two tubs, out of repair. Attendants, one hospital orderly and a sweeper. If a sepoy is unable to cook his own food, a comrade is told off.</p>
<p>VELLORE.</p>	<p>Two regiments of native infantry. Station 675 feet above the sea. Country consists of irregular chains of hills. Part of the native lines subject to overflow of water from a nullah. Site faulty. "Selected on military and not sanitary grounds." An indigo factory close to the native lines creates nuisance. Subsoil, alluvium overlying primitive rock. Climate "hot but healthy." Water from wells and a tank; the former brackish, apt to cause diarrhoea in new comers. Tank water used for drinking. The native town and bazaars extensive and densely populated. "Natives appear perfectly indifferent to the condition of their houses, few of which are without those hot-beds of disease, dungheaps and cesspits." Wind blowing over these causes nuisance in the barracks. Drainage from the prison a constant source of annoyance, from the filthy habits of the followers. No latrines in the bazaar. "Cleanliness is carefully attended to." Native population suffers occasionally from epidemic outbreaks. Fevers prevail after the drying up of the paddy fields. Diseases among the troops are, ephemeral, quotidian, tertian fevers; a few cases of dysentery. No cholera this year. Most rheumatic complaints due to venereal. "Epidemic influences, though not dependent on local circumstances, are yet so controllable by sanitary measures that too much attention cannot be paid to the observance of these."</p>
<p>QUILON.</p>	<p>Accommodation for 1,042 native troops of all ranks. The station is close to the sea, slightly elevated above it. Surrounding country flat, sandy, and well wooded. The parade ground is sometimes overflowed with water during the rains. Full exposure to sea and land winds; the latter, however, causing rheumatism and neuralgia. During the rains the weather is close and muggy; parching in dry weather. January to March the most unhealthy months. Water derived from wells, 15 to 20 feet below the surface in dry weather; close to the surface in wet weather. Barracks mostly in a ruinous condition, without doors or windows, because they are to be given up. No lavatories. No cook-houses. No privies or urinals. No drainage. Ruinous buildings interfere with the ventilation, and afford concealment for dead carcasses of animals. The dead body of an old woman was found on one occasion. Native huts wretched, huddled together, without cleanliness. Prevailing native diseases, chiefly of the skin, attributable to want of proper diet. Among the troops hepatitis is extremely rare. There are a few cases of venereal; but the principal disease is mild intermittent fever, with a few mild cases of dysentery. There has been no cholera. Small-pox is occasionally epidemic, and rheumatism rather prevalent. These diseases are most frequent in the hot weather. The general bazaar should be kept cleaner, and the refuse of stale fish removed more frequently. There is so little intemperance among the native troops that no effect on disease can be shown. The hospital is built on a mound 8 feet above the parade ground. There is one ward for 30 beds at 620 cubic feet per bed. Ventilation by openings in the walls. No waterclosets or urinals. Privies cleaned regularly. No lavatory; large tubs used for bathing. Iron cots. There are no kitchens. Attendance by hospital orderlies.</p>
<p>MANGALORE.</p>	<p>Accommodation for two regiments of native infantry and one-third company of artillery. Site, quarter of a mile from the sea, and 40 feet above the level. Surrounding country undulating, wooded, hilly, dry, with wet cultivation in the valleys. Tolerably open to the sea, shut in towards the land. No information as regards climate. Water supply derived from wells; said to be good and abundant. No analysis. No barracks. "Hitherto surface cleansing has been performed solely by the heavy rains falling from May to September." Authority now granted "to entertain scavengers' carts and sweepers." No public latrines. Cantonment patrolled to prevent nuisances. Most frequent disease among natives, fever, with spleen enlargement.</p>

STATIONS.	REPLIES.
	<p>Among the troops hepatic disease is very uncommon. Constantly sick from venereal: only one per cent. of total sick. Most common diseases, quotidian fevers and rheumatism; the latter chiefly during land winds. More cleanliness would tend to mitigate zymotic disease at the station.</p> <p>Drunkenness very rare among native troops.</p> <p>There are no means of instruction, except schools; none of occupation or recreation whatever at any native station.</p> <p>Hospital well placed; good water supply. Two wards, with space for 56 beds at 1,100 cubic feet and 77 square feet per bed. Ventilation only by doors and windows. One privy for each ward, over a covered drain, down which lime is thrown; and it is flushed out with water every morning. No lavatories. One large tub for each ward for bathing. Hospital cots partly iron; mostly wood. No bedding. A convenient cook-room, "used for medical preparations." Attendance by a hospital havildar, detailed from the effective strength. Orderlies also detailed. "Sufficient." Convalescents are allowed to go to their own houses, parading once a day at hospital.</p>
HURRYHUR.	<p>Accommodation for one regiment, native infantry.</p> <p>Station elevated 1,831 feet above the sea. Surrounding country flat; sparsely populated. Open to the prevailing winds. Surface soil, black cotton, resting on gravelly clay, with syenite and granite beneath.</p> <p>Most of the well-water unwholesome from earthy salts, and too hard to be used with soap. Drinking water almost exclusively obtained from the river, $\frac{3}{4}$ mile distant. It is carried in chatties to the men by the females of their establishments, or by servants. When the river is dry, water is obtained by digging in its bed.</p> <p>Climate dry, with considerable diurnal range in cold weather.</p> <p>Native population subject to occasional epidemics of cholera.</p> <p>Among troops hepatic disease merely accidental. Has only met with 5 fatal cases among natives in 20 years' service. Out of 4,400 admissions, regimental records show 51 from liver disease, with 6 deaths, in 9 years. During the same period there were 275 admissions from venereal. The chief diseases among native troops are fevers, cholera, rheumatism, dysentery. Intermittent the most common form of fever.</p> <p>Men barracked in huts. No ventilation. The streets not wide enough. No lavatories. No means of cooking. No privies or urinals. Drainage, "nil;" only open trenches, in which "the fluid refuse of the barracks flows for a limited distance, and is chiefly disposed of by evaporation."</p> <p>Bazaar much in the same state as the men's lines. Dung heaps close to the houses.</p> <p>Hospital on a healthy site; well supplied with water for cleansing, but not fit for drinking. No drainage. Refuse water and other impurities flow into a cesspit with no outlet. Solid refuse removed daily. Wards have verandah. There are 3 wards, containing 40 beds, at 1,243 cubic feet per bed. Ventilation by doors, windows, and roof openings. Sufficient. There is a privy. No lavatory. Sick <i>only furnished with water</i>. Convalescents go home to bathe. "The process of washing, which, of their own accord, usually satisfies them while in a hospital, is of the most superficial and unsatisfactory nature to the views of an European." There is a wooden tub and brick bath used remedially. Diets are prepared by the sick or their relatives. The kitchen is almost exclusively used for the preparation of poultices, &c. The attendance consists of a standing hospital havildar and orderly. Others added, if necessary. "System operates very well, and seems to be sufficient for the purpose." Convalescents sent out with a non-commissioned officer. Native dressers attend the "followers;" medical officer admits dangerous cases into "the dissecting room" where the relatives attend on them.</p>
SAMULCOTTAH.	<p>This station contains accommodation for one regiment of native infantry. It is situated in a valley with about 8 miles of flat land between it and the sea. The site is from 20 to 40 feet above the general level. The nearest river is about two miles distant. The station is freely exposed to the winds. But "unfortunately a large native town (with from 8,000 to 10,000 inhabitants), with bazaars and enclosures for hundreds of cattle, &c., has been allowed to grow up" close to it, "so that the prevailing winds carry impurity and contamination into the chief parts of the cantonment for nine months in the year." Close to the cantonment is a belt of prickly pear, cut into open spaces for privies. "This is a very great nuisance, of large extent, and likely to be provocative of cholera or typhus." Irrigation from the Godavery, close to the station. It produces "no appreciable effect on health." "But the climate is cooler in consequence."</p> <p>"Samulcottah has (for the plains of India) a most healthy climate." Highest monthly mean temperature, 95° in May; lowest monthly mean, 53° in December; daily range considerable, from 8° to 25°. Rainfall about 43 inches. Out of 50 Europeans only one child has died, and this not from the climate, in three years and four months.</p> <p>The water supply is chiefly from a tank fed by the rains. Water is obtained by percolation from this tank into wells, said to be "good." The tank water is used by the sepoys. One of its feeders runs through the regimental lines, and "must always bring considerable impurities with it." The water tastes of decaying vegetation. Some of the wells cannot be used, "as they contain apparently much saltpetre and other salts." The water is raised and distributed by the ordinary leathern bucket, or Palmyra leaf.</p> <p>There are no barracks, merely a place of arms.</p> <p>No privies or urinals.</p> <p>No conveniences of any kind.</p> <p>No drainage.</p> <p>The most prevalent diseases among native population are small-pox, syphilis, and intermittent fever at certain seasons. Native population healthy. Country well cultivated. No marshes. Sea breezes. Population well off. Have double the pay they could secure a few years ago.</p> <p>Among the native troops there has been some scorbutus, apparently caused by the use of putrid fish. Have only had one case of hepatitis, and that in an European. Prevailing diseases among sepoys: intermittent, remittent, and continued fevers; dysentery at beginning of cold weather; rheumatism frequent, severe, and obstinate; some small-pox.</p> <p>There are two hospitals, garrison and regimental, under one roof; site open, well ventilated and healthy. Water supply said to be abundant and wholesome. Hospital walls not 8 feet high, with a sloping roof. Floor on level of ground. Materials, brick. A verandah 5 feet wide on one side. There are 2 wards for 30 beds at from 294 to 386 cubic feet per bed.</p>

STATIONS.	REPLIES.
BERHAMPORE.	<p>Windows are "of wood;" when shut there is darkness and no ventilation; "should be glazed."</p> <p>There is space for ventilation between wall and roof, but not sufficient for coolness.</p> <p>Walls and ceilings limewashed once a month.</p> <p>Privy a small room, cleaned by totties. No lavatory. Only one tub in the pendall; exposed to the weather. No other means of bathing.</p> <p>Bedsteads of iron and wood.</p> <p>There is a kitchen used for boiling water, arrowroot, &c.</p> <p>Natives have their food cooked and brought to them.</p> <p>An assistant apothecary is the only attendant on the sick. Not sufficient.</p> <p>Accommodation for a regiment of native infantry.</p> <p>Station 112 feet above the sea, 76 feet above the nearest lower ground.</p> <p>The sea is 8 miles distant, and the nearest marsh 3 miles distant.</p> <p>Water pits and broken ground half a mile from the station, the effluvia from which are prejudicial to health.</p> <p>Country highly cultivated. A little irrigation half a mile distant produces no effect on health.</p> <p>The town of Berhampore half a mile from barracks. Subsoil, silicious rocks and gravel.</p> <p>Surface, loam.</p> <p>Water from wells and tanks. Much of the tank water is unfit for drinking purposes. Well water generally not good.</p> <p>Climate variable. Dry from March till the middle of June. Heat very great. September to November damp and most unhealthy from fever and beriberi. The most healthy months, February to May.</p> <p>There are 820 huts, those for the privates are 11 feet 6 inches long, 9 feet broad, and 7 feet 7 inches high.</p> <p>Ventilation by doors and windows; no lavatories; no cookhouses; no privies, nor urinals.</p> <p>No drainage. There are foul ditches in the native town, a mile distant. No means provided for surface cleansing. Refuse is deposited in front of the native houses. Bazaar said to be "drained and ventilated."</p> <p>There is a good supply of water, "but it is not used for drinking." No latrines; no sanitary police; no regulations for cleanliness in the bazaar. The place is dirty and crowded. The houses poor; dung heaps before them.</p> <p>The native population suffers severely from epidemics, of cholera, and small-pox, generally once a year. Beriberi, rheumatism, syphilis, fever.</p> <p>Among the troops, hepatic disease is exceedingly rare; about 10 per cent. of the total sick are from venereal. The troops suffer constantly from quotidian and intermittent fever also from ephemeral fever, small-pox and chicken pox. Epidemic cholera occurs once a year; rheumatism frequent. About a third of the admissions to hospital, and rather more than a third of the deaths are from these miasmatic diseases. Cholera occurs all over the station;—the other diseases in the places where the general sanitary conditions are bad. The use of narcotics and bad food are also predisposing conditions.</p> <p>The hospital is half a mile from barracks, on a healthy site. Water supply "sufficient;" "considered good by the sepoys, but obtained from a tank used for washing as well as for "drinking." Refuse water removed by a common (surface?) "drain."</p> <p>The hospital contains two wards, for 49 beds, at about 1,000 cubic feet per bed. Ventilation by doors and windows; "sufficient." Privies cleansed by sweepers. No lavatory. A bathing tub, hip bath, and foot tub allowed for the sick. No kitchen. Attendance, one hospital havildar, with an orderly comrade if necessary.</p>
MERCARA.	<p>Accommodation for one regiment native infantry.</p> <p>Elevation above the sea said to be 4,500 feet, and about 1,200 feet above the table land of Mysore.</p> <p>Average height of barometer at 10 a.m., 26.6 inches. Thermometer 72° F.</p> <p>Surrounding country hilly, partly wooded. Sea 40 to 50 miles distant.</p> <p>The town of Mercara is in two parallel streets, about half a mile long. Population about 1,000. The sepoy huts are built near the fort. The ground falls in all directions.</p> <p>Climate excellent. Thermometer falls to 62° F. before sunrise. During the day it is rarely 75° F. The highest observed temperature is 76° F. Rain falls for 6 months and fires are needed.</p> <p>Water supply unlimited. Said to be pure; but no analysis. Drawn from a well by bucket and rope.</p> <p>The sepoys hut themselves, receiving only two rupees hutting money (4s. to build themselves a house). The huts are of mud, and with long rain and wind they often fall. The sepoys would be more healthy if they were better housed.</p> <p>There is no drainage.</p> <p>There are no lavatories, no latrines, no cook-houses.</p> <p>Surface cleansing efficient.</p> <p>Bazaar "well ventilated, drained, and kept clean."</p> <p>Station and native population are healthy. Epidemics scarcely known. Prevailing diseases: fevers and bowel complaints. Hepatic disease is very rare.</p> <p>Among the troops 3 cases in 20 are from venereal disease.</p> <p>Intermittent fever, diarrhoea, and rheumatism are the chief affections.</p> <p>The hospital is 20 yards from the fort. Site freely ventilated. Water abundant and wholesome. A large cesspit has just been completed to receive the hospital drainage. "Cannot say how it will answer." Two wards; no regulation as to cubic space per bed, and no beds. Those in use appear to have been removed from a small European barrack and are of wood, with tape supports. Floors 6 inches above the ground. No ventilation beneath. Materials brick and chunam. Verandahs 10 feet wide. Windows on three sides; afford sufficient ventilation. Privy close to the hospital, in part of a building intended for a cook room, but not used on account of the smell. No lavatory. Native sick wash in the open air "according to their custom." Or they go to their huts for ablution. There are bathing tubs.</p>
BOMBAY PRESIDENCY. RAJCOTE.	<p>Accommodation for one regiment native infantry, one squadron cavalry, and a detachment of artillery.</p> <p>Site about 450 feet above the sea level, and 100 feet above the country, which is a vast undulating stony plain. The town of Rajcote, with 7,000 inhabitants, half a mile distant. The</p>

STATIONS.	REPLIES.
SEROOR.	<p>surface black soil; stony subsoil, with underlying sandstone and trap. Climate on the whole healthy. Highest mean maximum temperature 99°·1 in May. Lowest mean minimum 58°·7 in January. Mean daily range from 4°·8 to 21°·3.</p> <p>Water supply from rivers, but chiefly from wells, which, unless constantly used, become very foul from pigeons' dung and rubbish from their nests. No analysis. Water is raised by leather bucket and rope, and distributed by bullocks.</p> <p>The huts are constructed of unburnt bricks and mud, roofed with tiles. Dimensions various. No windows or verandahs. Doors the only ventilators. Ventilation might be better. No lavatories. No cook-houses. No latrines. Filth removed by sweepers. No drainage. Rain-fall lies on the black soil.</p> <p>Bazaar drained into a nullah. No artificial drainage. Ventilation indifferent. Water supply "good." Great want of cleanliness. No latrines. Bazaar overcrowded.</p> <p>Prevailing disease among native population: intermittent fever. Skin diseases not uncommon. Cholera occasional. Healthiness of population attributable to fine climate. Sickness, when prevalent, to filth of houses and streets, and entire want of ventilation.</p> <p>Among native troops there have been five cases of scorbutus in two years. No liver disease. Venereal disease has formed 2·9 per cent. of admissions. Prevailing diseases: ephemerical and intermittent fever, yielding together 67 per cent. of the admissions, and 26·6 per cent. of the deaths. Rheumatism; dysentery, rare. Neither cholera nor small-pox. Fevers occur in the transition from wet to dry weather. Health of the troops might be improved if Government rations were issued, as they hoard their pay and do not procure sufficient food. Ventilation of huts is also required. Native troops temperate. No admissions directly or indirectly from intemperance. No means of instruction or recreation, except a library and <i>gymkhana</i>, supported by European officers.</p> <p>There are two hospitals, with one ward in each. No limitation as to number of beds. Sites healthy. Water abundant. No drainage. Materials: sandstone and chunam. Verandahs. Floors 18 inches above the ground. Ventilation by opposite doors and windows, sufficient when wards are not crowded. Privy 17 yards from hospital, cleaned out every morning. No lavatory. Tepid baths available. Wooden cots; iron better. No kitchens or diet tables. One hospital orderly, with servants. Comrades allowed when necessary. Native women will scarcely submit to any medical treatment. But sick children are frequently brought to the medical officer.</p> <p>Accommodation for 400 irregular cavalry, 25 native commissioned, and 32 non-commissioned officers.</p> <p>The station is 1,752 feet above the sea, and on the level of the adjacent country, open and exposed to winds. The most prevalent of which is the sea breeze.</p> <p>Town of Seroor, with 7,000 inhabitants, contiguous to the lines.</p> <p>Subsoil trap rock.</p> <p>Climate dry except during monsoon. Influence on health favourable.</p> <p>Highest mean maximum temperature, 107° F. in April. Lowest mean minimum 50° F. in December and January.</p> <p>Water supply unlimited, from the river Goar. Water hard, but very good. No analysis.</p> <p>There are no barracks, only huts. Principal streets of bazaar kept clean, but the native houses generally exhibit carelessness and negligence as to repair. Fever is usually prevalent among the native population after the monsoon. Cholera and small-pox the most frequent epidemics. The comparative healthiness of Seroor is due to open situation and the absence of sources of malaria.</p> <p>Among the troops intermittent fever is prevalent. Cholera is epidemic in the hot season. There is a little mild dysentery. Chronic rheumatism is the chief cause of admission into hospital during the cold months. 27 per cent. of the admissions and 18 per cent. of the deaths are due to fever. 4 per cent. of the admissions and 20 per cent. of the deaths are due to cholera. No admissions to hospital from intemperance. No case of drunkenness on record. There are 6 or 8 cases of venereal disease in the year.</p> <p>The hospital is a detached bungalow on an open freely ventilated site. Water from wells. No drainage. Impurities removed by sweepers. The hospital is built of burnt bricks. It is on one floor, with a verandah 6 feet wide. Ventilation by open doors and windows. No lavatories or means of bathing.</p>
DHOOLIA.	<p>Station in a valley 1,000 feet above the level of the sea. Partially cultivated. Black soil with moorum subsoil.</p> <p>Climate hot and muggy. Seems beneficial to health of native troops. Highest mean maximum, 101°·39 F. in May. Lowest mean minimum, 60°·7 in December. Mean sun temperature as high as 115° F. in May.</p> <p>Water supply from rivers and wells. Abundant. Colour, "rather blue." Soft and of good quality.</p> <p>Accommodation consists of 372 native huts and pendalls (open sheds). Men place their bedding on the ground. Materials, burnt brick. Roofs, double tiled. Floors of moorum. Pendalls should have ventilators in the roof. No lavatories nor cook-houses. No privies nor urinals. No drainage. Cleansing efficiently done by sweepers; the refuse used for brickmaking.</p> <p>Bazaar clean; not crowded.</p> <p>Most prevalent diseases at station, fevers, cholera, and spleen disease. Population said to be "healthy" from pure air and good water. <i>Diseases of native troops</i>:—Liver, very insignificant; sick from venereal, 1 in 40. Most common disease, quotidian fever. Fevers occasion about 55 per cent. of the total admissions. Cholera occurs every hot season.</p> <p>Troops temperate. No confirmed drunkards.</p> <p>No means of instruction, except regimental schools. No means of recreation. Troops amuse themselves with quoits and skittles. Not restricted to barracks, either for sun or rain. Native troops should be instructed in field works, road making, making their own clothes, boots, &c., building huts.</p> <p>Hospital consists of one centre room, with a verandah; 12 beds. About 925 cubic feet per bed. Verandah will hold 20. Verandah beds would have about 185 cubic feet per bed. Accommodation too small. No means of ventilation but doors and windows. No drainage. Privies cleansed daily. No lavatories or baths. Common wooden bedsteads. Sepoys bring their own bedding, including two clean sheets. Cooking in an open shed. Attendants, a hospital orderly, a comrade to nurse when required.</p>

STATIONS.	REPLIES.
<p>DAPOOLEE.</p>	<p>Site in a hilly country, between the western coast and the ghats. Dry during the monsoon, swampy in rains. 600 feet above the sea level. Sea, nine miles west. Soil, volcanic; laterite, decomposed trap.</p> <p>Climate consists of three seasons. Cold, December to February; hot, March to June; rainy, June to October. Rheumatism and chest affections prevail in the rains.</p> <p>Water derived from wells. Amount varies with the season. There are 77 wells for a population of 3,425.</p> <p>Accommodation consists of 358 huts; one per man. They are 18 feet long, 8 feet broad, and 10 feet high. They have a door and opening opposite for ventilation. Size too small for families; and they are overcrowded.</p> <p>No sewerage. Dampness pervades every building during the monsoon. No lavatories. Cleansing tolerable.</p> <p>Bazaar has only surface drainage to the nullahs. Water tolerably plentiful. Five labourers employed for cleansing. Dung or dirt heaps are common. Crowding considerable. Among the native population little disease in hot and cold seasons. In rainy season diarrhoea, dysentery, and chest complaints; cholera, choleraic diarrhoea, measles, small-pox occur at intervals. Fever "attributed to insufficient food, exposure, and hard labour." Cholera, measles, and small pox, "to unripe fruit, contagion and unknown causes, chiefly atmospheric."</p> <p>Among the troops there is very little hepatic disease; no syphilis; quotidian intermittent occasions about 28 per cent. of the admissions, and rheumatism about 11 per cent.</p> <p>The sepoys are temperate. No confirmed drunkards.</p> <p>There is a native school, but no other means of instruction. No means of recreation, except plenty of shade.</p> <p>Hospital on a good site; supplied with well water from two wells in the compound. No drainage. On one floor; no ventilation beneath the floor, which is composed of hard beaten earth, "cow-dunged every week." There are two wards containing 30 beds each, at 1,250 cubic feet per bed. Materials, laterite stone, with lime plaster. A verandah 8 feet wide. No means of ventilation except the windows. Wards cleansed once a quarter. Privies are 75 feet from hospital. No drainage nor water. Cleansed by sweepers. No lavatory. There is a bath room, with means of heating water for each ward, but they are never used by native sick. Their usual way of bathing is to throw hot or cold water over themselves. Bedsteads of wood, infested with bugs. Iron ones should be introduced. Native sick use their own bedding. Two cook-rooms for castes to each wing. No apparatus. The sick either cook for themselves or a Brahmin cook does so. Attendance by an orderly from the corps, and a comrade when required.</p>
<p>JACOBABAD.</p>	<p>There is at this station accommodation for 2,400 native cavalry, and 1,600 native infantry. It has an elevation of 220 feet above the sea.</p> <p>The surrounding country is desert, flat, sandy, and dry.</p> <p>Climate said to be the driest in the world. The highest rainfall in any year since 1851 has been 8 inches; the lowest 2½ inches. Summer heat excessive. Mean temperature from April till end of October varies from 80° to 99° F. The variation is very great, and the climate "totally unfit for European soldiers."</p> <p>Water is brought in canals from the Indus, 52 miles distant, and stored in tanks. There are wells supplied by soakage of this water. It is raised by the Persian wheel and buckets. It is yellow at first, but becomes clear on standing. Amount sufficient. Quality not injurious to health.</p> <p>Bazaar kept "scrupulously clean." Country thinly populated. Prevailing country fever: intermittent, quotidian, tertian, complicated in winter and spring with chest diseases; diarrhoea and dysentery; spleen disease common; chronic rheumatism frequent.</p> <p>Among the troops there is little hepatic disease. Annual proportion of admissions from syphilis less than 15 per 1,000 of admissions. Endemic fever the chief disease. Dysentery not very frequent. Cholera unknown. Only one apparently sporadic case in six years. Small-pox rare. Chronic rheumatism and neuralgia "common."</p> <p>Troops accommodated in pendalls, which give 612 cubic feet and 72 square feet per man. No windows. Each man has his own door. Men sleep out altogether in the hot weather and inside in the cold.</p> <p>No lavatories; natives wash in the open air, with the aid of bheesties. No cook-houses. Each man has his own cooking arrangements. No privies or urinals. No drainage.</p> <p>Hospital on one floor, built of brick and mud. Verandah all round. Hospital "used more as a dispensary—only the worst cases requiring constant attendance being kept in it; these are placed wherever it is coolest." Ventilation said to be "good." Water supply from the same source as in barracks. No drainage. Refuse water and other impurities removed by sweepers. No privies. No kitchen. Men "make their own arrangements for cooking." Men "supply their own bedsteads and bedding." No attendance. "When there are bad cases, the patient is allowed to have a comrade." No sanitary defects "to remark upon or improvements to suggest."</p>
<p>DHARWAR.</p>	<p>Accommodation for 900 native infantry.</p> <p>Station 2,482 feet above the sea. Country barren hills; undulating. Said to be one of the healthiest stations in the Bombay Presidency. Climate very good; not very hot; never very cold; occasionally foggy; equable. Geological formation, metamorphic clays, mica schists, &c.</p> <p>Water derived from wells and tanks; said to be "very good and wholesome;" but said "to give rise to guinea worm among the natives." Amount generally sufficient for drinking and cooking, but scanty for other purposes in hot weather.</p> <p>The bazaar is crowded and narrow, with very imperfect ventilation. Said to be clean.</p> <p>Prevailing diseases among natives are fevers, bowel complaints, rheumatism, guinea worm, cholera "every now and then;" scarcely any spleen disease.</p> <p>There are no barracks. Liver disease very rare among native troops. About 8 per cent. of the cases of sickness are guinea worm, supposed to arise from the water. Venereal cases about 8 per cent. Intermittent fever is the most prevalent disease. There are a few cases of mild remittent; very little dysentery. But there is cholera in its most virulent form, and chronic rheumatism is common. Above 77 per cent. of the deaths have been due to cholera, and 4½ per cent. to dysentery. But the total mortality is small.</p> <p>Hospitals, one floor buildings, with verandahs. Ventilation not very good in permanent hospital. Ridge ventilation in temporary hospital answers admirably. Contents of privies removed daily.</p>

ADDITIONAL ADDENDA SUBMITTED BY SIR RANALD MARTIN.

On the SANITARY MANAGEMENT OF EUROPEAN TROOPS in the EAST INDIES, by T. E. DEMPSTER,
Deputy Inspector-General of Hospitals.

In the following notes, which I have now the honour to submit for the consideration of the Royal Commission, it is my design only to refer to subjects on which my personal experience has had a direct bearing, and as this experience has been entirely confined to the Presidency of Bengal, it is only of the customs, climates, and diseases of that portion of the British Indian dominions that I shall presume to speak.

I have never held medical charge of troops on board ship, and therefore the only remark I shall venture to make regarding the sanitary management of soldiers on the voyage to India is, that the fresh European about to encounter the risks of a tropical climate should abstain from the use of ardent spirits in any shape on the voyage, and that stimulants of this kind should only be allowed under special circumstances, and with the express sanction of the medical officer in charge. A moderate allowance of some light wholesome malt liquor may, however, be substituted for the usual spirit ration.

In 1834-35, while in medical charge of the 4th Battalion Bengal European Artillery at Dum Dum, I witnessed such dire effects from the then common practice of landing European recruits in Calcutta in the hot and rainy seasons, that, although a much better system now obtains, I feel myself constrained to reiterate the caution, that all Europeans should leave England so as to ensure their arrival in Bengal during the cold weather. I consider the 15th of November as the earliest safe date of arrival in Calcutta; this will leave three and a half good months, at least, for forwarding the new arrivals to some of the best up-country stations, whether in the plains or in the mountain ranges. Fresh troops may march in the cold season, not only with safety but with advantage. If expedition is required, I presume that good arrangements can now be made for sending them on by railroad; but I strongly object to the *river route*, whether country boats or steamers be employed, for then it is scarcely possible to avoid overcrowding, or to ensure the requisite degree of cleanliness and ventilation. It is well known that large bodies of troops proceeding by the Ganges route are liable to suffer severely from cholera and other diseases, even in the cold season of the year.

The whole of my experience leads me fully to concur with Sir Ranald Martin in the opinion, that fresh European soldiers should be at first located in the hill districts, and that to wait until the constitutions of the men shall have suffered serious deterioration by long exposure to the heat and malarious influences of the plains, and then to send them to the hill stations, is just to reverse the proper order of things. I believe that a residence of two or three years in the hills during the hot and rainy seasons of the year, with drill and exercise in the adjoining plains in the cold weather, would greatly tend to acclimate the newly-arrived European, teach him the habits and modes of life of the Indian soldier, and so render him more tolerant of the effects of the climate when his turn should arrive to serve for a period in the plains.

The duty of keeping meteorological registers at hill stations was, unfortunately, imposed upon the resident medical officers, that is, examination of instruments at regular stated periods was looked for from men whose professional duties rendered such regular examinations altogether impossible. At Darjeeling alone, an excellent set of meteorological instruments was placed under the general superintendence of the resident medical officer, but the observations were made and recorded by an instructed subordinate staff. The Darjeeling register is, therefore, the only one really to be depended on; all the rest are loose and unsatisfactory in the highest degree. This defect has, I believe, been recently remedied by the elaborate and scientific observations of the German brothers Schlagintweit. Their observations on the meteorology of these regions is, doubtless, to be obtained at the India House, and may prove of great value to the present inquiry.

A brief general account of the climate and course of the seasons at the *Landour Convalescent Depot*, perhaps the most healthy of our hill stations, may not be without interest on the present occasion; and I shall commence my rapid sketch from March, the month in which convalescents

from the plains begin to congregate in the hills. March, the beginning of the hot season below, is often cold and changeable at Landour, with sudden showers of rain or hail. With April begins the steady summer weather, which continues until about the 20th of June, when the "chota bursāt," or little rains set in. The maximum summer heat, in a *perfect shade* at Landour seldom rises above 74°, and the diurnal range of the thermometer rarely exceeds three or four degrees. On the other hand, it should be borne in mind, that we are there under an almost tropical sun, whose rays reach us through a rarer and clearer medium than in the plain below; and I have ascertained by repeated experiments (with rude instruments it is true), that the heating power of the ray of the sun is almost as great at Landour as at Meerut; but then, there is no accumulation of reflected heat as in the plains. The lightest fleecy clouds break the force of the sun's ray; the slightest shade secures a cool retreat. At certain turns of the hills, where the bare rock is screened from the cool breeze, and is exposed to the direct rays of the sun, the heat is often very oppressive; and this is especially the case in the "khuds," or steep mountain declivities, and narrow valleys. It thus appears that he who is content to remain chiefly in the shade may enjoy, in the hot season at Landour, one of the most equable and temperate climates in the world; but if he is much out in the sun, and especially if he descend into the neighbouring "khuds" and narrow valleys during the day, and return to the cold mountain tops at sunset, he will subject himself to great and trying alternations of temperature. Agreeable and salutary as such a climate may be to the healthy European, as compared with the burning plain below, he should never forget it is not the climate of his native land. These appear to me to be important considerations to the European resident in general, and to the European invalid in particular. During the summer months the night wind invariably blows from the north, or the direction of the great snowy range. For some time after sunrise it is usually calm, and where the oblique rays of the morning sun fall at right angles to the steep hill sides it is often very hot; but about 10 a.m. a cool refreshing breeze sets in from the south, or from the direction of the heated plain below, which continues until sunset. This cool wind, familiarly known as "the Dhoon breeze," occurs in summer with the same regularity as the well-known "sea breeze" on the Madras coast. But the explanation which accounts for the diurnal cool sea breeze will not serve in the present case. The cause is somewhat obscure. Rain seldom falls at Landour in summer; the sky is generally cloudless, but the atmosphere is often obscured with a dry mist, probably caused by minute particles of dust borne into the upper regions of the air from the hot plain below. Towards the latter third of June, the higher elevations first become enveloped in clouds, and then occur "the little rains." After an interval of variable duration, the regular periodical rainy season sets in, and continues with little intermission until about the 15th or 20th of September. This is the most dreary and unpleasant portion of the year in the hills. Rain falls with a copiousness and persistency altogether unknown in Europe; the air attains its maximum of humidity, and the whole station, often for weeks together, is wrapt in dense clouds.* Some time in September the periodical rains break up, and are succeeded by a season which is by far the most delightful and salubrious of the whole year. The sun has now lost its power; the air is cool and bracing; and the atmosphere has a purity and transparency of which I can convey no adequate conception in words. It is from the commencement of this beautiful season that the invalid usually dates his first real improvement in health. As the year advances towards its close the weather continues clear and steady, but gradually becomes colder and colder until December and January, when the thermometer often stands at or near

* The mean elevations are comparatively free from this inconvenience, and are therefore much less damp in the rainy season. This causes Subathoo to be often resorted to in the rains by invalids, but they avoid it as much too hot in May and June, when the thermometer, in a good house with open doors, often rises to 90°.

the freezing point. Several falls of snow occur during the winter months. The heaviest I ever witnessed took place at Landour on the 20th of February 1842. The first houses erected at Landour were placed on the highest eminences, and were constructed on the model of an ordinary Indian bungalow. These situations are now avoided as too cold and exposed. The favourite sites at present chosen are lower down on the southern face of the hills, and the plan of the buildings is more European, and better adapted to the climate. The northern aspect of the hill is rejected as damp and dreary in the rains, and sunless and often blocked up with snow in the winter season.*

Much has been said and written regarding the effects of the hill climate on the European constitution, and on the class of invalids likely to benefit by a residence at the hill sanitary depôts. All I have seen leads me to sum up the whole question in a very few words, viz., sound European adults, if moderately careful, retain their health and vigour unimpaired at good hill stations; and children, the offspring of pure European parents, are there as joyous, rosy, and active, as in any part of Europe. The young and naturally robust, although reduced by recent illness, and provided they do not labour under serious organic disease, generally recover rapidly and completely in the hills. Slight and recent cases of organic disease, especially if the spleen is the organ affected, often do well; but they require very careful management and a residence of two or more seasons at the sanitary depôts. On the other hand the old and worn out, the afflicted with organic disease of long standing, and those whose constitutions have been seriously impaired by long exposure to a high temperature, instead of deriving benefit will generally find their complaints aggravated by removal to the hills. Such, I believe, to be the general rules which should guide our selection of cases to be sent to the hill stations, to which doubtless there may be some especial exceptions. *Diarrhœa* is the endemic of these elevated regions, but assuredly it was not prevalent at Landour the year I had medical charge of that convalescent depôt. The quality of the water of the hill springs and streams may have something to answer for, but I am inclined to believe that the well known cause of this complaint everywhere, viz., *suppressed perspiration*, is really principally to blame. Most of the European residents have previously had their vital energies reduced by disease or exposure to a high temperature; and on their arrival in the hills they are very liable to have their morbidly sensitive bodies *first overheated, and then suddenly chilled*, under the circumstances set forth above. The grand prophylactic I conceive to be flannel, and especially the broad flannel abdominal binder, worn next the skin. If this should really turn out to be the common cause of bowel complaints at our present hill stations, the risk would be greatly reduced by keeping the men in well chosen localities at a lower elevation; but then certain classes of invalids would lose the curative effects of the cool bracing air of the upper regions.

European regiments which had previously suffered severely at unhealthy stations in the plains, are well known to have lost great numbers of men on being transferred to the hills. I think Her Majesty's 13th and 29th regiments of foot will be found to have furnished striking instances of this nature. I am of opinion that it would have been more judicious to have sent such sickly corps to a healthy locality in the north-west provinces,—such as Meerut,—where there is good barrack accommodation, and ample supplies of excellent meat, bread, fruit, and vegetables.

The following precautions are recommended to be observed by all invalids from the plains proceeding to the more elevated hill convalescent depôts,—such as Landour and Darjeeling. The ascent should be made in a slow and gradual manner, and the patient should be provided with an ample supply of warm clothing,—including flannel shirt and abdominal binder,—to put on as he comes into the upper and colder regions. If the invalid is much reduced in strength, and especially if he is labouring under disease of internal organs, the whole ascent should not be accomplished at once; but he should remain for a day or two at some convenient mean elevation, where proper shelter should be provided for the sick. It is at such half-way house that a complete change of clothing should be made before ascending to the highest point. Invalids often perform the whole journey from Rajpore, at the foot of the hills north of Deyrah, to the depôt hospital at Landour (about 7,600 feet above the level of the ocean),—*in less than four hours!* In this short space of time they exchange the

heat of the plains of India for an almost European climate, and a greatly reduced atmospheric pressure. That the robust and healthy human frame should be able immediately to accommodate itself to such entirely new conditions, without injury to its delicate and complex organism, is surely one of the wonders of nature. But when the body is enfeebled by sickness, and vital organs in a state of actual disease, this sudden plunge into a cold and rare atmosphere is too apt to chill the surface, disturb the balance of circulation, and cause congestion of weak internal organs. Nor is it surprising that serious derangement, or even fatal mischief, should occasionally result from such an ordeal.

The same general precautions should be observed by corps ascending the hills, more especially that one which relates to a proper change of clothing on attaining a certain altitude. I am persuaded that not a little of the blame that has been cast on the hill climate is fairly to be ascribed to a neglect of the above obvious and reasonable precautions.

I am well aware of the objections which may be urged to the proposal to locate a large proportion of our European troops in the hill districts of the Bengal presidency. These are:—The absence of extensive table land in the lower Himalayan ranges; the difficulty of finding a sufficient number of easily accessible sites, of the required elevations, among such rugged and precipitous mountains; the difficulty and expense of properly feeding European troops in such situations; and the dangerous character of the "Terai" jungle to be traversed before some parts of the lower ranges can be reached. But I am convinced that many eligible sites may be discovered in this and other parts of the country, if searched for in a proper manner; and that all the other objections can be mainly obviated by the construction of branch railroads up to the foot of the hills.

But supposing the search for eligible sites in the hills to have been attended with complete success, I much fear it will still be necessary, for years to come, to retain a considerable number of European troops in the plains, to overawe by their visible presence populous turbulent cities, or disaffected districts, and in such a case the sanitary management of Europeans in the plains of India must still remain a subject of vital importance.

Of all the deaths of European soldiers which I have witnessed in India the great majority have occurred from diseases of undoubted malarious origin and their sequelæ. The first and most indispensable rule, therefore, for preserving the health of the British soldier in the plains, must ever be to place him in as good and healthy a locality as possible. And I would here especially direct attention to the fact, that there are few districts in the north-west and central provinces of Bengal which are either wholly good or wholly bad; that in almost every district unhealthy and comparatively healthy localities exist; and, that unhappily, we have too often chosen the *former* as a site for our European cantonments. This, I believe, to be especially true with respect to Cawnpore, Kurnool, Dinapore, Delhi, Ghazee-pore, &c. Nearly all these stations are irretrievably vicious, and yet I believe good localities exist at no great distance from every one of them. The *close proximity* of some of the worst and some of the best localities, examined by the Canal Sanitary Committee, was one of the most curious and important facts elicited by that inquiry. With regard to rules for the selection of proper sites in the plains for standing camps or cantonments, I have nothing to add to what I have already written on this subject in the Appendix to the Report of the Canal Sanitary Committee, and in the note forwarded by Sir Ranald Martin to the Court of Directors.

A proper site being found, the next considerations are, accommodation, ventilation, personal and local cleanliness, clothing, food, use and abuse of stimulating drinks, exercise, and amusements; and on each of these important points I would offer such brief remarks as my experience in India suggests.

Barrack Accommodation.—Of the old style of barracks in the upper provinces, now so universally condemned, I need not here speak; they are, it is hoped, among the old things that have passed away. I have a personal knowledge of the new European barracks at Umballa, erected by Sir R. Napier, the horse artillery and infantry barracks at Meerut,* and the new horse artillery barracks at Loodiana, all of which, if properly ventilated, I consider generally good. Although all built of a single story, they are lofty and spacious,—stand on terraces raised from six to ten feet above the general level of the ground, and are supposed to afford about 1,000 cubic feet of air to each inmate. They have all deep double verandahs, the inner one being furnished

* I am no professed geologist, but I can state from my own observation that Landour is situated on stratified rocks of the metamorphic series, which are covered with a scant and not very fertile soil; and that the ground generally is very lightly timbered, and almost free from underwood.

* The European cavalry barrack at Meerut is wretched, and ought to have been abandoned years ago.

with well-fitting glass doors all round. I have not seen the new barracks erected in the Punjab under the auspices of the late Sir Charles Napier, but believe they are still better than those above referred to. Such accommodation, with due attention to safe ventilation, leaves little further to desire as far as the unmarried soldier is concerned. But wherever I have been the arrangements for the accommodation of the *married man* and *his family* have been most defective. At Dinapore, so recently as 1856, I found the married men of Her Majesty's 10th regiment living in a range of low out-houses, close to the public necessities, and in a filthy ill-drained locality.

On my recommendation Government hired an ample private barrack for their accommodation; but had the married families themselves been consulted, I strongly suspect they would have rather remained and endured the inconveniences of the locality from which I caused them to be removed, for reasons to be noticed hereafter. At some stations a whole or portion of a barrack is assigned to the married men of a regiment, and the space divided off into separate compartments for each family by means of *low cloth screens*. This expedient interferes with ventilation and cleanliness, and goes but a small way to secure the decent privacy of a married family. At other places the separate compartments are formed with low slight brick walls, which leave all the space above open, so as to permit the large barrack "punkahs" to swing freely over two or more of them. This is a somewhat better arrangement, both for decency and cleanliness. Constructed as up-country barracks now are, and probably must continue to be, it is only by adopting such like expedients that the married families can be accommodated within the walls of the main buildings. But I have generally found that the married soldier is ready to submit to almost any other inconvenience to secure a detached lodging for his family, where his conversation is not overheard, and the ears of his wife and children are unassailed by the too common ribaldry and obscenity of the adjoining "unmarried" barrack room. Many of the steady married men of the Company's European artillery obtained permission to reside in small detached private bungalows in the rear of the barracks. Such a group of bungalows or huts constitute what in Anglo-Indian barrack language is called a "*Patchery*," probably a corruption of the Hindoostanee word "pechāree," "behind or in the rear." The desire of married men to remove their families from the contamination of barrack life is surely most right and praiseworthy, and, therefore, I think it would be well to place such families in small detached bungalows, at a convenient distance from the barracks. Such erections might be slight and not expensive, the chief points to be attended to being a good site, a good thick, lofty, and projecting *thatched roof*, and a clear space in the direction of the prevailing winds. All unthatched *small* buildings are altogether uninhabitable by Europeans in the hot season. The whole of this subject, viz., the proper accommodation of married soldiers, is worthy of far more attention than it has yet received in India. Important as good barrack accommodation unquestionably is, a well chosen locality is of more importance still. I have met several striking instances, in which the troops lodged in the very *worst* barrack suffered in unhealthy seasons far less than those living in the *best*, at the same station, simply because the former had the advantage in certain local conditions.

Ventilation.—If the necessity of good ventilation is now fully recognised in Europe, its importance cannot be over-estimated in India, where the exciting causes of endemic and epidemic disease are so much more active and virulent. I beg to submit a separate minute on cooling, agitating, and renewing the air of barracks and hospitals in the upper provinces of the Bengal Presidency. I shall only further remark, in this place, that wherever the exigencies of the service may oblige troops, for a time, to occupy an insufficient space, the grand antidote to contingent mischief is a good and safe system of ventilation.

Personal and local cleanliness are also sanitary considerations, the importance of which becomes greatly enhanced in a climate in which the secretions from the surface of the body are so profuse and irritating, and all dead animal matter so rapidly undergoes decomposition. All Anglo-Indians of the upper classes, not actually ill, daily use either a bath of some kind, or perform equivalent spongings and ablutions of other parts of the body than merely the hands and face. So essential is this generally considered to the health and comfort of the European resident, that there is not a private house, or even staging bungalow anywhere to be found, which does not possess a *bath room* as an indispensable adjunct. Until of late years, however, the European private in his barrack had no proper means at his disposal of so keeping his person clean. A

few of the men bathed in the neighbouring muddy tanks and rivers, but the great majority adhered to the good old English custom of washing the face and hands once a day, and the feet as seldom as possible. Some years ago, however, a movement set in in a different direction, and the necessity of providing proper wash-houses for European barracks was generally admitted. When I left Meerut, in 1854, admirable arrangements of this nature had just been completed for some of the barracks at that station. A wash-house for the artillery hospital was about to be commenced, but when I came away my simple and cheap expedients remained just as I had originally planned them. On joining the Dinapore division as superintending surgeon, in 1855, I found both barracks and hospitals absolutely destitute of regular wash-houses; and the one I got built for the Dinapore European hospital was the first thing of the kind ever erected in those provinces. When transferred to the Cawnpore circle, in 1856, I found things precisely as at Dinapore; and I was surprised to learn that it had never been the custom to "indent" for *soap* for the personal use of the sick. Heretofore, a few tubs of water and a few "rack-towels" had been placed at one end of the hospital verandah, neither of which could be taken to the bedside of a patient unable to rise. I pointed out to medical officers that there was no occasion to wait the erection of expensive wash-houses, and how simple a matter it was to secure for the sick ample means of performing daily personal ablutions. It was only necessary to clear out a side room or out-house, to procure a few rude long tables and benches, a supply of cheap country earthenware basins and water-pots, bar soap cut into squares, tin soap-dishes, a good stock of coarse country cotton towels, and the whole was complete. All these articles I took upon myself, as superintending surgeon, at once to pass and sanction.

Bathing.—A good plunge or swimming bath is a troublesome and expensive affair, and as it can only be used with safety by the most healthy, vigorous, and temperate of the men, I am inclined to dispense with it altogether. The ordinary Indian "*douche*" or *affusion bath* is comparatively safe, while it is, at the same time, simple and easily managed in the extreme. A number of water-pots of convenient size, and made of the very cheap country porous earthenware, are placed on a bench, or on the floor of the bathing room or tent. If a cold bath is to be used, the porous water-pots are filled the night before; if a temperate bath is desired, the pots are filled just before being used. Tepid affusion is easily managed by adding the necessary quantity of hot water. But, in general, the pot of cold or temperate water is lifted up by the bather himself, and emptied over his head and naked body, a second, third, or fourth pot following in rapid succession. The body is then quickly dried and vigorously rubbed with coarse cotton towels; reaction speedily follows; and a safe, refreshing, and invigorating bath is completed.

During the *hot* season in the plains, such a bath as that above described,—if superintended by an intelligent non-commissioned officer,—may be used with comfort and benefit, under ordinary circumstances, by a majority of the men. I have given the above details to show how cheap and simple are the means, and how easily the arrangements can be made wherever there is a good well and a supply of earthenware water-pots, that is to say, in almost every inhabited part of the country. A spare tent can always be turned into a convenient enough bathing room in camp. The weak and sickly, the afflicted with organic disease of any kind, and the confirmed drunkard, must, of course, avoid cold affusion altogether. Still, they too should observe personal cleanliness, and wash parts of the body cautiously and in succession with tepid water. The condition of all such persons ought to be fully known to the medical officers of the regiment, who can, without much additional trouble, at the regular medical inspections, class the men for the different kinds of ablutions. Very simple and efficient arrangements can also be made to enable all to wash the feet, nates, and genitals, in cold or tepid water; but I shall again advert to this point when I come to speak of the prevention of syphilitic and other sores on these parts. Whatever is really conducive to strict personal cleanliness in a hot climate can never be deemed trifling or unimportant, therefore I have no hesitation in here recommending for general adoption in the barracks, a decent and salutary custom, borrowed from the natives of India, and universally practised by all Anglo-Indians of the upper classes, viz., to wash with pure water whenever the bowels are moved. Arrangements for conveniently doing this are of the simplest possible nature.

Local Cleanliness.—Of late years attention has been much directed in India to the necessity of proper conser-

vancy arrangements, in and about barracks and military cantonments generally. Commanding officers are no longer content to see that nothing is done to offend the eye, but efficient establishments have been entertained to regularly collect and remove all offensive matter to a safe distance. The habits of the natives in the sepoy lines, and in the regimental and station bazaars however, still present formidable difficulties to a complete conservancy system. The native of India, though cleanly in his own person, is disposed to leave all the rest to the care of such scavengers as the pigs, kites, vultures, &c.

Food and Drink.—The English are notorious for adhering to their national customs and modes of life in all parts of the globe. When I visited the Mauritius in 1832, it was generally understood that the English residents, including the garrison, were then suffering much from various forms of tropical disease, while the French and Creole inhabitants of the island were comparatively healthy. The English, it was said, ate, drank, slept, and walked abroad pretty much as they had been accustomed to do at home; but the French and Creoles, on the other hand, rose early for outdoor work or exercise, partook sparingly of concentrated foods and stimulant drinks, and in other respects adopted habits more suited to the tropical climate in which they were living. Such was the story told, and the explanation given of it, on the spot; but whether strictly true or not, it unquestionably points to a sanitary truth of grave import. I do not mean to assert that the Englishman in India should live precisely as the native of the country does, for the conditions are not the same, each differing from the other in race, inherited temperament, and acquired habits; but without pinning my faith to all the modern chemical theories of alimentary substances, I do maintain that both instinct and wide experience teach that the former cannot, with safety, either eat or drink in India as he did in England, and that the same quantity of animal food and stimulant drinks, taken with advantage by a *working* man in a cold moist climate, is not only unnecessary, but positively injurious to the *almost idle* European soldier in the burning plains of Hindostan. Of the recruits drawn from Ireland and Scotland, it is certain that the majority must eat in the hot weather in India *many times the bulk of animal food* ever consumed in their native country while working hardest in the coldest season of the year. The same, however, cannot perhaps be said of the consumption of ardent spirits.

The raw materials supplied by the commissariat as food for the troops in India have been greatly improved of late years, and especially since the promulgation of Lord Dalhousie's orders on this subject. Not only are the beef, mutton, and bread of better quality, but a liberal supply of the vegetables of the season has been added to the soldier's ration. The power to reject inferior or unwholesome articles of food now rests entirely with the officers of European regiments. It was not so in former times. The present scale of barrack diet is ample, and not improper for men using active exercise in the cold weather; but I am strongly impressed that too large a quantity of *concentrated "nitrogenous"* aliment is consumed by men confined to an up-country barrack, and leading a life of monotonous inaction, during the long dreary months of the hot and rainy seasons in the plains. A good *barrack dietary* for the *hot season* is still, I think, a great desideratum; and I am persuaded that there is always to be found abundant material, if properly dressed, to furnish such a variety of wholesome, palatable, but *not too nutritious* food, as would render it easy considerably to reduce the allowance of solid beef and mutton, without trenching on the real comfort of the men. Of good food there is now no deficiency, but a good wholesome system of cookery is still a great want. The soup and boiled beef have long disappeared from the mess tables of the Company's European troops, and their daily bill of fare presents a sufficient variety of dishes; but the cookery is generally of a very objectionable character, all meat being made into rich pies, or hot curries, or fried with fat in common frying pans. Beyond this, their barrack culinary art does not at present go. While on the subject of food, I must not neglect to warn all concerned against the use of the flesh of the *common village swine*. The natives of India, as the Israelites of old, go beyond the camp to relieve the calls of nature, but they do not observe the salutary Mosaic injunction, to have a paddle on their weapon and "turn back and cover that which cometh from them." The ground so defiled is generally quickly cleared by herds of swine, literally fed upon human ordure, which they devour with surprising greediness. The men of newly arrived European regiments, if not duly cautioned, are often delighted to find both *pork* and *bacon* so abundant and cheap everywhere; and much to the horror of the high caste Hindoos and Mussulmans, and not

a little to the scandal of the old Anglo-Indian, a number of these disgusting country pigs have sometimes been permitted to follow in the rear of a British regiment as part of its "flocks and herds." I need not say that all such "*ordure fed*" pork and bacon should be strictly interdicted as unwholesome in the highest degree. Such food is looked upon by old European residents with as much disgust as by the Jews or Mussulmans. Strange to say, the Indian *sheep* too, if not watched and properly fed, is scarcely more cleanly in this respect than the pig; and it becomes necessary to ascertain that sheep killed for the use of the men have been well and properly nurtured.

Consumption of Ardent Spirits.—This is a subject on which I have long looked with deep and painful interest. I have lived too long with European troops in India not fully to coincide with Dr. J. Johnston and Sir Ranald Martin when they say, "that as drunkenness leads in a moral point of view to every crime, so in a physical point of view, it promotes the invasion, and retards the cure of every tropical or other disease." In this sense, the abuse of ardent spirits has been the fertile source of a large amount of the moral and physical degradation I have witnessed among my countrymen in the East. Fully persuaded of this, I considered it my duty, so long ago as 1836, at Agra, to endeavour to establish a society among the men of the 4th battalion of artillery, the members of which pledged themselves to abstain altogether from the use of spirits in any shape; a fair number joined, and for a time it seemed to promise well; but the officers of the corps looked coldly on, and the scheme, after a trial, fell to the ground. Years afterwards a temperance movement was renewed at Meerut, in the 1st brigade, horse artillery, and this time the officers were its chief promoters. The detestable *morning dram* was abolished altogether, and no spirits allowed until *after dinner*. This was a great step in the right direction, for I have never known either officer or man who *could not dispense* with a dram of raw spirits when he got up, who did not go to bed drunk, if he had the means of doing so. The men were encouraged to receive a money compensation in lieu of spirit rations, or to drink a certain quantity of good ale or porter instead of rum. After a time I learnt that only 20 men of Major Dave's troop (2nd troop, 1st brigade, horse-artillery,) drew spirit rations, and that all the rest either drank a moderate quantity of ale, or abstained from stimulants altogether. The effect of all this on the health, efficiency, and good conduct of the men was excellent. I had never before seen European troops in India in so good a condition in all respects. This troop had arrived from the sickly station of Loodiana with 50 per cent. actually in hospital; and after a residence of nearly four years at Meerut, where the above-mentioned reformation took place, they marched to Sealkote *with a clean bill of health*; no death having occurred among the men for a period of two years. I have no records to refer to at present, but the above is, I believe, substantially a true and faithful statement of what then took place. In congratulating ourselves on the results of this temperance movement, however, it is but fair to state that Meerut is one of our most healthy localities.

At the Landour convalescent dépôt not a drop of spirits is allowed to the men unless prescribed by the medical officer in charge. This salutary regulation was originally enforced at the recommendation of a most admirable military surgeon, Dr. Robinson, then surgeon of Her Majesty's 13th foot, and for which he is said to have incurred so much odium, that some of the old confirmed drunkards attempted one night to cast him over the precipice. However, he carried his point, and I can fully testify to the great benefit of this judicious regulation to the health of the convalescents. Although I am of opinion that the freshly arrived European does best to confine himself to pure cold water or slightly acidulated drinks, yet if good malt liquor is only to be considered a substitute for rum, I would advocate its use from the very first. After several years' residence in India, good pale ale is often drank with advantage; and to the weak anæmic female in India, it is often one of the real necessities of life. My testimony on this point may be of more value from the consideration that I have no personal predilection for malt liquor, having never been able to drink it in my life. Beer or ale is however an expensive and bulky article to carry, as compared with spirits. Great care and attention is also required in transporting it up country, large quantities having become bad and undrinkable on reaching the commissariat stores at Meerut by the old modes of conveyance. But *railroads* should now be able mainly to obviate this objection to supply the troops with ale or porter instead of rum. A good wholesome beer is now brewed in the hills; but as yet the price is too high, and the quantity too limited for general regimental use.

Clothing.—If the European is out in the open air before sunrise in the cold season of the upper provinces, he will experience the *sensation of cold* even more acutely than he ever did at home in ordinary winter weather, and will confess that good warm clothing is at least equally necessary in both situations. The temperature of the early morning air is not very low, it is true, as measured by the thermometer, probably from 36° to 40°; and, occasionally, it touches the freezing point; but the heat in a tent at 2 p. m. of the same day will often be found from 70° to 80°. Even in the cold season it is found necessary to begin a march before sunrise, so as to reach the new ground before the sun is very high; and this extensive diurnal range renders the European system morbidly sensitive to the morning cold. I say the *European* system, for it has often excited my wonder on a march to see robust horse artillerymen dismount from their horses at the first halt benumbed with cold, and running up and down to restore the circulation in their extremities, while half naked native children were playing about as if nothing unusual were the matter; but if a good supply of warm clothing is necessary in the cold, light cotton garments are equally indispensable in the hot, dry, and rainy seasons. And here I would especially urge the necessity, *at such seasons*, of keeping the soldier's *neck* in every situation as free and unincumbered as the neck of the British sailor is at all times. Nothing so much interferes with the comfort and free action of the whole body as any warm, tight, or stiff covering round the neck. Who has not experienced the relief of removing a hot neckcloth, and opening the shirt collar after being overheated? A turnover collar loosely tied with a narrow black band, is surely as graceful and seemly as any military stock ever invented.

Flannel.—A good deal of difference of opinion exists among experienced medical men as to the necessity of wearing flannel next the skin in India. I venture to give the following as the result of my own experience. If the robust and healthy European has never worn flannel at home, he may continue to dispense with it on his first arrival in India. The coarse flannel supplied for the use of the British soldier is very apt to irritate the skin, produce profuse perspiration, and so cause more harm than good, and this is especially the case if it be of the sort that *shrinks on washing*, and flannel in India must be well and frequently washed. But after a residence of a few years, when the system has been lowered and rendered sensitive to all atmospheric changes, a good *light* flannel shirt worn next the skin is unquestionably an excellent safeguard against contingent evil. A proper fabric of this kind is procurable by the more wealthy classes; but I have never seen any flannel served out to the soldier in India that his officer could be induced to bear next his own skin in really hot weather. This is a point which I am sure calls for attention and remedy. I succeeded in effecting a sort of compromise with many of the men under my medical care, who had suffered from fever or bowel complaint, viz., by not insisting on the flannel *shirt*, and so inducing them to wear the flannel *abdominal binder*, this I am persuaded was often attended with the best results.

Exercise and Amusement.—On these important subjects I have but a very few words to add to the excellent observations to be found in Sir. R. Martin's "Influence of Tropical Climates." The question is often asked, should the European soldier be strictly confined within the walls of his barrack during the heat of the day in the warm weather, or may he be permitted occasionally to walk abroad, as in other and more temperate climates? The alternative will be found a perplexing one. If you confine him to his barrack-room, how is the uneducated man to get through the long dreary day? The officer has walked or ridden out in the early morning; on his return home he has looked in at "the coffee-shop" or reading-room, and has seen and conversed with persons not always before his eyes. During the day he visits his friends, spends some time at the billiard-room, or more profitably employs his time in reading, or other intellectual amusements at home. But the uneducated soldier, shut up in his barrack, has literally nothing to do but to lie down and try to sleep,* until the hour shall come for dinner, and the long-looked-

for *drum* to relieve, for a short period, his utter vacuity of mind and lassitude of body. Rather than force men to lead such a life, is it not better, say many well-informed persons, to give the soldier a reasonable indulgence to walk abroad, even in the heat of the day, not buttoned up to the throat and in red regimental jackets as some martinets will have it, but in loose white cotton clothes, open collars, and proper white covers to their caps. But *where* are the men to go? They have no acquaintances to visit, few out-door amusements to join; and it is too likely they will find their way to the nearest bazaar, and add the dangers of intoxication and other debauchery to that of a fierce tropical sun.

The whole case is truly a perplexing and pitiable one, and loudly calls for the humane and judicious consideration of all interested in the welfare of the British soldier in the East.

I have, &c.

T. E. DEMPSTER,
Late Superintending-Surgeon,
Bengal Establishment.

ADDENDA.

No. 1.

PREVENTION of SYPHILITIC and other DISEASES of the GENITALS.

THIS is, in every point of view, a subject of importance to the health and general efficiency of a regiment. According to my experience, certain forms of disease of this class keep men longer from duty than any other complaint to which the soldier is especially exposed.

In India it is hardly possible for the European soldier to have intercourse with any females but those of a recognized and well-known class, whose numbers and names can at all times be correctly ascertained by the police; and it would not be difficult, through the agency of an intelligent sub-assistant surgeon or native doctor, quickly to detect the first appearance of disease among them, and so to guard the men from contamination. When I first arrived in India there were Lock hospitals at every large European military station, under the superintendence of one of the medical officers of the place, but the duty involved was a disgusting one, was ill or carelessly performed, and did very little good. Such hospitals were abolished a great many years ago.

In conducting the usual medical examinations, I have often been shocked, especially in very hot weather, to observe the filthy state of the persons of many of the unmarried men; but they had a ready and reasonable excuse to offer. How could they keep their persons properly clean without indecent exposure, seeing that there were no private wash-houses and no place in which they could perform ablutions but *an open barrack verandah*? I am well satisfied that this state of things is one of the great predisposing causes of syphilitic disease,—for integuments in a state of irritation, and often partially excoriated by increased and unremoved natural secretions, are precisely in a condition to be at once inoculated by the slightest contact with venereal virus of any kind.

The remedies I propose are as follows:—

1st. To conduct the usual medical examinations of the unmarried men with much regularity and care.

2ndly. To subject the public women to a similar examination, through the agency of a sub-assistant surgeon or native doctor of trustworthy character, and who should be held responsible for any extensive undetected disease.

3rdly. To cause all the men to *wash the genitals in cold or tepid water, at regular stated periods, during the hot season, and to afford them the ready means of at once doing so after suspicious contact*. A few simple verbal cautions may be communicated by medical officers to men who will expose themselves to such risks.

If all this were strictly attended to, I am persuaded two-thirds of the disease, which at present renders so many of the men inefficient,* might be effectually prevented.

Of course, I have only dealt with the physical, not the moral prevention of disease of the nature under consideration.

T. E. DEMPSTER,
Late Superintending Surgeon,
Bengal Establishment.

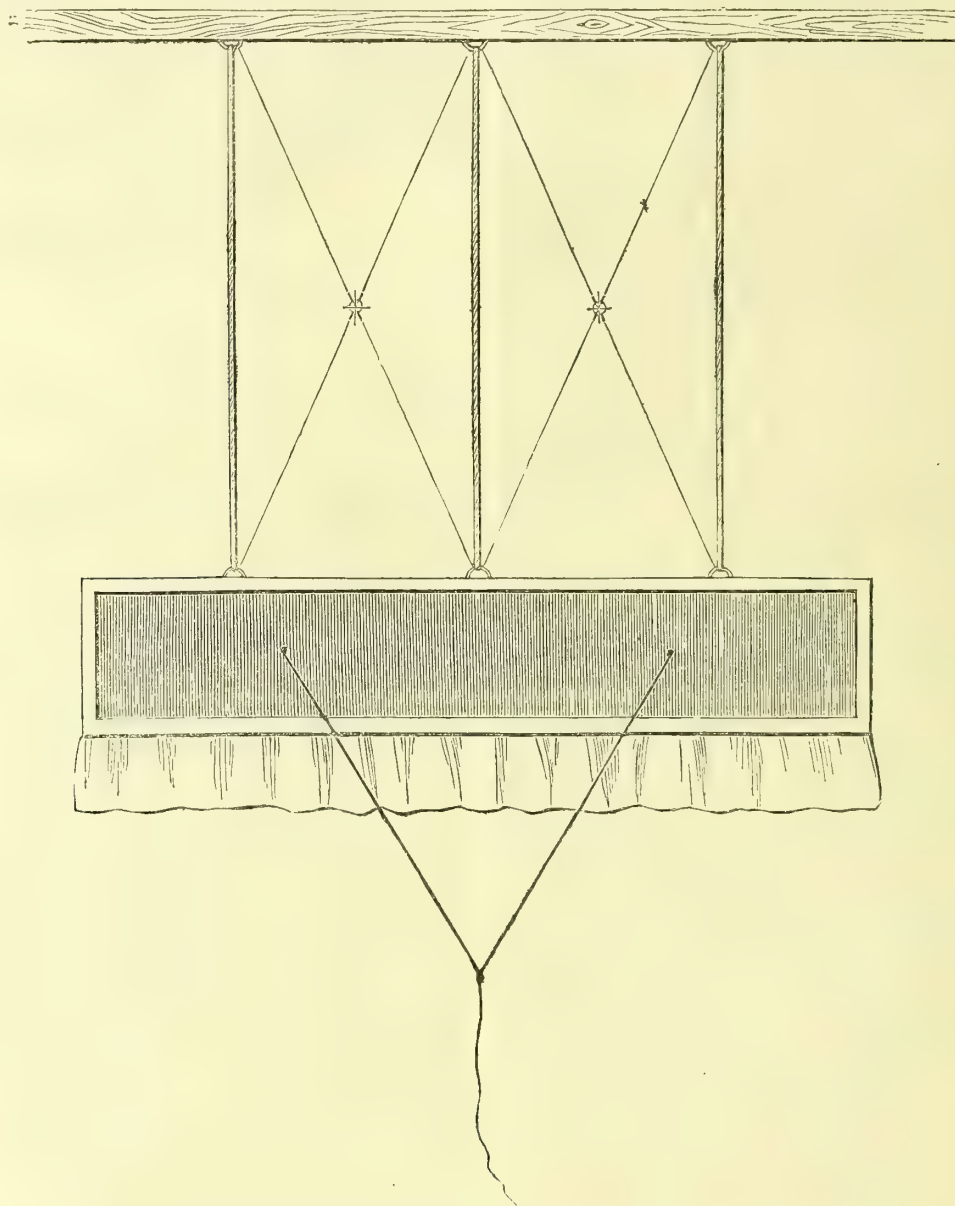
* If the barrack cots are taken up, as is sometimes the case to prevent the men sleeping during the day, they will still be allowed to have hard measure, by all who reflect how often they themselves seek the *horizontal position* during the hot season.

No. 2.

NOTE ON THE VENTILATION AND COOLING OF BARRACKS AND HOSPITALS IN THE N.W. PROVINCES OF BENGAL.

Preliminary Remarks.—A brief description of things so well known in India as swinging *Punkahs*, *Tatties*, and *Thermantidotes*, may be necessary to those who have never resided in that country.

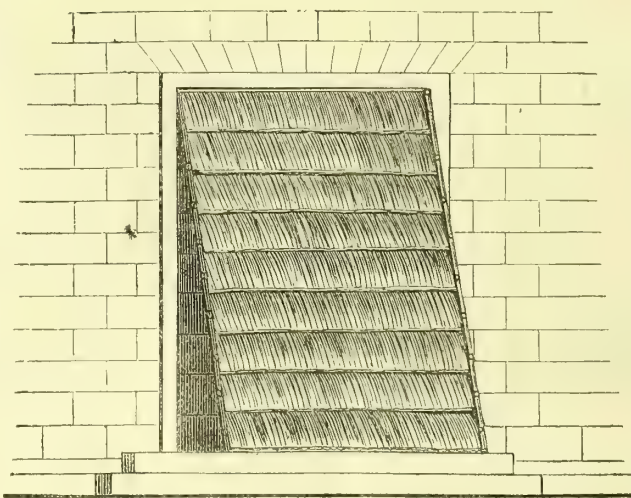
The common house punkah is merely a long substantial wooden frame, covered with cloth, and suspended to the roof of an apartment by strong ropes. A deep, full, cloth fringe is usually attached to its lower edge, which greatly increases the volume of air displaced by its motion. The punkah is made to swing forwards and backwards by means of a thin strong cord attached to it in the manner represented below.



Punkah suspended to the beam of an apartment, with pulling cord attached.

The size and dimensions of punkahs vary according to the size and proportions of the apartments in which they are to be used. All Indian barracks and hospitals occupied by European troops have, during the hot season, punkahs suspended at short intervals, which are kept swinging over the heads of the men day and night, and are pulled by a class of native servants called "coolies," who are relieved every four hours.

The relief afforded by the punkah in the hot weather, and especially during the hot oppressive nights of the rainy season, can hardly be conceived by



"Kus kus" tattie applied to common doorway.

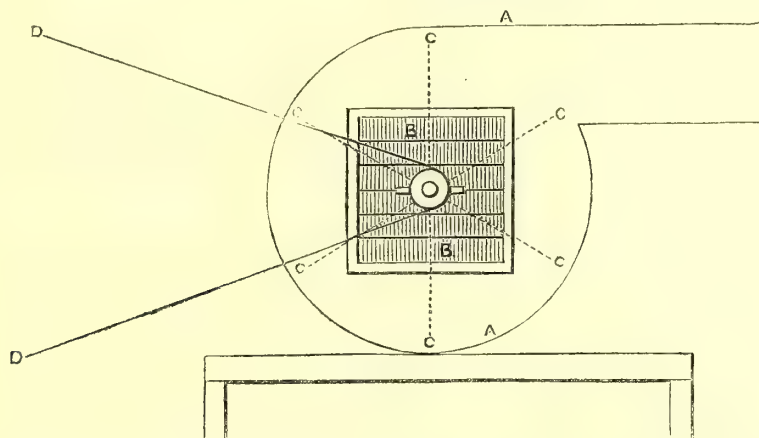
those who have never lived in such a climate.

Tatties are light bamboo frames, made accurately to fit a doorway, and into which are neatly, but not too closely, arranged the slender roots of a fragrant grass, "kus kus." These roots readily absorb and retain moisture like a sponge, while they admit a strong current of air to pass freely through them. Hot dry air, at a temperature of from 105 to 108 degrees (the average temperature of an up-country hot wind), passing through a well-wetted "kus kus" tattie, is instantly reduced to 76 or 78 degrees of Fahrenheit.

So long as a steady hot wind blows, these tatties afford the ready and effectual means of keeping our houses, barracks, and hospitals at a very moderate temperature; indeed, at such times nothing is easier than to make a large apartment *too cold* to the feelings of an old Indian. The drier and stronger the hot wind, the greater is the cooling

power of the tattie. But when the wind becomes very light, or loaded with moisture, the effect of the tattie is either greatly diminished, or altogether lost. It is, therefore, in light winds or calms that the "thermantidote" becomes so useful, especially if the air is, at the same time, tolerably dry.

THERMANTIDOTE.

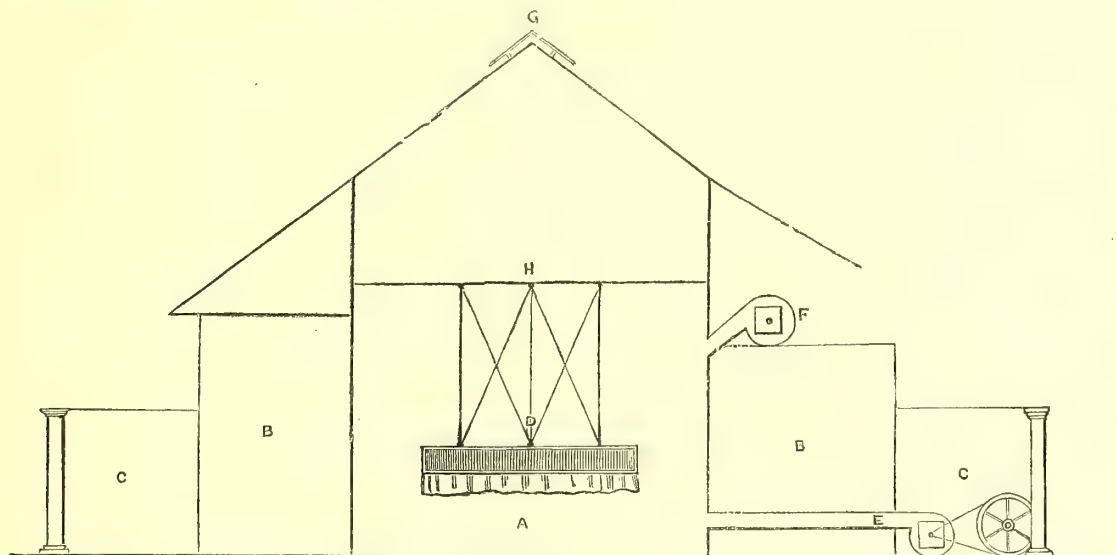


For several years past this cooling machine has been in common use in the north-west provinces of Bengal. It was invented, or rather first applied to its present use, by the late Dr. James Ranken, formerly Postmaster-General of Bengal. It is a mere modification of the old fanter or winnowing machine. Large openings are left in the sides of the box, in which the fans (c, c,) revolve, and into these openings "kus kus tatties" (B) are closely fitted and kept well watered.

Great improvements have been made of late years in the construction of thermantidotes. A moderate sized machine of this kind worked by a single man, will now throw a

stream of cold air so as to be perceptibly felt at the extreme end of a room thirty feet long. All bungalows, barracks, and hospitals in the upper provinces of Bengal are furnished with well-fitting glass doors, all round the inner verandah, which are kept closed during the day, so as completely to exclude the hot wind.

P.S.—During the hot winds, a thermometer kept in a deep well-shaded open verandah having a northern aspect, stands at 2 p.m. at from 105° to 108° ; but if placed in the open plain, and under the small double roof used by the Royal Engineers as a perfect shade, it will usually rise to 116° .



Transverse section of an Indian barrack or hospital.

- A, main ward.
- B, b, inner verandahs enclosed with glass doors.
- C, c, outer verandahs, open.
- D, punkah.

- E, present position of thermantidotes and tatties.
- F, proposed position of ditto.
- G, old roof ventilator.
- H, punkah beam.

An efficient and safe system of ventilation must ever form a subject of prime importance in the sanitary management of troops in all parts of the world; but it must be borne in mind that, during the hot season in the upper provinces of Bengal, it is essential to the health and comfort of the European soldier that the air of barrack rooms and hospitals should not only be frequently renewed, but cooled and agitated at the same time.

The very simple and ingenious patent ventilator invented by Mr. McKennell, which is found to act so effectively in cold and temperate climates, I am sorry to say, must entirely fail during the hot season in the plains of upper India, except, perhaps, for a very short period in the twenty-four hours.

The action of this ventilator essentially depends on the supposition, that the impure air of a crowded apartment is *always much warmer* than the external atmosphere; that the foul air, therefore, will always rise, and pass out through

the inner tube of the apparatus fixed in or near the roof; and that a counter-current of pure cold air will be created through the outer concentric opening, and freely descend towards the floor by its comparative gravity. But all these conditions will be found to be reversed in a barrack or hospital in the upper provinces during the hot season. There the internal air, however impure, will always remain *colder than the external hot wind*. Under such circumstances there can be no ascending stream of foul, no descending counter-current of pure cold air. Even in the rainy season, and after the cessation of the hot winds, the difference of temperature between the internal and external air will ever be too small to create active currents without the aid of some propelling force; and it will be remembered that air once breathed is specifically heavier than pure air at the same temperature.

A little before daybreak, and until sunrise, in the hot season there occurs a sudden and considerable fall of

temperature; and during that short period the external air is decidedly cooler than that of an inhabited apartment. At this time such an apparatus as Mr. McKennell's would act well, and if properly proportioned to the size of the building, would probably cause the whole internal air of a barrack to be *completely renewed* before the wind begins to get hot, and it is necessary to shut the glass doors. In the cold weather in the plains and in the hill districts at all times, I believe, no other ventilators need be employed; but during the hottest periods of the day and night other means of ventilation must be resorted to. I have given above a brief account of the appliances and means in common use for this purpose, as well as for cooling and agitating the air of an inhabited apartment in upper India. While a steady hot wind blows, an apartment of any size can be kept sufficiently cool and well ventilated by the application of the requisite number of well watered "kus kus" tatties. But then, as at present used, the stream of cold moist air must pass directly across the lower part of the barrack-room, and many of the inmates must be exposed to a *thorough draught*. The most delicate and sensitive persons delight in the "punkah;" but to lie, and especially to *sleep*, in a stream of cold moist air from a tattie or thermantidote is well known often to be attended with very serious consequences. The thermantidote, now very generally used in up-country barracks and hospitals, combines the advantages of a refrigerator and ventilator, even in light winds and calms. As it is now applied, the tube is carried across the inner verandah (an awkward arrangement, by which much power is lost), and opens either immediately below or a little above the cots of the men (see plan). I would retain both tatties and thermantidotes, but as I do not think it desirable ever to keep a barrack-room so cold as to subject the men to great alternations of temperature in passing out and in, and as I am convinced it is most desirable to avoid thorough draughts of cold moist air, I would remove both from their present position (which is nearly on a level with the barrack floor) to the top of the roof of the inner verandah, as shown in the subjoined rude sketch plan. Any required number of thermantidotes placed in this position can be readily turned, and all the tatties kept constantly wet, by the simple machinery proposed by Mr. Moorsom in his plan for revolving barrack "punkahs." The cold pure air from tatties and thermantidotes so placed would quickly descend by its own gravity, and be freely mixed up and dispersed through the whole apartment by the action of the punkahs, thus effectually renewing and cooling the air without subjecting any of the inmates to cold thorough draughts. The glass doors (for there are no windows in Indian barracks) should be closed below, with the exception of a certain number in proper positions to *leeward*, to serve as counter openings.

The only novelty in my scheme is the proposal to draw the supply of pure cold air from a *considerable elevation*, and not from the ground floors, as is at present the universal practice in India; and in this respect my plan entirely coincides with that of Mr. McKennell. By this arrangement I conceive we shall not only avoid all dangerous thorough draughts, but draw the supply of fresh air from a safer and purer source than from the *malaria laden stratum nearest the ground*. This appears to me to be a consideration of real importance in certain unhealthy localities.

T. E. DEMPSTER,
Late Superintending Surgeon,
Bengal Establishment.

No. 3.

REMARKS on some of the PRINCIPAL MILITARY CANTONMENTS of the BENGAL PRESIDENCY at which I have either resided for considerable periods, or have carefully examined for special purposes.

The period of my service in India extended over 37 years, during which I was absent only 18 months, on sick leave in Australia. I have, during my long Indian career, served with European or native troops at the following stations in the Bengal presidency, viz., Dum Dum, Barrackpore, Dinapore, Buxar, Allahabad, Secrora, Cawnpore, Agra, Kurnool, Almorah, Landour, Nusseerabad, Umballa, Loodiana, Mooltan, and Peshawur.

Peshawur.—I accompanied the field force under the command of Sir W. R. Gilbert, G.C.B., on our first occupation of that city and district after the second Sikh campaign, and, as superintending surgeon of the Bengal column, I was nominated a member of the special committee of which Major-General Sir C. Campbell (now Lord Clyde) was president, assembled for the purpose of selecting an eligible site for a new cantonment.

I beg to submit a copy of a memorandum drawn up by me on that occasion, and signed also by Dr. Straker, the

other medical member; together with a copy of a note on the same subject which I subsequently addressed to Sir W. R. Gilbert on the breaking up of the field force under his command.* The main object of the first of these docu-

*NOTE by the MEDICAL MEMBERS of the COMMITTEE on the necessity of prohibiting CANAL IRRIGATION within certain limits round the SITE of the NEW CANTONMENT, and REMARKS on some other points connected with the MEDICAL TOPOGRAPHY of PESHAWUR and its VICINITY.

The distance which secures safety from the effects of malaria varies according to certain circumstances, some of which can only be accurately ascertained after considerable experience. With such a stiff clayey soil, and with such unlimited facility of swamping the land which exist in the neighbourhood of Peshawur, we consider two miles a prudent distance; but *one mile* at least is, in our opinion, essential to safety, under such conditions as here present themselves, unless where any part of the city may intervene between the malarious locality and the ground occupied by the troops.

According to almost universal experience, there is no more ready mode of generating malaria in such a climate as this than by profusely irrigating a stiff retentive soil; and therefore we believe it imperative not only to prohibit all canal irrigation within one mile of the cantonment pillars, but to take steps for securing the perfect drainage of the space included within this line.

Although the soil generally all round Peshawur has a large proportion of stiff clay, and water is everywhere abundant, yet there appear to be very few natural swamps or stagnant pools. The water in the numerous streams and springs is generally in a state of rapid transition; and the fall of the country admits of easy and perfect surface drainage. These are the great saving local conditions we observe.*

There is an old but extensive musselman burying-ground, between the site of the new cantonment and the city. It is highly desirable that no more dead be interred in this situation.

That the site selected by the Committee was the one formerly occupied by the Sikh troops is alone a presumptive proof of its relative salubrity. With the precautions above recommended, it appears to us by far the best, in a sanitary point of view, of any locality available in the vicinity of Peshawur, bearing in mind other and equally important military considerations.

In occupying a new country with our troops, it is always important to come at the results of the experience of its inhabitants in all matters connected with health or disease. With this view we assembled five of the most respectable and intelligent of the native physicians or "hukeems" of the city, and obtained from them answers to the following questions:—

1. What are the prevailing diseases in the city of Peshawur?
1. In the cold weather coughs, colds, and complaints of the throat and chest, &c. are common. In the fall of the year intermittent fever and bowel complaint are the most severe and prevailing diseases.
2. What is the most unhealthy season of the year?
2. The months of July, August and September. It is during these months that fever and bowel complaints are prevalent.
3. Is the mortality in the city generally considerable or is disease often widely diffused without being fatal?
3. Fevers and bowel complaints are often very prevalent, but the mortality is usually small.
4. Have you remarked any peculiarities of the weather which indicate a healthy or unhealthy season?
4. If heavy rain falls in July, August and September, the season is observed to be unhealthy. It seldom rains at Peshawur in these months; much rain usually falls at the present (April) season, and it is attended with no harm. If the prevailing winds are westerly in the three hot months, the season is unhealthy; but the reverse is the case if the prevailing winds are easterly at that period of the year. Numerous "falling stars" also indicate a sickly season.
5. Of the past ten years how many do you consider to have been decidedly unhealthy?
5. There have been some severe and very fatal visitations of cholera and small-pox during that time, but we remember no extensive mortality from the ordinary local diseases.
6. Did actual famine or great scarcity of food occur within that period?
6. There has been neither famine nor unusual scarcity of food in Peshawur during the past ten years; indeed, not for a long series of years.
7. Is enlargement of the spleen a common complaint in and about Peshawur?
7. The disease exists in the city, but is not very common or severe.
8. What class or classes of the people suffer most from disease?
8. The poor are ill lodged.
9. Is it considered necessary to health to avoid sleeping on the ground floor at particular seasons of the year?
9. During the very hot weather it is proper to sleep in the open air on the tops of the houses; at all other times of the year people sleep below. It is dangerous to sleep on the tops of the houses in the months of October and November.
10. What articles of food and what kinds of fruit are generally reckoned unhealthy?
10. None of the common articles of food are considered unwholesome. Of the fruits, the pomegranate, grapes, oranges, limes, water melon, small cucumbers, and a sort of plum "beer" are good and wholesome. Stone fruits generally, the melon, and large cucumber are unwholesome. The "surda" or cabul melon is however good.

*These remarks only apply to the immediate neighbourhood of Peshawur. To the north of the fort and city the land suddenly becomes low and flat, and at about a mile from the walls in this direction commences the low marshy district noticed hereafter as the "Tappa" or division of Dowdzace.

ments was to remonstrate against the practice of excessive irrigation in and about the new cantonment. In the second, I considered it my duty to point out the sanitary objections inseparable from any locality between Peshawur and the mouth of the Kyber Pass; to indicate a far more promising position in an opposite direction, and, if possible, to

11. What drinking water is reckoned most wholesome? Is the water of the running streams or that of wells preferred by those who can command either?

11. All who can obtain it, drink the water of the *Bara* river. A running stream from the *Bara* passes through the city, but this contains so many impurities as to be unfit for drinking purposes. The poor, who cannot afford to send for the *Bara* water, are obliged to use the water of wells, but this is the cause of much sickness among them.

12. What parts of the city do you consider most healthy?

12. All parts of the city are nearly alike; but if there is a difference, it is in favour of the most elevated quarters.

13. What are the healthy and unhealthy localities outside the walls?

13. The "Tappa" * of Dowdzaee, where much rice is cultivated, and where there is a great deal of marshy land, is very unhealthy; fever and enlarged spleen are there very common. Of the four "Tappas" round Peshawur, *Dowdzaee* and *Dooba* on the north are decidedly unhealthy; *Kulleel* and *Momund* on the west and south of the city are healthy.

One of the "hukeems" said, but the remark was contradicted by the other, that Peshawur was more healthy than Cabul.

The above replies are not literally translated, but we believe we have given the correct substance of what the "hukeems" said. The conversation took place in the presence of Lieut. Lake, through whose aid they were brought together.

Before meeting the "hukeems," careful medical examinations of the inhabitants were made in four separate quarters of the city, and were conducted in the manner formerly practised by the late Canal Committee. The following are the results:—

Proportion of persons having had fever during the past three years	1848, 16 per cent. 1847, 22 do. 1846, 28 do.
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Proportion of persons labouring under spleen disease	8 do. and all of small size.
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This corroborates the statement made by the "hukeems."

Two villages outside the walls were afterwards examined in the same manner. 1st. *Nowlay*, situated on relatively low ground about a quarter of a mile to the south of the cantonment.

Proportion of persons having had fever during the past three years	1848, 30 per cent. 1847, 40 do. 1846, 40 do.
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Proportion of persons labouring under spleen disease	5 do.
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N.B.—Only a very small number of people could be got here for examination.

2nd. *Thakal*, situated about a mile to the west and a little to the north of the cantonment site, on rising ground, but having much broken ground and deep ravines immediately to the south and eastward.

Proportion of persons having had fever during the past three years	1848, 40 per cent. 1847, 33 do. 1846, 33 do.
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Proportion of persons labouring under spleen disease	13 do.
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These results are considerably less favourable than what were obtained within the walls. In *Thakal* the aspect of many of the children was sickly. In this village too were found for the first time two cases of considerable enlargement of the spleen. It should, however, be particularly borne in mind that both these villages are surrounded with luxuriant cultivation, and that all the fields bearing crops are copiously irrigated by canal streams.

In conclusion, we beg to say a few words regarding the important subject of drinking water. All classes agree in lauding the good qualities of the "Bara" water, and we have no doubt that it is really wholesome; but that all well water is uniformly the reverse is not so obvious. The natives ascribe all diseases to the water they drink; and their notions on this subject are often fanciful and absurd.

The poor of the city drink from the wells, and are comparatively sickly; but the poor are everywhere exposed to many causes of disease from which the better classes are exempt.

Before condemning the water of wells in every instance, it is desirable to procure an accurate chemical analysis of both kinds; but, meanwhile, it would be imprudent and unsafe to reject advice so confidently stated to be founded on the experience of the inhabitants of these parts.

(Signed) T. E. DEMPSTER,
Superintending Surgeon,
Bengal Column.

(Signed) C. D. STRAKER,
Superintending Surgeon,
Bombay Column.

Peshawur, 3rd April 1849.

(True copy.)

T. E. DEMPSTER,
Late Superintending Surgeon,
Bengal Establishment.

COPY of a MEMORANDUM on the NEW MILITARY CANTONMENT at PESHAWUR, forwarded to Major-General Sir WALTER R. GILBERT, commanding the LAHORE DIVISION. 6th April 1849.

The choice of a site for a new cantonment at Peshawur having, for political and military reasons, been restricted to the immediate

guard against the immediate erection of such costly and permanent buildings as would render a change of ground hardly practicable, if, on trial, the site then chosen should prove decidedly objectionable.

I have never visited Peshawur since these papers were written, and cannot say whether or not our recommendations regarding irrigation have ever been attended to; but I have reason to believe that extensive and costly barracks and other buildings have been erected on the original site, and that the troops have, on many occasions, suffered most severely from fever and other malarious diseases. It is, however, very possible that military and political considerations alone may still render any change of ground not to be thought of.

Loodiana.—I resided four years at this station as surgeon of the 1st brigade European horse artillery. It has now been entirely abandoned as a cantonment for European and native troops, and is not likely ever again to be fully occupied. Any minute description of that old cantonment, therefore, is hardly now called for; but as *Loodiana* is remarkable in having been sometimes one of the most healthy, and at other times one of the most unhealthy stations in upper India, it may be both interesting and instructive if I can satisfactorily indicate the causes of these remarkable changes in its sanitary condition. This I shall

neighbourhood of the city, it became, in a certain degree, a choice of difficulties.

The position selected by the Committee is, undoubtedly, the very best within the limits thus prescribed; but it is by no means free from objections in a sanitary point of view. These have already been fully noticed in the minute by the medical members, and may be here repeated, viz., a stiff clayey soil, great abundance of surface water, and the long practice of excessive canal irrigation at all seasons of the year. If it is probable that the state of the country will soon admit of the troops being removed from the immediate vicinity of Peshawur to the eastward of the city, and if a site for a permanent European cantonment can be pointed out in that direction, which shall be free from the medical objections inseparable from any position between Peshawur and the mouth of the *Khyber Pass*, it will be prudent to delay the erection of expensive buildings until circumstances allow of the occupation of the best and most healthy locality. For some miles to the east of the city the land is low, the soil clayey, and the face of the country generally much flooded with water. As we proceed farther to the eastward (on the Lahore road) the aspect of the country improves in all these respects; and at a distance of from six to eight miles from Peshawur, we come to an extensive well-cultivated tract, which, judging from its external features, appears as well suited to the location of European troops as any I remember to have seen in the Punjab. The country here is a fine open, fertile, and unusually dry plain, with a light permeable soil, and a gentle fall from north to south. In some parts the soil has a large admixture of sand, which, however, little impairs its fertility. Although the present (April) may be considered the rainy season in these parts, and the most obvious marks of the late heavy falls of rain are everywhere visible all round Peshawur, hardly a drop of surface water is to be perceived in this direction. Irrigation is generally practised, but obviously to a moderate extent with regard to the quantity of water used, and in other respects carried on under the most favourable conditions, viz., in a light permeable soil, with a perfect natural surface drainage. The watercourses were, without exception, found perfectly dry, and presented sandy or dusty channels. It is clear, therefore, that the whole country can be kept perfectly dry and well drained, even in the wettest seasons of the year. Perhaps the command of water for irrigation is here much greater after the rise of the larger rivers in the hot season; but it is obvious that no stream of water flows naturally in this direction, and that all, or any portion of the supply, can easily be excluded. The water in several of the wells which I examined is about eighteen feet from the surface (a good mean distance), and the country people assert that it is good and wholesome.

However favourable the mere external features of a place may appear, it ought never, in my opinion, to be hastily chosen as a proper position for European troops until authentic evidence of some kind can be produced that its inhabitants are not unhealthy. I had no opportunity of making my usual medical examinations in the surrounding villages, but I stopped and interrogated many of the country people, and several respectable travellers whom I met between Peshawur and Phubbé. The witnesses, in this case, could have had no collusion with each other; and I carefully shaped my questions so as to give no intimation of the nature of the answer expected. Without a dissenting voice they all concurred in pronouncing the climate ("Huhwa Panee") of this part of the country excellent; and all agreed in declaring it much more healthy than Peshawur and its immediate neighbourhood. On the other hand, the inhabitants of the villages to the west of Peshawur uniformly stated that they were much afflicted with fever and bowel complaint in the hot weather, but at the same time always admitted that the mortality was small.

Should these statements of the people be hereafter fully confirmed on careful inquiry, the beautiful and extensive tract of land just described (of which the villages of Kassim and Jabba may be considered about the centre) will, I am persuaded, be found well deserving of the attention of Government as an eligible site of a cantonment for British troops.

(True copy.)

T. E. DEMPSTER,
Late Superintending Surgeon,
Peshawur Field Force.

* "Tappa," a local term for the districts into which the country is divided.

* The air and water.

endeavour to do as briefly as possible. The old cantonment of Loodiana was built along the margin of the high ground overlooking an extensive tract of low, moist land, which formed the ancient bed of the Sutlej. That river has now passed over to the opposite high bank, and flows under the Fort of Phillour, nearly seven miles from Loodiana. In the low ground immediately under the Loodiana bank ran, in ordinary seasons, a narrow but well-defined watercourse, the water in which flowed in a pretty strong stream all the year through, and which served to drain not only the cantonment itself, but the low ground immediately under it. The surrounding country is studded with elevations of fine loose sand, which is driven before the strong dry wind in the hot season, and has, of late years, so advanced on the cantonment as often to cover a great part of its surface several inches deep, with a fine sand drift. Much of this sand found its way into the watercourse above mentioned; but, under ordinary circumstances, the force of the current was sufficient to keep its channel clear and prevent its being choked up. The periodical rains, so regular in the lower and central provinces of Bengal, are most irregular and precarious in the part of the country under consideration. The first year I was at Loodiana a fair quantity of rain fell; the watercourse above alluded to flowed continuously and with a rapid stream, and the season proved healthy. Next year a few showers only fell during the expected rainy season; the watercourse became dry, and its channel completely choked up and obliterated with drift-sand, which so advanced on the station generally as to threaten the destruction of all the arable land. But this year also proved remarkably healthy. The *third* year was different in all respects. Much rain fell at the usual season, but the now abundant drainage water, no longer finding an outlet through its usual channel, spread itself over a large surface of the neighbouring low ground, where it formed extensive shallow stagnant pools, soon covered with an abundant crop of aquatic plants. For some time after the breaking up of the rains the station continued healthy, and I was beginning to hope we had escaped the danger, when, in the first week of October, almost every inhabitant of the place was prostrated with fever. Next year an attempt was made to clear the channel of the nullah, or watercourse, by letting in from above a small stream of the Sutlej, as that river rose in the rainy season; but the scheme failed, the water so let in refused to confine itself to the old narrow channel, spread far and wide, and perhaps did more harm than good. That *fourth* season was quite as bad as the third, and the men of the first brigade horse artillery marched, in the ensuing cold weather, towards Meerut, prostrated by disease, and having 50 per cent. actually in hospital.

There are some points deserving of particular attention connected with these almost universal invasions of endemic fever:

1st. The type of the disease was very virulent, and a patient not immediately seen, and judiciously treated, ran great risk of dying in the cold stage.

2nd. The men of the horse artillery, all picked men from the whole body of artillery recruits, were, at that time, lodged in one of the best and most commodious barracks then built in those provinces, yet they suffered far more severely than the European foot artillerymen, a decidedly inferior class in all respects, and who occupied a barrack of the oldest and most objectionable construction. The explanation I conceive to be as follows. Between the horse artillery barrack and low ground (the true source of the malarious poison) there was no effectual screen of trees or houses interposed; while, betwixt the foot artillery barrack and low ground there were not only more trees, but a considerable *smoky* native bazaar.

3rd. After a year's residence at Meerut I particularly remarked the curious fact, that the Loodiana fever hung more obstinately to the officers and their families than to the men and women of the corps generally; and this, I believe, may be accounted for by the consideration that the former had lived in bungalows close to the verge of the high land, and had probably received a more concentrated dose of the marsh poison.

The whole circumstances of the case above related appear to me strikingly to illustrate the conditions under which malaria is eliminated in the N.W. provinces of India, and farther to demonstrate the danger of locating troops either on the banks of large up-country rivers or on the margin of the low moist tracts of land which once served as the beds of such rivers.

Meerut.—I resided at this station from December 1850 to September 1854, holding, during that period, medical charge of the 1st brigade European horse artillery and headquarters of the regiment of Bengal artillery.

Meerut is deserving of special attention, first, because it has, during a long series of years, proved one of our most healthy up-country stations; and, secondly, because it is an

example of a large up-country European military cantonment, situated neither close to the banks of any large river, nor in the immediate vicinity of the low moist land in which such rivers once held their course. It was here that the men of the 1st brigade horse artillery and 1st Bengal European fusiliers quickly regained a high state of health and efficiency, after having been completely prostrated by malarious disease at Loodiana and Lahore.

The cantonment is built on an open and generally fertile plain, and is about thirty miles from the nearest point of the Ganges. I have mislaid the notes I made regarding the nature of the soil, but I believe I correctly describe it when I say it is neither remarkably stiff and retentive, nor strikingly loose and permeable, being generally a due admixture of humus clay and sand. The water in the sub-soils is unusually near to the surface for an up-country station, averaging from 11 to 14 feet in the cold season, and being considerably nearer during the periodical rains. This renders moderate *well* irrigation generally practicable in and about Meerut, and doubtless tends to moderate the temperature in the hot and dry season. The periodical rains are usually regular and copious, and the course of the seasons differs little from that experienced at Kurnool, Delhi, and Agra. As a general index to the climate and soil, I may mention that Meerut produces the best and most abundant supply of strawberries, peaches, grapes, and European garden vegetables anywhere to be found in the Bengal presidency.

The general drainage of the country is good, but it was defective towards the north-west portion of the cantonment; and before I left Meerut in September 1854 the Government of Agra had undertaken the drainage of that quarter on regular and scientific principles. Numerous unseemly irregular excavations in various parts of the station were then also being drained and filled up, or, where that was impracticable, converted into deep circumscribed tanks capable of holding water all the year through. These excavations had been chiefly formed by the removal of soil for the erection of barracks, bazaars, &c.

The nature of the ground obliged the executive engineer to carry the drainage from the European lines directly across the space occupied by the officers' bungalows. These drains were "*pukka*," that is, constructed with burnt bricks and lime, but all were *open*. The main shaft crossed at right angles the space between the European infantry and artillery lines, was conducted under the public mall, and finally discharged its contents into a natural channel on the other side. The urinous odour from these open drains was often most offensive during the hot weather, although they were carefully washed out and sprinkled with lime once in the 24 hours. It was proposed either to cover in these drains altogether, or to keep them constantly flushed by a stream of water from wells in the European lines. Both these propositions involved considerable expense and trouble, and neither had been adopted when I left Meerut.

The only sanitary suggestion brought from Lombardy by Colonel Baird Smith, which had not previously been recommended by the canal committee, is the proposal to use a stream of water from an irrigation canal for the purpose of constantly flushing the drains of cities and towns near to which such canals pass. This might, perhaps, be done with benefit at Meerut and elsewhere in the vicinity of the Ganges canal, provided always great care is taken to prevent this additional supply of water from percolating into and saturating the subsoils, a contingency which might exercise a most unfavourable influence on the salubrity of the whole locality.

Much attention has been paid of late years to conservancy arrangements in and about military stations, and such arrangements are as complete at Meerut as anywhere. I will here notice a difficulty in such matters peculiar to the East, and which will require both judgment and tact fully to meet. As remarked in another place, the native of India goes beyond the camp to relieve the calls of nature, and usually resorts for this purpose to some waste piece of ground in the immediate vicinity of the cantonment. The ordure is thus scantily spread over a large open surface; much is quickly removed by the pigs and kites, and in the hot and dry seasons what remains soon dries up and becomes inodorous. In the rains such "*public fields*" are necessarily much more offensive, but at all times they are less so than if the same quantity of ordure were collected together in common moist heaps. Public bazaar necessities have been erected at Cawnpore and other places, but it is extremely difficult to induce the natives generally to use them. Let it be remembered that in all military stations there are probably 20 natives to every British soldier, and supposing the whole native population could be induced or compelled to use the public necessities, I am persuaded that, unless the most efficient arrangements exist for quickly removing to a safe distance or otherwise disposing of all

offensive matter, more harm than good will accrue from forcing the native of India to depart from his natural and usual habits in this respect. During the long siege of Mooltan in 1848, I recommended that deep narrow trenches should be dug in the rear of regiments and used as public necessaries; after a short interval one trench was covered up and another opened. This simple arrangement tended greatly to keep the entire camp sweet and wholesome.

Cawnpore.—I resided at this station for 12 months in 1856–57, in the capacity of superintending surgeon of the Cawnpore division.

Cawnpore has long been notorious as one of the largest, hottest, and most unhealthy of our up-country military stations. The cantonment extends nearly seven miles along the edge of the high bank overlooking a very wide portion of the bed of the Ganges. This broad irregular river channel is wholly submerged in the periodical rains, but has nearly nine-tenths of its surface exposed to the action of the sun and air at all other seasons of the year. A main stream of the river flows close under the cantonment bank, and along both margins of this stream abundant crops of melons, cucumbers, &c. are raised after the annual recession of the waters. The high bank on which the station is built is a solid mass of light coloured adhesive clay, containing, in many parts, much “*kunkur*,” an impure vesicular limestone of recent formation well known in Upper India. The ground nearest the river bank is very broken and irregular, and is everywhere traversed by deep rugged ravines. The “*compounds*,” or spaces in which each bungalow stands, were until recently surrounded by high mud walls, which impeded ventilation and gave the whole station a most unseemly appearance. In the hot winds the whole surface of the ground (where not irrigated) is absolutely bare and devoid of vegetation, but in the rainy season becomes rapidly covered with a luxuriant crop of high grass. Trees, however, remain green all the year through. A magnificent new range of European barracks was in the course of erection at Cawnpore when the mutiny broke out. The manner in which the site of these barracks was determined on is a good example of how these things have usually been managed in India. The committee, I was credibly informed, assembled in the cold dry weather, and only saw the ground at that season. A high, dry, and apparently well-drained plain was observed about a mile and a half from the river bank, and, without one inquiry being made as to the sanitary state of the natives residing in its immediate neighbourhood or the condition of the ground during and after the periodical rains, this plain was fixed on as a proper site for one of the most costly ranges of European barracks ever erected in that part of the country.

I carefully examined the ground under consideration during and after the periodical rains of 1856. I found the soil a stiff retentive clay, the surface covered with rank grass, and everywhere ankle-deep with water; in fact, at this period of the year, it remained an extensive concealed marsh. Although the ground in question is well raised above the highest level of the river, and has deep trenches cut from it into the Ganges, the whole of the water cannot be drained off from a surface which is either a dead level or has a scarcely perceptible inclination in an opposite direction, and where a retentive soil prevents the surface water from finding its way into, and being carried off by lower and more permeable strata. All this tends to keep the locality long in the mid-condition betwixt moisture and dryness after the cessation of the rains; that is, in the very condition universally admitted to be most dangerous to health.

The native cavalry lines are on the same high open plain, and about half a mile to the south of the new European barracks. After the rains of 1856 fevers were more prevalent in these lines than in those of the native infantry, situated in an ill-drained locality, close to the crowded and filthy native city of Cawnpore.

Savada.—A large building situated about one mile south of the new barracks, and on the same plain, was formerly occupied by the Cawnpore missionary establishment, but had been abandoned (it was said) in consequence of the unhealthiness of the locality. The missionaries have removed to a position some miles to the west of the city and civil lines, and have, I have reason to believe, judiciously taken up the very best locality anywhere to be found in the neighbourhood of Cawnpore. Cholera may be said to be endemic at Cawnpore, and Sir A. Tulloch’s tables will show what the mortality of European troops has been in past years.

The excessive heat of the climate, the nature of the soil, the broken and irregular character of some parts, the difficulty of completely draining others, and lastly, its close proximity to a most objectionable reach of the river Ganges, all combine, in my opinion, to render Cawnpore an unfit locality for European troops.

Lucknow.—On the annexation of Oude the whole of the European and native troops holding military possession of that province were placed under my medical superintendence, and it became my duty frequently to visit the cantonment, city, and residency of Lucknow during the years 1856–57. In November 1856 I was called upon by the officer commanding the Oude field force to examine the ground in the vicinity of Lucknow with a view of pointing out an eligible site for barracks for European troops, should circumstances render their permanent location in that quarter necessary; and the following is a copy of the report I drew up on that occasion:—

“An eligible site for the erection of permanent barracks for European troops may, in my opinion, be found in almost any part of a tract of ground comprising an area of several square miles, and situated immediately to the north, north-east, and north-west of the old Sepoy cantonment of Lucknow. I went over this ground on an elephant immediately after rain so heavy and continued that it flooded all the low parts of the province of Oude, and yet I found the ground almost uniformly dry and free from swamp. The low unmetalled country roads which pass through it became perfectly free from water or “*poachy*” ruts a few hours after the cessation of heavy rain. This last is an excellent test of the good drainage of a country. Considered as a whole, the ground under notice has a gently undulating surface, and a light permeable but not unfertile soil. There are small sandy patches here and there, but generally it was covered with grass, or bearing fair grain crops. The natural surface drainage is excellent, and with a little artificial aid could be rendered perfect. A few pools of water had collected in isolated spots, and there are one or two larger “*Jheels*” which are either easily drainable or convertible into deep wholesome tanks. The ground in question is at a safe distance both from the city and banks of the river Goomtee. The external features above enumerated usually characterise a healthy locality, and this character is corroborated by the following important and indispensable evidence. 1st. The old cantonment of Lucknow is built on ground of precisely the same general character as that above described, and although little attention has been paid until lately to artificial drainage, its past medical statistics, as far as my examination and general repute go, will prove it to have been, in past years, one of our very healthy Indian stations. 2ndly. I made particular inquiries regarding the sanitary condition of the native inhabitants residing within the tract under consideration, and found them, even in the rainy season, generally healthy and free from endemic fevers. There is one village due north of the cantonment, immediately in front of which a considerable marshy pool had collected, in consequence of some obstruction to the natural drainage channel which runs past the village; here I expected to find fevers if they were to be found prevailing anywhere, but concurrent testimony prove the inhabitants to be generally healthy.

“In my letter No. 224, dated 20th of August 1856, to the address of Brigadier Wheler, commanding the Oude field force, I fully stated my objections to quartering European troops in or in the immediate vicinity of a large crowded native city.

“(Signed) T. E. DEMPSTER,
“Cawnpore, 18th November 1856.” “Superint. Surgeon.”

In 1856 the men of H.M. 52nd Foot were, for want of other accommodation, lodged in the King’s mews within the city of Lucknow, where they suffered severely from an invasion of cholera, under peculiar circumstances which it would occupy too much space here fully to relate. At the recommendation of a medical committee, of which I was president, the regiment was removed into camp, and there kept during the remainder of the hot and rainy seasons. After the second change of ground, cholera entirely disappeared, and, what was hardly to be looked for, the men continued during the rest of the year singularly free from the common diseases of the country and season. There can be no more striking proof than this of the general salubrity of the locality. Lucknow is only fifty miles from Cawnpore, and this short distance can, at all times, be easily passed by rail in a couple of hours. When the projected railroad from Cawnpore to Lucknow is completed, European troops will become as available for any sudden emergency at the one place as at the other. If therefore the opinions I have above stated as to the comparative salubrity of these places should, on further careful inquiry, prove well founded, it will become a serious question to determine whether not only humanity but true economy demands that the European force considered indispensable in that part of India be henceforth placed at Lucknow instead of Cawnpore.

Delhi.—As a member of the canal sanitary committee, my attention was particularly directed to the city and cantonment of Delhi, although I had never served at that station. The city itself was in 1847 the finest, most cleanly, and best ordered native town I had ever visited. It is, as is well known, situated close to the left bank of the Jumna, and is surrounded by a well kept wall and ditch. The troops were originally stationed within the city walls, but a good many years ago they were removed to the present position, lying to the north of the city. To remove troops from within the walls of a populous native town, and place them on an open and apparently dry inclined plain, seems, at first sight, a most judicious measure; yet nothing could have proved more mischievous in a sanitary point of view. Looking at the ground then occupied by the native troops, nothing very objectionable met the eye; indeed it was singularly free from shallow pools and open filthy ditches, then too often seen in some other military cantonments. Bad surface drainage and want of local cleanliness therefore were obviously not the causes of the notorious insalubrity of the Delhi cantonment. The ground in front of the Bells of Arms has a gentle slope towards the north nearly a mile in breadth, when it terminates by an abrupt fall of from 10 to 14 feet in the low “Khadir” land of the Jumna. Before selecting the present site, had the authorities thought of the simple and obvious expedient of inquiring into the physical condition of the inhabitants of the neighbouring villages, the nature and probable source of the present mischief would at once have become apparent.

Three villages stand near the edge of the low land in which the parade ground terminates. The fields cultivated by two of these villages are partially irrigated from the Delhi canal, but the third, situated to the north of the sapper lines, uses no irrigation. These old sapper lines were found so pestilential that the locality was abandoned altogether after a short trial. On examining the inhabitants of these three villages, the result was marvellous even to myself who had just gone over more than a thousand miles of irrigating canals. Will it be believed that from 85 to 90 per cent. of these unfortunate creatures were found afflicted with enlargement of the spleen? My own conviction is, that if subjected to a very minute and careful examination, not an individual would have been found perfectly sound. Within the city walls, and especially in the most dense and crowded quarters, I found comparatively few indications of pure malarious disease. This accords with what has been observed in other countries, viz., that the high walls and narrow crowded smoky streets of large cities often prove a safeguard against marsh miasma, although other causes of human disease may abound in such situations. In the cantonment bazaar, and suburbs outside the walls, a considerable amount of spleen disease was found; but when we proceeded farther from the city, and close to the low “Khadir” land, the *spleen test* indicated the presence of marsh miasma in its *highest intensity*.

Some years afterwards Dr. G. Paton, now postmaster-general of Bengal, and Dr. Balfour, civil surgeon of Delhi, both most reliable authorities, went over the same ground and fully confirmed my examinations. On the authority of the latter medical officer, I state (what I was not at first aware of), that the Delhi parade ground above described is artificial, having been originally a swampy nullah bed, the old outlet, or rather portion of the notorious Nujfghur Jheel, or shallow lake; and that much more of the ground in that direction is flooded in the rainy season than I suspected when I saw it. The whole locality is, in my opinion, altogether beyond remedy, and ought to be abandoned.

No one would think of placing European troops within the walls of a native city, unless under the most pressing emergency; and if it is imperative to retain a European force in the neighbourhood of Delhi, I have reason to believe a comparatively safe position for them may be found some miles to the south of the city.

If the profession in this country should be inclined to suspect some exaggeration on my part in the statements I have put forward regarding the extraordinary amount of spleen disease existing in certain low moist localities in the north-west provinces of Bengal, I would refer them to page 558, number XL., of the British and Foreign Medico-Chirurgical Review, in which they will find my general statements fully corroborated by the result of examinations undertaken eight years after the publication of the Canal Sanitary Report, and carried out, altogether without my knowledge, by a medical officer specially appointed by the Government of Agra to investigate the probable cause or causes of a virulent and fatal fever then raging in the “Zilla” or district of Allyghur.

Dinapore.—I held the office of superintending surgeon of the Dinapore division from September 1854 to March 1856.

The European barracks at Dinapore are peculiar, being neither built of more than one story, as in lower Bengal, nor in detached ground ranges, facing east and west, as in the upper provinces; but are constructed of a single story, and in the form of a large oblong parallelogram, the long side of which runs east and west. I have not at present the means of giving an accurate description of the size and dimensions of these buildings, and therefore I shall only remark in this place, that they have no open outer verandahs,* and no glass doors, but are furnished throughout with venetians or jalousies.

Dinapore, like Cawnpore, stands immediately on a bank of the Ganges overlooking a still wider expanse of low land, which is submerged in the rains, but has the greater part of its surface exposed to the action of the sun and air at all other times. The level ground occupied by the cantonment is of very limited extent, and is hemmed in by low irregular land, subject to inundation on the rivers Ganges and Sone attaining their highest annual rise. The soil generally is a rich fertile mould. A deep nullah or natural watercourse runs immediately in the rear of the barrack square, which acts as a good and efficient drain so long as the Ganges remains at a moderate level; but two or three times during the rainy season the water in the river rises higher than the level of the bed of the nullah, when, not only can no more drainage water run off by this channel, but the nullah itself, and all the deep ditches connected with it, become filled to overflowing. As the river again falls, the nullah is quickly emptied, but many of the ditches remain full of water for months afterwards. The nullah in question enters the Ganges at a point midway between the barrack square and “Sudder bazaar.” It was proposed to narrow this mouth and fit it with flood gates to prevent the influx of the river water when at its highest; but there was a worse evil which this would not have remedied. The river Sone enters the Ganges about 12 miles to the west of Dinapore, and is subject to very high and sudden floods. Once almost every rainy season the Sone overflows its banks, and the water finds its way across the country to the low land lying immediately to the south-west of the cantonment, and this back water not only fills the nullah above-mentioned, from an opposite direction, but occasionally floods more than half of the Sepoy parade ground to the west of the barrack square. In fine, I have long come to the conclusion that Dinapore is irremediably vicious as a position for European troops. Fever and dysentery of a severe type are generally prevalent at Dinapore in autumn, and a year seldom passes without an outbreak of cholera.

In order to convey a general idea of the climate of this part of the Bengal Presidency, it will be necessary for me to say a few words regarding that of lower Bengal and of the north-west provinces.

The climate of Bengal proper differs in many important respects from that of the upper provinces, being much less hot in the hot weather, and much less cold in the cold. At the hottest season of the year in the lower provinces the air is comparatively cool and moist, and the face of the country green, and generally characterized by a luxuriant tropical vegetation. Here there are no “hot winds,” and “tatties” and “thermantidotes” are consequently all but useless. The periodical rains are far more copious and continued than in the north-west, and the temperature is seldom so low, at any time, as to render a “punkah” disagreeable during the day, or a fire necessary at night. Here too the European can generally manage to sleep at night without being constantly fanned by the punkah. In the latitude of Agra, Delhi, Kurnool, &c., a fierce dry hot wind blows during the day from about the 10th of April until the latter end of June. At some places, as at Cawnpore, the hot wind continues during a great part of the night. The whole face of the country is at this time parched up and devoid of vegetation. To this succeeds a warm moist rainy season when the ground, lately so bare and apparently so sterile, becomes covered with luxuriant green crops within a period so short as to excite the astonishment of the newly arrived European. Although the temperature of the external air is so much greater in the hot winds than in the rains, it is in the latter season that the sensation of heat is most painfully experienced,—still air, loaded with moisture, and at a temperature exceeding 90°, becomes almost intolerable to the European; at such times the only relief is the constant action of the punkah day and night. This rainy season terminates about the end of September, and is followed by October with its cool nights and hot and often oppressive days, the month of the year most fatal to the European constitution. The cold weather often dates from the 1st of November, but after the 15th of that month

* On the south side of the long infantry range a slight temporary verandah had recently been put up to serve as a shade from the midday sun.

it has decidedly set in all over the north-west provinces. From the latter date until the end of February the European officer sits with a fire in his apartment, sleeps at night under blankets, and dons, especially in the early morning, apparel as warm and comfortable as he would wear in England. The heating power of the ray of the unclouded sun, however, is often considerable even in the coldest season, and violent exercise in the open air at mid-day irksome and oppressive.

The inhabitants of Bengal proper are a small, effeminate, and unwarlike race; those of the north-west provinces, on the other hand, are comparatively large and robust in frame, and energetic and courageous in character.

The climate of Dinapore may be described as an unpleasant mean between these two extremes; for, in the warm weather the air is seldom hot and dry enough to render "tatties" useful, or sufficiently cool and moist to admit of open doors. The European barracks have pun-kahs, but neither "tatties" nor glass doors, although in the houses of the officers both these last are considered necessary to comfort.

Hill Stations and Sanitaria.—I held medical charge of the 61st regiment native infantry, at Almorah, for seven months in 1839.

Almorah is the native capital of the hill district of Kumaon, and is about 40 miles in the interior from the foot of the hills. I have retained no written memoranda regarding this station, and can only now describe it in somewhat vague and general terms. The Sepoy cantonment is, I believe, about 4,500 feet above the level of the sea; is situated on a broad, somewhat bare, and isolated eminence, but is nearly closed in by higher hills, some of which are heavily wooded. The course of the seasons is not very unlike that before so fully described when speaking of Landour; and the climate is generally agreeable to the feelings of the European, except in midsummer, when we experienced some unpleasantly hot weather. Almost every European, on his first arrival at Almorah, suffered from a slight attack of diarrhoea. This was universally ascribed to the quality of the water of the hill streams, and the residents generally took care to boil and filter this water before drinking it. The cantonment was decidedly unhealthy in 1839; and not only the Sepoys, but the European officers and their families, suffered much that year from intermittent fever and diarrhoea. Goitre is endemic in the valleys in the neighbourhood of Almorah; and at Hawulbaugh—an outpost about 800 feet lower than the cantonment—I saw a litter of thorough-bred greyhound pups, every one of which was born with a large goitre!

Simla is about 40 miles in the interior of the hill district. Its elevation is nearly that of Landour, and the climate and course of the seasons closely resemble each other. The rock on which the station stands belongs, I believe, to the same series as at Landour, but is much more friable and disintegrated. The ground generally is covered with a rich black vegetable mould, and is heavily timbered, with a great variety of fine pines, Indian oak, &c. In the rainy season also the surface is covered with a heavy crop of rank grass and underwood. On some occasions a fatal low typhoid fever has appeared at Simla, the young having been its common victims.

Mussourie stands on a range of precipitous hills immediately adjoining Landour, and the account I have given of the one place will apply, in most particulars, to the other.

I have not staid beyond a very short period at Subathoo or Kussowlie, and will not therefore attempt any particular account of either.

Darjeeling is a hill station in the Sikkim territory, to which invalids resort from all the lower and central provinces. Like Simla—but unlike Landour, Mussourie, and Kussowlie—it is situated from 30 to 40 miles in the interior of the hill district.

As superintending surgeon of the Dinapore division, I paid a short visit to Darjeeling, for the purpose of inspecting and reporting on the European sanitary depôt at that place. I have retained no copy of my official report, and will only here state that I was well satisfied with the general arrangements for the invalids, and with their barrack and hospital accommodation, which is here infinitely superior to that of the Landour depôt; but I particularly remarked and reported that both barracks and hospital were destitute of proper wash-houses. I also, on this occasion, recommended that proper arrangements should be made for detaining for some time at the mean elevation of Kursian all the more weakly patients, before taking them up to the depôt. This recommendation, I am informed, has been adopted with considerable benefit.

The climate of Darjeeling is nearly as cool in summer as that of Landour, but the atmosphere is greatly more moist. Rain falls every month of the year, and the periodical rainy season is truly excessive. I visited the depôt in

the dry month of April, and yet, in my journey to and from the station, I literally saw nothing beyond the mountain path on which I was travelling, for everywhere I was enveloped in a dense cloud, which wetted my clothes as if I had been exposed to a slight shower of rain. I was informed by the resident medical officer that croup and such like diseases of the air passages—often so fatal to the young at other hill stations—are very rare at Darjeeling; and that so uniformly moist was the general condition of the air, that one seldom took cold by remaining in wet or damp clothes.

The depôt itself stands on a detached elevation, which is well raised above the general level of the rest of the station. This I suspect to have been an error; for the barracks are generally wrapt in a dense mist, while the houses of the other residents are enjoying a clear air and pleasant sunshine.

My own experience of Darjeeling is too limited to enable me, of my own knowledge, to say anything regarding the effect of its climate on the European constitution.

All the hill stations situated to the west of Hurdwar (the point at which the Ganges flows into the plains) may be reached from below without passing through any dangerous "Terai" jungle; but this, I have reason to believe, is not the case with the lower Himalayan ranges lying between Hurdwar and the Brahmapootra river. A "Terai" jungle of ill repute must be crossed before reaching Darjeeling, but this can always be done with perfect safety, if care is taken to pass through this tract *while the sun is well up, and during the hot and cold seasons of the year.*

I cannot conclude this rapid sketch of the medical topography of some of the old military stations of the north-west and central provinces of Bengal without enumerating what the whole of my experience teaches me should be mainly kept in view in selecting a proper position for European troops in the plains, viz.:—

1st. To choose not only a dry, well-drained site for the cantonment, but to take care that such site itself is situated in a generally well-drained country, free from swamp and shallow pools, and not subject to inundations of any kind at any season of the year.

2nd. To select, if possible, a light permeable soil, with a good natural surface drainage, and by all means to avoid a stiff retentive clay.

3rd. To avoid the banks of large up-country rivers, and the vicinity of the low moist "Khadir" land, once the bed of these rivers.

4th. To fix on no position until satisfactory evidence is obtained that the native inhabitants of the district have a healthy aspect, and are generally free from marks of having habitually suffered from malarious diseases. Wherever this is the case, it will be almost universally found that the drinking water they use is good and wholesome.

There are various other minor points to be attended to which I have fully noticed in the paper presented to the Court of Directors by Sir R. Martin.

Acclimatization.—On this most important subject I desire to speak with due caution and reserve. According to my own experience, troops fresh from Europe are most liable to suffer severely from a certain class of tropical diseases, during the first two years of their residence in India; and this is especially the case if they are landed at an improper season, or sent, for the first year, to a very hot unhealthy locality. The diseases I allude to are acute dysentery, acute hepatitis, severe remittent fever, and sunstroke. But, I believe, much may be done by judicious management to correct or modify this evil. In 1853 I had medical charge of a considerable detachment of European artillery recruits at Meerut. They had been landed in Calcutta in the cold weather, and immediately marched up the country, under the command of an experienced officer; and when they reached the good locality of Meerut, they joined the head quarters of the regiment of artillery, and associated with old and experienced Indian soldiers. This detachment numbered 300 men, and though during the first hot and rainy seasons every one of them suffered a mild attack of fever, none died, with the exception of a single individual who had reached the station hopelessly afflicted with tubercles in the lungs—certainly not a common tropical disease. After a period, varying in duration according to the locality, discipline, and general habits of the newly-arrived men, they become far less obnoxious to the diseases of the country, especially in their more acute and suddenly fatal forms, and far more tolerant of adverse climatic influences.*

This partial acclimatization, I think, takes place most quickly and surely among the recruits of the European local army, where the new arrival comes at once under the command of experienced Indian officers fully alive to the danger of all unnecessary exposure; and where he associate

* Cholera I have always looked upon as an exceptional disease, to which no rule, that I am aware of, can apply.

with a body of old Indian soldiers, among whom certain precautions and habits suited to the country and climate have become, so to speak, traditional and hereditary. I am aware that the old Indian soldier has often been accused of showing an evil example to the men of newly arrived Queen's regiments, — by teaching *bad* local knowledge, and by exhibiting a proof, in his own person, that drunkenness and life in a hot climate are not always incompatible, whatever the doctor may say. To a certain extent this may be admitted to be sometimes true, especially where both officers and men are equally ignorant of the customs and language of the people. Still, I firmly believe, that a knowledge of the country and climate is essential to the preservation of the health of the European in India; that Englishmen of all people are most slow to adopt new habits and modes of life however salutary, and that such necessary accommodation to new and adverse circumstances will take place most surely and quickly among the officers and men of a local army. Of all things it is essential that the medical officer of a newly arrived corps should be a man of thorough local experience.

After a residence in the plains of India of about *ten* years, the European soldier's constitution is liable to become slowly, but permanently, deteriorated, and he is then often found to be afflicted with *chronic* disease of the liver, spleen, or colon. But this period also may be lengthened or shortened, according to the conditions above noticed. It would go far to confirm or correct the opinions I have here ventured to express, if a careful and extensive comparison were made, not only between the mortality, but invaliding, together with the ages and periods of Indian service of invalids of the Queen's and old Company's European troops. The European officer of good constitution and regular habits, after ten years' service, may often be looked upon as at his *best* for efficient duty in India; but I much fear this will rarely be found the case with the European private soldier; and it has often grieved me to see men described in the "invalid rolls," as "old and completely worn out," after from ten to fourteen years' service in the country.

Spirits and Malt Liquor.—Rum is the spirit supplied by Government to the European troops in the north-west provinces of Bengal. It is made in the country by contractors, proprietors of large sugar-works in those provinces. The spirit is first sent to the commissariat stores at Meerut, where it is kept for a time and tested and examined by a committee of medical officers before it is served out for the use of regiments. During the four years I remained at Meerut, I frequently sat as president or member of these committees on spirits or malt liquor. I have already expressed my opinion as to the sanitary side of the proposal to substitute wholesome malt liquor for the rum now served out to the men, or supplied for the use of their canteens; but I clearly see and fully admit a great practical difficulty in the bulk of the former article, and the inconvenience and expense of carrying a sufficient supply on the march, especially during active service in the field. But if such service is undertaken in the hot season, I am persuaded it would tend greatly to the health of the men to abstain altogether from stimulants in any shape or form, except on special occasions, to be determined by their medical officers. But how British troops would submit to such regimen is another and more uncertain question. Good *tea* and *coffee*, served out early in the morning, and before the commencement of a march, and again during the day and at night, are the substitutes I would propose for stimulant beverages of any kind. I am acquainted with officers, keen sportsmen, who are celebrated for their power of undergoing, with impunity, a great amount of fatigue and exposure to the sun in the hot season, and who never taste spirits or beer while so exposed, but confine their drink entirely to *cold tea*. The sale of bazaar or country spirits is a fertile source of injury to the men and perplexity to their officers; and the clever manner in which both sellers and buyers sometimes contrive to escape detection would be amusing, were it not so mischievous. For instance, when the 1st brigade horse artillery were in camp at Umballa, our men were getting drunk in the most mysterious manner, although every reasonable precaution had been taken to prevent the irregular sale of liquor. Immediately in the rear of our camp was a "tope," or grove of trees, and under this shade was encamped an apparently respectable native traveller, with the female members of his family, in a covered "bylie," or bullock carriage. Around one side of this covered cart was a slight canvas enclosure, the usual arrangement for enabling respectable native women to cook and eat unseen while on a journey. It is rude, and in every way improper, to pry into the interior of such an enclosure or covered vehicle, and, for a long time, the presumed respectable native traveller remained undisturbed. At last a drunken soldier exposed the whole trick. The covered cart, instead of concealing respectable native females, held a

cask of spirits, and the enclosure was the place into which the men crept, one by one, to buy and drink the liquors. Country spirit is sometimes adulterated with *datura*, to add to its intoxicating power, and I have often seen it produce most serious and occasionally fatal effects.

The single objection I see to altogether prohibiting the distillation and sale of country spirits in all cantonments occupied by European troops is the considerable loss the revenue would suffer in that case. But this is a question solely for the consideration of the Governments.

Ale and Porter.—These articles are imported from England and sent up to Meerut *in cask*, where they are kept in store for a time, examined by a mixed committee, and if found good served out to regimental canteens. The ale or beer is, doubtless, generally of excellent quality when first imported; but it is a most delicate article, and if long exposed in cask to the heat of a country boat, it often goes bad before it can reach Meerut. Porter, however, is found to bear such carriage and exposure much better.

The large quantity of pale ale consumed by the upper classes in India is uniformly bottled in Calcutta, and sent into the interior in six or twelve dozen chests. I was president of a special committee assembled at Meerut in 1852, I think, to examine and report on the quality of the *hill beer* brewed by Mr. Mackinnon, the intelligent and enterprising proprietor of the Mussourie brewery. Before the committee met I went myself to Mussourie, was very politely shown over the whole establishment, and then satisfied myself that the malt was made from a sort of barley called "chevalier," grown by Mr. Mackinnon himself in the hills, that the water used was selected with great care and judgment, and that the hops imported from England were of the best quality, as testified both by the specimens exhibited and the nature of the pockets or packages in which they were imported. This hill beer is much liked, brings a good price, and the demand for it is greater than Mr. Mackinnon's present establishment can supply. The local committee examined the beer in question at the beginning of the hot season and pronounced it good and wholesome in every respect; but to test its power of keeping we put aside some bottles in a cool place, retained them there all the hot weather, and again assembled and opened the bottles in the ensuing cold season. The beer was still pronounced to be perfectly good, and although it was not *well up*, it remained clear and transparent after being poured out and allowed to stand in the glass for 12 hours.

T. E. D.

No. 4.

OBSERVATIONS ON THE ESTABLISHMENT OF THE SUBORDINATE MEDICAL DEPARTMENT OF BENGAL.

Fully to explain the provision made in the Bengal Presidency for medical attendance on the sick of European regiments, it will be necessary to give a brief account of an establishment peculiar, I believe, to British troops serving in the East Indies, and in doing so I shall speak of things as they were when I left Bengal in 1857.

To each European regiment was attached a subordinate medical staff, consisting of one apothecary, one assistant-apothecary, one hospital steward, one assistant-steward, and from two to three hospital apprentices. When properly controlled and well managed, these persons render the most valuable aid to the surgeon, who has often a heavy sick list with numerous acute cases, in which life often depends on the patient being closely watched, and frequently reported on, by qualified attendants. Some of the young men of the department have had the advantage of attending the junior classes of the Calcutta Medical College, but generally speaking, their medical education has heretofore been mainly practical. They are liberally supplied with elementary treatises on medical subjects, and before being pronounced qualified for promotion to the senior grades, they undergo an examination in English, Hindoostanee, arithmetic, elements of anatomy, pharmacy, uses and doses of the principal articles of the *materia medica*, treatment of the most common tropical diseases, minor surgery, preparation of official hospital returns, &c. This examination has not generally been of a very searching character. The regimental surgeon is supposed to superintend and guide the studies of the younger men, but this is a duty he has seldom leisure to perform.

To the apothecary belongs the custody of the medical stores as well as the preparation and dispensing of the surgeon's daily prescriptions. He sees the patients at stated periods, and reports to the medical officers all fresh admissions or other cases requiring immediate attention. One subordinate remains on duty at all times within the wards. Every thing connected with the bedding, clothing, and diet of the sick devolves on the steward and his assistants, but both apothecary's and steward's departments act strictly under the orders and supervision of the regimental surgeon.

The subordinate medical service, considering the class from which it is recruited, is fairly paid, and holds out a respectable and comfortable provision for life to the sons of deserving non-commissioned officers and such like public servants. It is open, however, to qualified Christian youth of all classes, but heretofore it has generally been filled by "Eurasians" or "country born" young men, regarding whom it is proper to say a few words. The "Eurasian" has a thorough knowledge of the language and customs of the people, and therefore can make himself most useful in communicating with and superintending the duties of the native hospital servants; but he is too often deeply tinged with the vices of the country, and wants the moral checks which exercise so wholesome a control over persons holding a relative position in England. I have met with some Eurasian subordinates of most unexceptional character, but I agree with Sir R. O'Shaughnessy in considering them, as a class, to be of a low moral standard.

All "indents" for "Europe and country" medicines, instruments, bedding, hospital clothing, wine, beer, and other requisites for the sick, are prepared by the subordinates, supervised by the regimental surgeon, and checked and sanctioned by the superintending surgeon (now deputy-inspector-general) of the division. It is, however, obvious that the real wants of the sick European soldiers in India can only be properly anticipated and provided for by a medical officer who has a competent knowledge, not only of the climate, but of the resources of the country and customs of the people; and it is well known that the surgeon fresh from Europe is often glad, in all such matters, to place himself for a period in the hands of a smart medical subordinate, who, while he saves his superior from all trouble, rarely fails to take full advantage of the opportunity thus afforded him. The amount of peculation which has been habitually practised in some regiments, would astonish the uninitiated. Valuable drugs, wine, clothing, food, &c., have all been appropriated by fraudulent subordinates, to the serious loss of the Government, and to the injury of the sick soldier.* In point of intelligence and practical knowledge of their duties, a large proportion of these subordinates are sufficiently well qualified to render them most valuable hospital assistants, but what we chiefly farther require are trustworthiness and integrity. In such a climate as India it will be admitted that the purely medical duties of the surgeon must often be greater than he has strength satisfactorily to perform; and it was in consideration of this, and to relieve him from other harassing minor services, that the aid of a subordinate establishment was given. To take inventories of hospital stores, to ascertain the real expenditure of the medicines, and the condition of each particular article of bedding, clothing, &c., however necessary, to be carefully performed, involve an amount of time and personal labour which the surgeon of a European regiment in India can rarely bestow. On the other hand to solely intrust this duty to the present class of subordinates is in every way improper, for then the temptations thrown out by corrupt native commissariat underlings become so strong, and the facilities for peculation so great, that certain irregular gains will soon come to be looked upon as part of their regular and rightful perquisites. This state of things, I have good reason to suspect, is too common in the Bengal medical subordinate department.

The Lawrence Asylum in the hills might be turned to excellent account in supplying recruits for the subordinate medical service, and nominations to that branch might be held out to Christian youth of European parentage, as the reward of good conduct and proficiency. These lads, in addition to good moral training and European blood, will possess the advantage of speaking Hindoostanee fluently, although, happily, they will have been brought up apart from the common herd of native Indians. Such medical education as may be considered necessary to bestow on these young men should be conducted in a regular and systematic manner; and once posted to a regiment, they should be removed from it as seldom as possible.

Native Hospital servants.—In addition to the establishment just noticed, each European regimental hospital is amply furnished with native "ward Coolies," cooks; "dhobies," or washermen; "bheesties," or water-carriers; sweepers, clothiers, and stewards' servants; indeed, nothing can be more liberal than the Indian Government has been in such matters.

Hospital sergeants.—I look upon this appointment as one of the most important in the non-commissioned ranks of a regiment. Some steady, sober, but soft and otherwise useless man, is too often considered by commanding officers as fit to fill this responsible situation—there cannot be a more

grievous mistake. Much of the good order and discipline of every hospital will turn on the character, intelligence, and temper of the hospital sergeant; and when it is considered how much of the time of every British soldier in India is actually spent within the walls of an hospital, all reflecting officers will readily admit how important good order in that quarter must ever be to the discipline of a whole regiment. Every possible care must be taken to guard against the hospital being sought by the lazy and malingering as a place where they may escape disagreeable duties, and procure irregular indulgencies, which they could not obtain in barracks. An intelligent hospital sergeant, who strictly does his duty, will go far to prevent the hospital ever becoming a favourite resort for such characters. In the European local army, the hospital sergeant is never employed to write official returns, or to perform such like duties.

Hospital Orderlies have not hitherto been allowed in the European local army, but when a patient was seriously ill, it was the practice to permit an intimate comrade to attend on him for a time, to perform such personal offices as could not be so agreeably rendered by a native servant. One great objection to this practice is, that these waiting men must necessarily have their food brought from the barracks, and this has often afforded the opportunity of passing in liquor and other improper articles, both to the patients on whom they were waiting, and to others in the same ward. The food of these waiting men should never be allowed to pass beyond the hospital guard room.

Preparation of Official Reports and Indents for Medicine, and other hospital requisites.

I have no means at present of stating the exact number, and nature of the daily, weekly, monthly, half-yearly, and annual reports and returns required in India from the surgeon of an European regiment, but they are in truth, *legion*; and if all were prepared by the medical officer himself, would occupy his whole time and attention. It was long understood that the writing of all these documents was an important part of the duty of the hospital subordinates; but about 15 years ago a dispute arose on the subject and a reference was made to army head-quarters, when it was decided that these persons had far more important duties to perform than to write "Queen's medical returns." From that hour forward, the relative position of the Queen's surgeon and his subordinates became materially changed. It was difficult for him to find other persons qualified by a knowledge of forms and medical terms to prepare such complicated returns with neatness and accuracy; and, in point of fact, these papers continued to be written by the subordinates, as heretofore, but now as a *favour*, or for a pecuniary consideration, and *not as a duty*.

The surgeon was personally responsible for the regular transmission of certain elaborate returns, and it was his duty to see that the sick under his charge were fully supplied with every requisite medicine and comfort; but he had no such personal interest in the *cost* which might be incurred by the Indian Government, to which he owed no direct allegiance, and from which he had nothing to hope.

The "Company" paid for all, and the "Company" had its own officers to look after its own interests. Under such circumstances it is not surprising that some surgeons should content themselves by solely attending to the interests of their own sick, and should hardly consider that they were further called upon minutely to watch their subordinates, and check petty peculations, when the result to themselves might be, that the latter would strike writing in a body, just as the annual returns were urgently wanted. It is not therefore improbable, that a sort of tacit compromise sometimes took place between the parties. The returns were regularly forthcoming when required, and no particular questions asked as to "the quantities expended since the date of last indent;" or, "the quantities required for the ensuing six months." Whenever a suspicion of such a state of things existed, a superintending surgeon, who was held by his own Government strictly responsible for any undue expenditure within his circle, was too apt to consider his chief duty to lie in curtailing such indents; and it naturally followed from this that, when a regimental surgeon really wanted *one* pound of any article he asked for *two*, and thus left a margin for the checking officer's pen. All this was wrong. The checking officer should consider it one of his chief duties to know and grant everything necessary to the welfare and comfort of the sick; and the regimental surgeon should be held responsible that he not only asks for all his sick require, but asks for nothing more, and carefully guards against extravagance, culpable waste, or actual fraud. That the subordinates *do* assist the surgeon in making out *all* his returns, I believe to be a fact; and I am of opinion it should once more be declared to be their duty so to do. The vast amount of this writing may, I

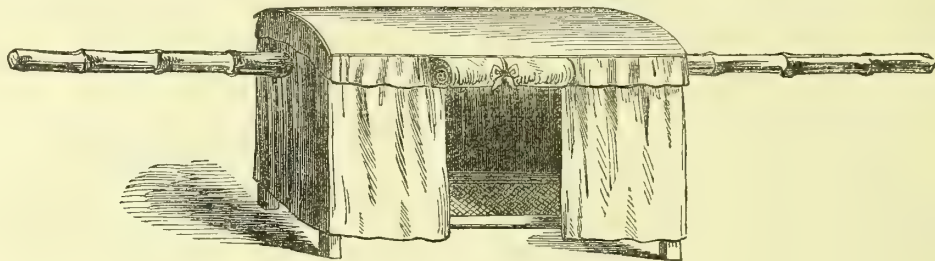
* I have in my possession a curious account of the manner in which some of these frauds are managed, communicated to me privately and confidentially by an hospital subordinate himself.

conceive, be greatly curtailed with benefit to all concerned; the duties of subordinates should be clearly and strictly defined, and these duties and *no others* demanded of them.*

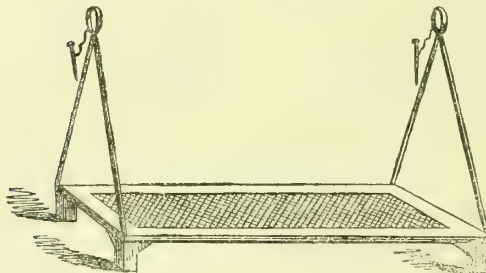
Carriage for the Sick and Wounded.

It is generally known that the sick of European regiments in India are carried on the march in a sort of country litter borne by bearers, called a "Dooly;" but it is not so well known that the army dooly of the several presidencies differs materially from each other, both in construction and in the practical uses to which it can be turned. During the siege of Mooltan and subsequent Sikh campaign, I had an excellent opportunity of comparing the merits of the Bengal and Bombay army dooly as a conveyance for the sick or wounded soldier in the field. At first sight, the Bengal dooly appears a very rude and primitive contrivance, and, in respect to workmanship, a whole century behind the one in use in the Bombay army; but it will be found, on further inquiry, to combine the following useful qualities. It is light, and so slung on its bamboo pole as to be easily carried by the bearers. It can be readily converted into a most convenient and comfortable camp bed. It affords greater facilities for putting in, or taking out, a

very weak or severely wounded man than any contrivance with which I am acquainted. On the march, the very sick or severely wounded soldier, once comfortably placed in the Bengal dooly, need not be removed from it at all until he reaches his final destination. At the end of a day's march the top and cloth cover are quickly taken off, the dooly and its occupant placed in the hospital tent, and the pole withdrawn before the sides of the tent are laced on, leaving the patient undisturbed in a comfortable camp cot. In the morning, as soon as the walls of the tent are taken down, the pole, top, and cloth cover are again quickly replaced, and the dooly removed from under the tent, and ready to proceed in rear of the marching column, without the smallest fatigue or inconvenience to its tenant. A wounded man can be dressed nearly as easily in his dooly as on an ordinary hospital cot, the only drawback being that the patient is placed a little too low for the surgeon; but this can be remedied by putting a few bricks under each of the short legs. Finally, during very hot, very cold, or rainy weather, the dooly tops can be turned into a convenient shelter for the bearers. On active service, and where bearers are not to be replaced if they fall sick, this is no unimportant consideration.



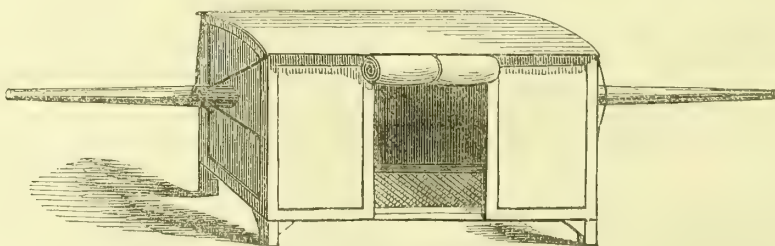
Bengal army dooly with top, bamboo pole, and cloth cover adjusted.



Bengal army dooly, with top, pole, and cover removed, and ready to be used as a camp cot.

The Bombay dooly is a thing of greater pretensions altogether. It has a cane-bottom, immovable top, and fixed painted canvass sides or panels, and the pole, which is fixed as in an ordinary palanquien, cannot be withdrawn: the frame is light, but substantial. When entire and in good order, this kind of dooly affords an excellent shelter for the sick, or for surgical instruments, medicines and dressings, in very stormy or rainy weather; but here its advantages stop. It is not so easily carried by the bearers as the Bengal dooly, in consequence of the lower point at which the pole is fixed. It cannot be used as a bed for the sick, unless left outside of the hospital tent altogether. A very weak or severely wounded man is placed in it with much difficulty, and being in, cannot be taken out again, without inflicting much suffering and fatigue. Moreover, it is hardly possible for a surgeon to dress a severe wound, or perform any operation on a patient lying in such a conveyance. Lastly, the

stiff-painted canvas panels are readily torn and injured by stumps of trees and such like obstacles, and when so injured, it is for the rest of the march or campaign, a less efficient protection against wind or rain than the Bengal dooly, with its loose, not easily torn, but easily repaired cloth curtains. A few inexpensive alterations and additions would render our Bengal dooly everything that can be desired. An additional good cloth to the curtains, or, better still, a dooly cover, entirely made of *white country blanket*, with a sufficient number of proper buttons to close the sides and fix the ends of the curtains in boisterous weather, would render it a complete protection against wind or rain, and so obviate its single defect. On field service, ten doolies, with six bearers each, are (if I remember right) allowed by the regulations for every hundred European soldiers; but on occasions of ordinary relief, only one half that number.



Bombay army dooly, as it must remain at all times.

* It will be proper here to explain that the "Company's" superintending surgeon had no authority to interfere with the hospital practice of the surgeons of Queen's regiments,—his duties being confined to the regulation of the supply of medicine and hospital requisites of every description, and to matters affecting the general sanitary management of the troops within his "circle" or superintendence.

In addition to the convenient but expensive conveyance above described, other carriage is generally forthcoming as occasion requires, for another class of patients often very numerous in the field, viz., foot-sore men, convalescents, and all the slighter cases of sickness or injury. Elephants with pads, camels with "kujawahs," or basket litters swung on each side, and country carts or "hackeries," spread with straw and fitted with a covering of slender reeds called "sirkee," have all been employed for this purpose. Elephants and camels can keep up with the marching column,—a great advantage,—but the situation of a weak man on the pad of an elephant, or in a camel litter, is anything but agreeable; and except to the robust and healthy, either mode of conveyance becomes, after a short time, fatiguing and irksome in the highest degree. The somewhat complicated litter proposed by Sir J. Login, if placed on a perfectly steady and well-trained camel, would doubtless carry a sick man with some degree of comfort; but it is hopeless to look for a sufficient number of well-trained animals when required, and a restive camel, of all intractable brutes, is the most unmanageable by the European. In some kinds of country carts a weak man may lie or sit without much inconvenience; but their rate of travelling is so slow, that they are seldom up for hours after the camp is pitched, and all others have had their breakfast. So wearisome is this mode of conveyance to the European, that the men told off for the carts will generally be found to have walked the greater part of the way. It was probably in consequence of the facility of procuring such questionable extra conveyance on sudden emergencies, that the authorities in India never thought of providing any description of ambulance or wheeled carriage for the sick and wounded in the field, similar to those in use in most modern European armies. It is true, that during the rains in India,—a season when an army rarely takes the field,—the condition of the country is ill adapted for wheeled carriages of any sort; but at all other periods of the year there are few countries in which they can be more conveniently employed. At our gun carriage agencies there are not only skilled workmen but abundant *spare* materials for the economical construction of such vehicles; and in every mounted corps there are always to be found horses, not quite up to work with the guns or in the ranks, and yet well suited, for some years to come, to the slow, steady draft of a carriage for the sick. On an emergency, elephants or camels may be used, or, failing these, a sufficient number of draft bullocks can at all times be relied on.

I am the last to desire or advise the supersession of our admirable Bengal dooly, but it is not only a most expensive description of conveyance, but its use is entirely dependant on the presence and fidelity of a sufficient number of dooly bearers. I have known many hundreds of these persons to desert in a body during an important crisis of a campaign. Six hundred dooly bearers, not including "sirdars," are at present required in the field for a European regiment 1,000 strong. This is not only a great expense to the State, but a *great incumbrance* to an army.

A certain proportion of well-designed and carefully constructed carriages for the sick would enable us to dispense with a considerable number of dooly bearers, and would partially provide against the untoward contingency of their deserting in a body just as their services are most urgently required. Of course, I have often thought of a plan for such a carriage, but I have not sufficient confidence in my own mechanical knowledge to venture to submit it to the Commission; I am, however, satisfied that an ambulance for the sick in India should possess the following qualities:—The springs, wheels, &c., should be so strong as not easily to break down on common country roads, while all other parts should be as light as possible. The clumsy wheels of the up-country "Hackary," and the primitive manner in which they are fitted to that conveyance are, I am assured, peculiarly adapted to the narrow unmetalled roads and unbeaten tracts on which they travel; and I know well, that such rude carts often arrive at the end of a march in perfect safety, when trim English built vehicles break down on the road. A carriage for the sick in India should also afford proper shelter from the sun or rain, and, at the same time, be so constructed as to admit of a free circulation of air. The centre of gravity should be low, to prevent its being readily upset, and to enable the patients to get in and out quickly and easily, to lighten the draft, and to assist it over any unexpected obstacle. Such a carriage would, I believe, often prove of much value in India, except, perhaps, during and immediately after the periodical rainy season.—T. E. D.

No. 5.

NOTE ON BREAD.

Of all the articles of food consumed by the European soldier in India, none has given more dissatisfaction to the men themselves, or more trouble to their officers, than the bread formerly supplied by the commissariat. According to the old regulations, if the bread or any other barrack ration was objected to, a regimental committee was immediately assembled to examine and report upon it. If the article was pronounced unwholesome or of inferior quality, the commissariat officer had the power to demand a station committee, at which he personally attended, and this last committee not unfrequently reversed the decision of the former one; but whether reversed or confirmed, the men had generally to wait many hours before they received the disputed ration, or a proper substitute for it. By Lord Dalhousie's new regulation (promulgated, I believe, in 1852-3), the decision of the regimental committee was made final; the standard of quality for the men's bread was declared to be the fine loaf eaten at the mess tables of the officers; and it was intimated that if the soldier should get bread or other articles of food of an inferior quality, the blame would henceforth rest with the officers themselves, to whom absolute power was now given to accept or reject all rations tendered by the commissariat.

The natives of India neither make nor use any kind of fermented bread themselves, but in every European military cantonment two descriptions of "English bread" were formerly known, viz., the fine, white, porous, but rather tasteless loaf used by the upper classes, and the brown and somewhat heavy loaf of the barracks. This last was often agreeable enough to the taste when fresh, but after being kept some hours was apt to become sour and doughy. The native bakers maintain that a good light bread, suited to the European taste, cannot be made with the flour of the common Indian bearded wheat, but that "*soojee*" must invariably be employed. When the complaints and discussions on the subject of bread for the troops were at their height in 1852, a committee to inquire into the matter was assembled at Meerut, of which I was a member, and on that occasion I had the wheat ground, and the materials for the two kinds of bread prepared, in my own house, and under my own eye. The following are the results of the information I then obtained:—

To prepare the "soojee" for fine bread.—The whole wheat is placed in small separate heaps on the ground, gently sprinkled with pure water, and allowed to remain in this state from four to twelve hours according to the condition of the atmosphere, until the grain has become somewhat soft and swollen with the moisture. During this preliminary process some chemical change is doubtless effected on the gluten and starch of the wheat. The grain, after having been duly moistened, is ground in the common Indian handmill, and then quickly passed through a *very coarse* sieve, which separates the bran in a large unbroken form. This bran is put aside and only used to feed poultry, cattle, &c. The flour is next put by handfulls into *very fine* sieves suspended from the roof and vigorously shaken. By this process a fine, white, impalpable flour is separated and collected below. This fine flour is also rejected as a bread stuff; it is very white, is rich in gluten, but can only be turned to profitable account by the "hulwaes," or native confectioners, to whom it is usually sold. The residue of the flour, after these two siftings, is then subjected to the following curious manipulations, commonly performed by females:—A woman sits on the ground with a heap of the flour on her right; this she takes up by handfulls and places in a sort of broad shallow shovel made of "sirkee" grass, called a "sooph," and, by a very dexterous movement of the hands, she causes all the lighter and darker portions of the flour to fall on the ground immediately in front, while all the more round, solid, white particles are collected at the lower edge of the shovel, and are from time to time transferred to the ground on her left side. When the whole has undergone this manipulation, the heap on her left is the *first "soojee"* used in making the fine, white, porous loaf; that in front is called *second "soojee,"* and of this last material the barrack loaf was entirely formed. If a very fine "soojee" is required, it is subjected to two or more such siftings. This "soojee" is, I believe, identical with the article now sold in England under the name of semola or semolina. "Toddy," or the fermented juice of the date tree, is the yeast commonly used by the Indian baker, but when that cannot be procured, other, but less efficient, ferments are occasionally employed. It was pretty generally supposed that the old barrack loaf was made of whole or unbolted wheaten flour; but, from the account given above, it will clearly appear

what an entirely different thing this second "soojee" is after the abstraction of the bran, fine impalpable flour, and fine "soojee,"—all rich in plastic, nutritious principles. The fine "soojee" is rich in gluten, and makes a light, digestible, and nutritious bread; but it may be doubted whether it is really to be preferred, as a barrack ration, to the well-baked brown loaf, made of whole or unbolted English wheat.

The bearded wheat of India is, I believe, very inferior in quality to the wheat of England, America, or Cape of Good Hope; but I know not if the difficulty experienced in making good bread with Indian wheat flour depends chiefly on the inferior quality of the grain, or is to be ascribed to want of skill on the part of the native baker.

Mr. Astell, formerly judge and magistrate of Bolundshuhur (a civil station about twenty miles to the west of Meerut), not only succeeded in growing good English wheat at that place, but baked and used in his own family an excellent household bread, made entirely with whole or unbolted English wheat flour. I have often seen and eaten this bread, and found it unexceptionable in all respects.

A good, wholesome, and nutritious barrack loaf is a matter of prime importance to the British soldier in the East, and if such bread as Mr. Astell succeeded in making could be supplied to the troops in sufficient quantity, it would go far to enable us to reduce, in the hot weather, the present excess of the more concentrated nitrogenous aliments.

Now that India has its railroads, I know not whether it would be more convenient and economical to grow a good description of wheat in the upper provinces, or to import it from England, America, or the Cape; but this I do know, that a good wholesome household bread can be made in India of flour alone. The processes employed by native bakers with success in the plains answer very imperfectly at the hill stations, and this has proved a source of much trouble to the weak and dyspeptic at these places. The yeast used in the hills was probably the main cause of this failure, but if large bodies of European troops are henceforth to be kept in these regions, this subject will become one well worthy of particular attention.

T. E. D.

OBSERVATIONS on the RATES of MORTALITY among the TROOPS in INDIA, by Dr. EATWELL, Principal of the Medical College, Calcutta.

As regards vital statistics, there is great difficulty in forming any approximatively correct idea of the rates of mortality amongst the civil population in this country, owing to the absence of a correct census, and of any comprehensive system of registration of deaths. In this respect, Bengal, though our oldest possession, is behind both the North-Western Provinces and the Punjab, in which censuses of a certain degree of accuracy have been taken. This want, however, results from the prejudices of the people, which can hardly be disregarded. In Calcutta even, there is but an imperfect census of the native population, calculated from the number of houses and allowing 8·7 persons for each house, and 5 persons for each hut. The general mortality tables of Calcutta, more especially of the native portion of the population, are also of necessity very imperfect, the only means of estimating the mortality amongst the general population being from the records kept in connexion with the different places of interment in the case of Europeans and Mussulmans, and at the regulated ghats on the river bank at which Hindoos bury their dead, or consign them to the stream. As regards the prevailing diseases amongst the native civil population tolerably correct information may be derived from the returns of dispensaries and of native hospitals throughout the country. These institutions exist in all the chief towns of this presidency, and all furnish returns of the diseases treated at them. The gaol hospital returns will also furnish information on the same head, but in taking these returns as indices of sickness and mortality, it is requisite to bear in mind that incarceration itself modifies disease, and frequently gives an unusual rate of mortality to certain diseases, as cholera and dysentery. Still, I am of opinion that the returns of sickness and mortality in gaol hospitals are capable of affording much trustworthy and valuable information, at least as regards prevailing sickness in the localities in which they occur. The returns of native regiments, if taken for a long series of years, may give a fair approximative idea of the prevailing diseases of the locality, and of the mortality attending them, although there are some serious sources of error in such cases, which require to be recognized and eliminated from the inquiry. The men of a regiment frequently bring with them to a station constitutions peculiarly predisposed to disease, through influences to which the men have been previously exposed. Thus, we found that the native troops who had been stationed long in the Straits of Malacca became affected in China, through slight causes, with a most destructive form of hospital gangrene. The occurrence of this affection was attributed to an enfeebled condition of system engendered by employment of an insufficient and almost exclusive fish diet. Again, at Barrackpore, near Calcutta, it has been found by experience that sepoys from the upper provinces sicken generally after two or three years, and consequently native troops have not been allowed to remain beyond that period at Barrackpore without relief.

As regards medical topography, there is not, I believe, a station in India of which the topography has not been written by one or more medical officers. The archives of the late Medical Board (now of the Director-General of the

Medical Department) must contain ample information under this head.

As regards climatology, a considerable amount of information must be in existence in the annual reports of military and civil medical officers in the archives of the Director-General. Such observations are probably, in many instances, imperfect and only approximatively correct, from the difficulty of procuring good instruments in this country, and of preserving them in constant efficient condition, and also of obtaining trustworthy assistants for conducting observations.

But the primary object of the Commission will, I presume, be the investigation of the causes of disease amongst European soldiers, and the suggestion of measures for their removal. You will find some exceedingly valuable information on the vital statistics of European troops in India in the last numbers of our "Indian Annals," in papers by Dr. Chevers and Dr. Macpherson; I forward by this mail copies of the journal containing the articles.

The question which, of all others, will demand the most careful investigation is that of the effect of different elevations on the health of troops. There appears to be an opinion in some quarters that elevations of from 5,000 to 6,000 feet are preferable to those of from 7,000 to 8,000. Sir R. Martin, I see, is of opinion that elevations of from 2,000 to 3,000 feet should be tried. It is impossible to overrate the importance of this question. Not only is it one involving the proper outlay of an enormous sum of money, which will be required for the construction of barracks, but it involves the question whether there be in India a climate in which the European can be preserved in health and in vigour, and not be exposed to an excessive risk of succumbing to disease. Not only will the proper locating of our European troops depend upon a correct solution of this question, but the feasibility of colonising our hill districts with Europeans will hang on the same decision. I must say that I should regard with extreme suspicion all elevations below 3,000 feet in India, unless they were table-lands, such as the district of Mysore, or culminating ridges around which existed free circulation of air, and having their bases and the country around cleared and cultivated. According to my experience in the tropics the deadliest fevers occur about the bases of and at low elevations in hills. In India it is usual to attribute such fevers to the dense jungle which usually occurs in such situations. In China, however, the hill sides at Hong Kong and Amoy are bare of trees, yet the malarious fevers which I witnessed at those stations during some three years of residence in them, exceeded in malignity anything I have ever seen in Bengal.

I have learned to regard the hills and the bases of hills within the tropics always as suspicious and dangerous localities. Bengal itself is a vast swamp almost, from its extended rice cultivation, but it is a mistake to suppose that severe fevers prevail generally in the plains of Bengal. Agues and enlarged spleens are met with, but not to a great extent, except in limited localities, whilst severe remittent fevers are not generally common. In China I saw an immense amount of fever, and I was forcibly struck by the

imperceptible manner in which the intermittent fever glided into the remittent fever at the commencement of the hot season, and how the remittent in like manner faded into the intermittent on the setting in of the cold season. The atmospheric conditions which accompanied this change were an elevated temperature, and an atmosphere more or less stagnant for a portion of the day, and laden with moisture. Under such circumstances cuticular evaporation was very slight and the removal of animal heat by insensible perspiration imperfect. In this way animal heat would accumulate, and from the diminished necessity for its generation, and perhaps from actually diminished supply of oxygen in a stagnant moisture-laden atmosphere, hydrocarbons would accumulate in the blood until they became a "materies morbi," capable of setting up an attack of fever, which would consist in their chemical decomposition and elimination. I regarded the severe remittent fever of China as an intermittent produced by some external agency, and acting, according to my idea, on the ganglionic nervous system, and having at the same time a second element of disease, a materies morbi, existing in the blood and developed there by some imperfection in the processes of oxydation which are always going on in the economy. I believe that whenever you have an elevated temperature approaching blood heat, without a condition of atmosphere which shall ensure rapid evaporation from the surface, and consequently adequate cooling of the body, you will get severe fever dependent on blood poison generated in the blood itself. If there be a malarious influence present, the fever will be a remittent, if not, a continued fever. Our worst fevers in India are what are called jungle fevers, from the fact of their being constantly caught when traversing forests, but I am satisfied that such fevers may occur independently of the presence of forests, in low situations surrounded by hills, where stagnation of air and humidity are conjoined to elevated temperature, whilst our deadliest Indian jungles are at the bases and on the sides of hills. Holding these views, I should insist, as conditions for escaping remittent fever, that the mean annual temperature of the locality should not exceed 60°, and that if during the summer months the thermometer ranged high there should be such a condition of atmosphere as regards dryness and prevalence of wind as should allow of the necessary cooling of the body. All stations on the sides of ranges, unless such ranges be swept parallel to their faces by continued winds and have a dry atmosphere, should in my opinion be at an elevation of not less than 7,000 feet. I should certainly be disposed to regard mean annual temperature and the character of the flora of a locality as good guides to its general fitness for the European constitution. There may be local sources of disease, but I find difficulty in escaping from the conviction that a locality having a climate agreeing in mean annual temperature with that of temperate Europe, and having a flora rich in European forms, must (*cæteris paribus*) be more suitable to the European constitution on the whole than a locality having a mean annual temperature approaching a tropical one, and a corresponding partly tropical flora. But, the distrust which has recently arisen with reference to our hill stations in India, has been occasioned by the prevalence of a fatal form of diarrhoea and dysentery at certain of our Himalayan stations (Subathoo and Kus-sowlie, respectively 4,200 and 6,200 feet above the sea level). The investigation and determination of the real nature and cause of this complaint are of the greatest importance, since if it could be shown that the efficient cause of the disease was consequent on elevation or on physical conditions inseparable from elevation, the doom of our hill stations generally would be sealed. I send you an interesting and careful paper by Dr. Grant on this subject, and also a very able and valuable paper by Dr. Chevers, which will give you very full information on this point; also a second pamphlet by Dr. Grant, on the topography and medical history of Murree, a convalescent depot in the district of Hazara. My own belief is, that the hill diarrhoea of the Himalayan stations depends on local agencies unconnected with elevation, and that it does not differ materially (as pointed out by Dr. Grant) from the disease which decimated Her Majesty's 26th regiment at Chusan during the early occupation of that place. Sufficient elevation of the floors of barracks, choice of material and construction to ensure their dryness, sufficient cubic space in the barrack rooms for the number of inmates, means of *renewing vitiated air*, efficient drainage round barracks,

removal of all sewage matter to a distance, a proper supply of fresh meat and of fresh vegetables, good pure water, and sufficient clothing; these appear to be the conditions for ensuring health generally; and to the absence of one or more of them, it is probable that the hill diarrhoea owes its origin. It should always be borne in mind that patients who have suffered from malarious fevers are apt to suffer from bowel complaints when exposed to cold, whether this be the result of change of season or locality. I had ample proof of this in China, and have remarked the same in India; the proneness of soldiers to bowel complaint in our Himalayan stations may frequently have depended on this cause, without the intervention of local causes.

The question of the influence of water in producing disease is one of importance, and the present opportunity might with propriety be taken for investigating it completely. The natives generally have an idea that the water of a locality has a great influence on its salubrity. The common expression of a native in speaking of a locality is that "the air and water are good;" which implies salubrity. But this notion of the water being an efficient cause of disease is not confined to the natives. On returning from the Neilgherry Hills in the Madras Presidency a few months ago, I was informed on the spot that the water of a small stream which flows in a valley at the foot of the hills between the main range and a low outer range invariably gave fever to anyone drinking it at a certain season of the year, and that orders had been given by the military authorities prohibiting soldiers on their way to the hills from drinking the water. The water was said only to be deleterious in the dry season when it was low. I had not an opportunity to make particular inquiries on the subject, but have no reason to doubt the general correctness of the information as to orders having been given to prevent soldiers drinking of the stream. I have been informed that a similar opinion prevails at Peshawur, where severe remittent fevers occur at certain seasons of the year. In both localities we have valleys beneath mountain ranges. In Hong Kong, in 1842 or 1843, a medical officer who had been in the West Indies started the idea of the water being the efficient cause of the severe malarious fevers we experienced there, and a committee, composed of the superintending surgeon, the naval deputy inspector of hospitals, and a regimental surgeon, was appointed to investigate the question. I, at the time analyzed roughly, with such means as I could command, the different drinking waters of the place (the memorandum on the subject having, I think, been sent to the Board of Ordnance at home), and I gave evidence on the subject before the committee. I formed a strong opinion against the water having anything to do with the production of the fever, not only from the condition of the water itself, but from the fact that I had observed that persons on board ship at Amoy had enjoyed, at a distance of a few miles from the land, perfect immunity from the fever which struck down the whole garrison on shore, although the water used was the same in both positions; and also, that the same fact was observable at Hong Kong, though in a less marked degree, the ships in the latter place lying close to leeward of the high land, and the crews having greater facilities of going on shore. Whilst doubting the influence of bad water in producing fever, I believe it to be an efficient agent in many instances in causing bowel complaints, and even cholera, in certain atmospheric conditions. I would suggest that a careful chemical examination be made of the water in all those localities in which severe fevers exist, and where the water has been cited, either on medical authority or on strong non-professional authority, as a probable cause of the disease; and, especially, that the water of the hill stations in which diarrhoea has largely prevailed (Kussowlie, Dugshai, Subathoo) be analysed and minutely examined.

The chemical portion of the investigation could not probably be entrusted to better hands than to Dr. R. D. Thomson's, whose experience in this branch of chemical investigation fits him for carrying out the chemical part of the inquiry with efficiency.

* * * * *

W. M. EATWELL,
Principal of the Calcutta Medical College.

Extract from a letter addressed to Dr. Farr,
September 9, 1859.

REMARKS by Lieut.-Colonel OUCHTERLONY on the Lighting of Barracks in India.

SIR,

11th July 1861.

THE irksomeness of military life in the East is more especially felt by the private soldier during that period of the day which intervenes between the setting of the sun—followed as it is by almost instantaneous darkness—and the time fixed for retiring to rest. Reading, study, or application to the practice of a trade, are the resources offered; but their efficacy is greatly impaired by the insufficiency and inferiority of the artificial light provided by Government for these and other barrack purposes.

The medium through which this is, I believe, almost universally supplied to Indian barrack rooms consists of a lamp formed by a cotton wick kept floating by means of cork buoys upon a surface of crude and often very opaque oil, poured upon water in a glass vessel. Much of the illuminating power of such a lamp is necessarily lost, owing to the unfavourable medium through which the downward rays are transmitted; and not only does waste ensue, but great detriment and injury to the visual organs of the men who essay to read by its light, driving many a well-disposed man from his book or slate to the canteen or to the dram shop.

Instead of this oil I would propose that gas should be the illuminating medium employed; that, in effect, the oil issued to the men in barracks should be burnt in the form of gas instead of being consumed in nourishing the unsteady flame of a rude and imperfect lamp; and I am anxious to show, or to attempt to show that, far from being a source of enhanced cost to the State, it will be found productive of very great economy in a financial point of view, while at the same time the comfort and moral advantage of the soldier are strikingly ministered to.

I will take, leave, in the first place, to consider this question as one of economy.

The common lamp oil usually issued for barracks in India costs about 1s. 3d. per gallon, a quantity which would supply about 36 to 40 open wick lamps for three hours. From this same quantity from 100 to 120 cubic feet of the purest olefant gas could be produced, sufficing for the consumption of 18 burners for three hours, at the rate of two cubic feet per hour per burner. Experiments by various eminent chemists have established that the illuminating power of coal gas ignited in an ordinary burner is to that of a common open oil lamp with a single wick as 5 to 1½; and as the intensity of oil gas is nearly double that of coal gas, it is safe to assume the proportion which its lighting power bears to that of an oil lamp at 8 to 1½, or :: 16 : 3. It results from this that eight ordinary fish-tail oil-gas burners would produce as much light as 40 common oil lamps; and as 48 cubic feet of gas would suffice to supply the former for three hours, it is seen that if economy were exclusively studied, the supply of oil for barracks could, if gas were employed, be diminished by one half.

But the economical result goes even further. The retorts manufactured for the conversion of oil gas will produce it from any unctuous or greasy matter introduced into them; and as barrack kitchens in India abound in such refuse, it is easy to perceive how extensive a saving might be effected if all this were collected and employed in the production of gas.

Several valuable products also result from the manufacture, such as "lamp-black," and, in small quantities, tar. The cost of an apparatus constructed on the plan of Major Fitzmaurice, whose experiments I had recently an opportunity of witnessing at Woolwich Dockyard, would be as follows:—

1. For an apparatus to supply 50 burners, 120l.
2. Do. do. 100 do. 230l., and upwards in proportion.

The manipulation of the apparatus is extremely simple, and could be undertaken by any moderately intelligent man possessing some little acquaintance with the mechanic's art, of whom every regiment in India possesses many.

No purification is required, and the gas, after passing through cold water to reduce its high temperature, is fit for use.

For heating the retorts in India, jungle wood would be used, the cost being in almost all parts of the country insignificant.

A great and important benefit may thus be conferred on the troops employed in India without involving the State in any outlay beyond that at present incurred, save and except the cost of the apparatus to be furnished to each up-country barrack,—a cost which might, in fact, be soon covered by a

small temporary diminution of the quantity of oil now issued for the men's use.

I feel sure, from the experiments I have witnessed, that if gas were employed, more than double the illuminating power might be elicited from the regulation allowance of oil; while the light produced would be of the purest, most brilliant, and most healthy character.

(Signed) J. OUCHTERLONY,
Lieut.-Colonel H.M.'s Madras Engineers.

T. Baker, Esq., Secretary to the Royal Commission
on the Sanitary State of H.M.'s Indian Army.

REMARKS by Lieut.-Colonel OUCHTERLONY on the Practicability of brewing Malt Liquor in India for the Use of the Troops.

22nd July 1861.

All officers of experience must be sensible of the vast importance of introducing into the canteens of the European regiments serving in India a malt liquor of sufficiently good quality and moderate cost to induce the men to drink it at their meals in preference to the deleterious arrack now so generally consumed.

This desideratum can, I am convinced, be attained by the introduction of ale and porter to be brewed in that country. The quality of samples which have been produced, bearing in mind that the strength or bitterness of it can with perfect ease be increased in the process, exactly according to the fancy of the consumers, has been very favourably reported by several officers and soldiers* by whom malt liquor brewed by myself in the Neilgherry hills was

* The under-mentioned Non-commissioned Officers and Private Soldiers of the 15th Hussars, who drank the Neilgherry Beer, are of opinion as opposite their respective names.

Bangalore, 11th June 1849.

Regimental Serjeant Major Handley	The beer is good but rather sweet, and tastes very new.
Troop Serjeant Major Mann	- Very indifferent.
" " Saunders	- Good.
" " Stanley	- Passable; in my opinion requires to be kept some time.
" " Mitchell	- Good, but too sweet.
Serjeant Major Hearne	- Good.
Trumpet Major Westwood	- Good.
Serjeant Sihon	- Good, but too sweet.
" Somerville	- Good.
" Southerland	- Very good.
" Taylor	- Good.
Corporal G. Mortimer	- Good, but too new.
" Smith	- Good.
" Theakston	- Good.
Privates Sadliers	- Good.
" Patrick	- Good.
" H. Harris	- Good.
" Martin	- Good.
" Asquith	- Good.
" Foster	- Very good.
" Freak	- Good.
" Weekson	- Good, wants age.
" Dickenson	- Good, but sweet (his × mark.)
" Ivy	- Sweet.
Serjeant Major Holloway	- Good.
Serjeant Ring	- Good.
" Joice	- Good; sweet through its freshness.

Opinions of the men of Her Majesty's 51st Light Infantry, of the quality of the Beer brewed on the Neilgherries, and forwarded to the above Corps as a sample.

Very good.—E. Ashton.
Very good.—P. Peek (his × mark).
Very good.—Thomas Hale (his × mark).
At present very good; I think it will not keep; I lived at an inn five years.—William Warren (his × mark).
Very good.—John Hill (his × mark).
Very good.—William Haynes (his × mark).
Very good; I think it would be better if a little older, say three months; I have been a brewer, and am of opinion it would keep.—William Hinan (his × mark).
Verb good beer; the best I have tasted in India. John West.
Very good.—William Tomes (his × mark).
Very good; I was five years at a public house.—William Kelfe.
Indifferent; too sweet, not enough of hops; I think it would make a man's head ache should he take a little too much.—W. Luck (his × mark).
Indifferent; too sweet and too new; might improve by keeping; I was a brewer for eight years; not sufficiently hopped.—James Gregory (his × mark).
Good.—Henry Binge (his × mark).
Very good, if it will keep.—William Ellis (his × mark).
Good, I think it will be better if older.—Corporal W. Vick.
Very good; I was four years a brewer.—H. Eveshead.
Very good.—Isaac Whitfield.
Very good.—James Farren.

E. ST. MAUR, Lieutenant Colonel,
Commanding Her Majesty's 51st Light Infantry.

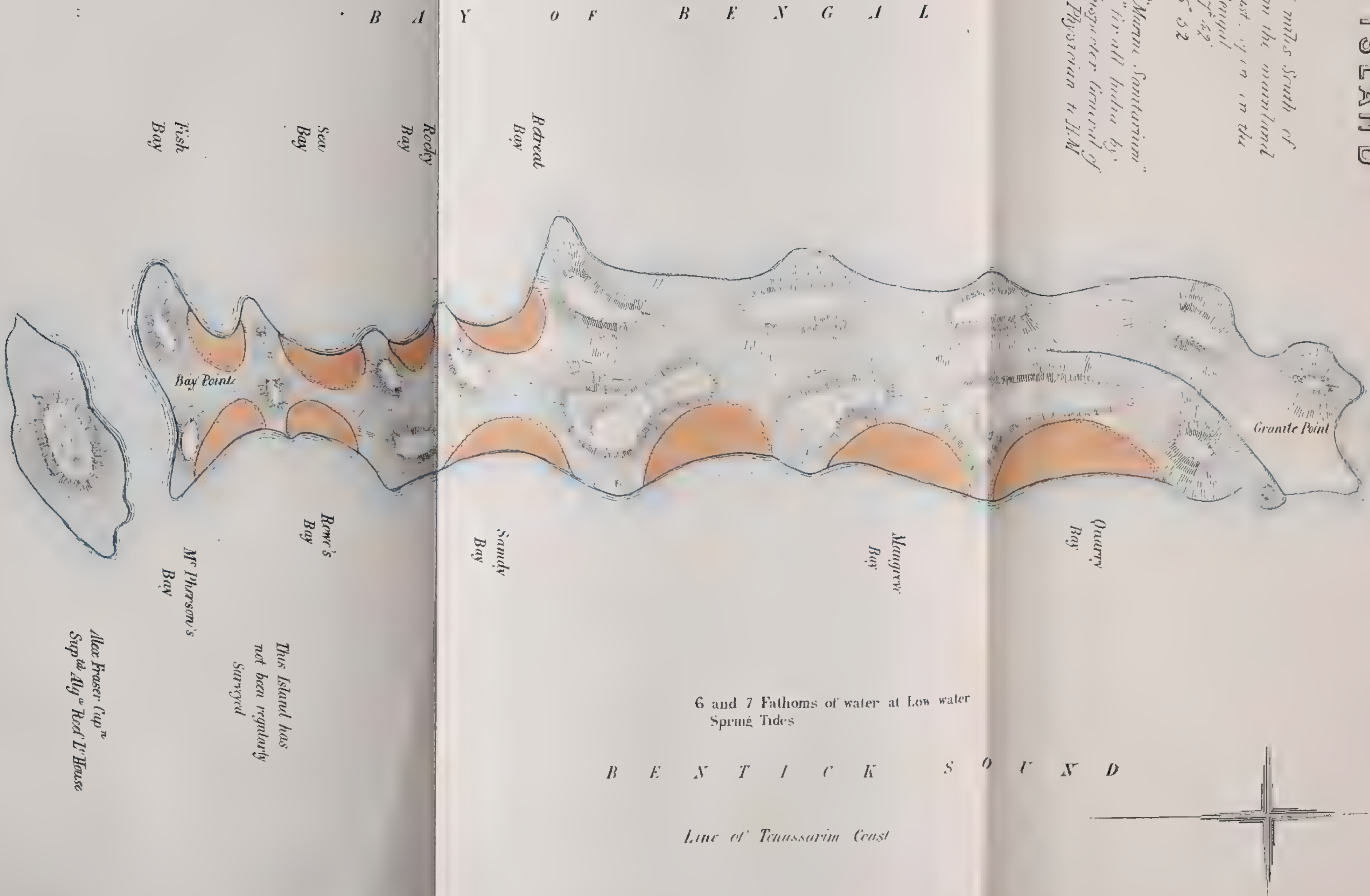
Lieutenant Colonel Milnes, 94th Regiment, reports that "After allowing the beer to remain quiet in the canteen for a week to get settled after the journey, I assembled at the canteen non-commissioned officers and privates from each company (about 20 in number) who were in the habit of drinking beer, among whom this beer was divided at the rate laid down, three annas per bottle, and after drinking it I asked their opinion individually, when all expressed themselves quite satisfied with it, and said if such were supplied at the canteen they would call for it in preference to that which they now drank at four annas per bottle. I would likewise observe that having myself patronized this 'beverage,' since I have been in India, and having drank a tumbler of this beer, I can pronounce it to be very good pleasant beer, and fully equal to the price charged, I observed a degree of

CALLA GOLF OR

CURLEW ISLAND

An Island about 36 miles South of
Amherst 5 miles from the mainland
of the Tanassari coast, 71 m in the
West to the Bay of Bengal
Long. $97^{\circ}42'$
Lat. $15^{\circ}52'$

Recommended as a "Mamm. Sanatorium"
and "Watering Place" for all India by
D.D. Macpherson, Inspector General of
Hospitals & Quarters, Physician to H.M.



by order of Government tried, while the cost will be seen from the following statement of expense of brewing at Kotagherry.

10 gallons of table ale, viz. :—

	Rs.	a.	p.
Barley (for malting); 14 seers	-	0	8 0
Sugar, $\frac{3}{4}$ maund, of 25	-	2	8 0
Hops, H., fuel, labour, &c.	-	1	0 0
	Rs.	4	0 0

which is about six annas and five pice per gallon, to which, if we add three annas and seven pice for carriage per cart to Bangalore or Trichinopoly, and to cover incidental expenses, we have 10 annas per gallon for the cost to the men, when issued to them from the cask in canteen.

The importance, in my estimation, of this subject induced me when in India to persevere in experiments, in spite of numerous failures and at considerable expense, and I was most anxious to continue them, if I could only hope that they might eventually bring about the object at which I aimed, and that Government might be induced to look favourably upon them, and give support to the scheme.

In the manufacture of fermented malt liquors there are so many expedients to which resort may be had to communicate to the product the peculiar character or quality which circumstances may render desirable, that I felt confident that having overcome the chief and great difficulty in the process, viz., the production of the vinous fermentation, without undue acceleration in its action, I should have been able, by the adoption of practical suggestions, to make beer brewed in the Neilgherry hills preserve its soundness and wholesome taste for any length of time which it may be desired.

The beer which I manufactured there could not be considered by any means a fair sample of what might be produced on those hills, were the process to be carried on upon a large scale with proper utensils, and I must add, by persons more practically acquainted with its details than I could pretend to be.

"sweetness in it which is probably owing to its being so recently brewed."

Major Hands, commanding 2nd L. I., now 107th Regiment, says, "The men like the beer, and I think that the undertaking will succeed if full encouragement were given to the brewery."

Major General Kennett writes "I have tasted the beer brewed at Kotagherry by Captain Ouchterlony, and pronounce it a sound, well-fermented, and pleasant drink, very similar in taste to the ale sold at public houses in the country in England."

Mr. E. F. Elliot, Superintendent of Police, Madras. "I first tasted Captain Ouchterlony's beer at Kotagherry, in the middle of last year, when I thought it a pleasant drink, but very light; however I must mention that I took several bottles of the same beer to Madras, that it stood the journey well, and that it met the approbation of those who tried it. Last month I had opportunity of judging a recent brew, which has a decided improvement on that of last year, more body with fine flavour, similar, in my opinion, to home-brewed beer in England, only more potent."

Surgeon Taplin. "Having tasted some of Captain Ouchterlony's last brew of beer, I am inclined to pronounce most favourably. It is in my opinion a very palatable but somewhat potent drink, likely to keep well."

The Rev. J. Griffiths, A.M., "I have tasted Captain Ouchterlony's beer on several occasions; the first sample, nearly a year ago, I disliked very much, being too new; the two or three last were such an improvement on the former, that I could barely distinguish it from college ale, and the last sample strongly resembles what is called in London Llangollen ale. I certainly preferred it to Bass's or Alisopp's."

Major General Dyce. "I have tasted some beer sent to me by Captain Ouchterlony, and which I understand has been lately brewed. It appears to me a sound, palatable, good liquor, and resembles, both in smell and taste, the common English ale, but much stronger."

Sir Henry Pottinger, Governor of Madras, observes—"The sample which I have tasted was extremely good."

The Madras Council expressed their opinion to the Court of Directors that it was "very desirable the experiment thus commenced should be continued on a larger scale."

The necessary buildings for a Government brewery there would cost a mere trifle; all the operative part of the process would be carried on by cooly labour, rendering but a very small fixed establishment necessary; the casks in which the beer and porter would be sent to the plains could be returned filled with sugar, and while every possible expense to Government would be covered by a very small per-centage on the prime cost, a stimulus would be given to the industry of the cultivators of barley and sugar-cane, which by causing an increase to the revenue of those provinces, must render such an establishment a source of absolute though indirect profit to the State.

The first beer I made was brewed solely from hill malt, and the quality was in consequence very poor indeed; but upon observing that it had been hailed as a boon in England by the poorer classes and by the brewers, that the Legislature had accorded permission to the latter to employ raw sugar in their breweries, it occurred to me that if an article which is a staple commodity of India could thus be profitably returned to the East in a form which required only a low temperature, a simple process, and a trifling admixture of hops to produce, we had on the Neilgherries every element save the last, necessary to its exhibition at an infinitely small cost.

Even under the last head the difficulty appeared likely to vanish, since a supply of hop sets then sent out to me from the India House almost all struck, and grew with apparent vigour.

Excellent malting barley was also raised on waste lands on the Neilgherries from seed sent out for the purpose by the Honourable Court of Directors; and a sample of the crop having been sent home for inspection, it was pronounced in Mark Lane to have deteriorated from the original seed in quality only two per cent.

The question of establishing a brewery might, therefore, now be in a state that might induce some capitalist to enter upon the speculation, if aware of the great and increasing demand for this important article of consumption among European troops stationed in the East.

(Signed) J. OUCHTERLONY.

T. Baker, Esq., Secretary to the Royal Commission on the Sanitary State of H.M.'s Indian Army.

RETURN of the Quantity (hogsheads or gallons) of MALT LIQUOR sent to INDIA for the use of EUROPEAN TROOPS, under Contract to Government, during the Years 1856, 1857, 1858, and 1859: and of the Invoice Cost of the same for each Year respectively.

Years.	Porter.	Ale.	Total.	Cost.
	Hogsheads.	Hogsheads.	Hogsheads.	£ s. d.
1856	20,249	685	20,934	89,214 17 4
1857	36,742	11,180	47,920	202,823 11 2
1858	102,962	48,399	151,361	736,557 18 3
1859	72,572	40,354	112,926	517,818 6 9

The amounts representing the cost of the malt liquor comprise the freight to India, which by the terms of the contract is included in the price charged.

RETURN of PECUNIARY LOSS incurred by Government to admit of the Contract Beer being issued to the Troops at a rate low enough to place it within the means of the private soldiers.

Years.	Bengal Army.	Madras Army.	Bombay Army.
1855-56	£77,212	No returns.	
1856-57	32,459	4,368	No returns
1857-58	39,852	4,857	received.
1858-59	No returns.	6,098	

SKETCH of "CURLEW ISLAND," or CALAGOUK, with a Letter from Captain FRASER, of the Engineers, whose duties in connexion with the erection of the LIGHT HOUSE on the ALGUADA REEF have taken him much to the Island.

Calagouk or Curlew Island in the Bay of Bengal, as a Sea Coast Sanitarium.

In the course of my inspections of the several stations of the army during the past three and half years, I have submitted to Government my views of the beneficial effects to the European constitution, in health and in convalescence, from disease, of a residence on elevated mountain ranges, as a prophylactic remedy under peculiar states of the system. I pointed out during the progress of my tour, how peculiarly favoured the presidency of Madras is, in possessing elevated ranges contiguous to the chief military posts, and I selected certain places on the coast as the most eligible which came under my notice as a place of resort for invalids, whose health would appear to derive benefit by a residence there.

2nd. There are however certain disadvantages in all sea coast localities situated on the main land and possessing no elevation, such as the absence of sea breeze and the deleterious effects of land wind passing over miasmatic or exten-

sive tracts of low arid plains at certain seasons, from which an island of moderate dimensions is comparatively free when placed in the midst of the ocean, possessing bays, sandy beaches and an undulating surface—a good water supply and capabilities for draining.

3rd. The subject of sanitarium for European troops stationed within the tropics has engaged my special attention for many years—but hitherto I have in vain searched for a locality such as I have now adverted to. There is no place answering the description contiguous to the vast line of coast between Bombay and Calcutta, and in the straits of Malacca; although the Island of Penang certainly possesses very many advantages, it has also its disadvantages. It has no protected sandy bays, and the low land is so little above the level of the sea that it is incapable of efficient drainage. Hence "the hill," which is upwards of 2,000 feet high, is the only place of resort for invalids, and it is surrounded by such an extent of forest and low land, that it cannot, strictly speaking, be viewed as a sea coast sanitarium. It

is, moreover, too distant from our possessions in India to make it a place of general usefulness.

4th. During my inspection of the Pegu Province, I learned that European invalids of all classes, when they require a change, are sent to the coast and thence transported to Madras, at a great cost to the State in money and in loss of service, and no place in India can be worse adapted for sick men than the depôt at Poonamallee, where these invalids are sent (*vide* my report on that locality). There are insuperable obstacles to the establishment of mountain sanatoria within, or contiguous to the British possession in Burmah; such desirable localities being situated in inaccessible positions, both as regards difficulty of communication and distance from stations, insalubrity of intervening low country, want of population and supplies, en route. Our existing well tried sanatoria in India, ought, therefore, to be the sole place of resort for European invalids, whose constitutions benefit by a residence on elevated localities, and to this end, as regards the Pegu Province, the object of Government should be to improve the communication from the frontier stations to the sea, and to establish a sea coast sanitarium in a convenient position for such as are likely to benefit by a residence there.

5th. The wonderfully remarkable sanitary condition of all European residents in the interior and on the sea coast of Burmah, the extent of that coast and the group of islands which stud its shores from Amherst to the Mergui Archipelago, naturally drew my inquiries in that direction for an insular or marine station suitable for all India. I was thus brought into communication with Captain A. Fraser, of the Engineers, Superintendent Alguada Reef Lighthouse, now under construction, an officer fully acquainted with the sea board of Burmah. Duty obliging Captain Fraser to proceed in the direction of Mergui, he very obligingly agreed to afford me an opportunity of personally inspecting the line of coast and islands contiguous—and on my solicitation he cheerfully acceded to co-operate with me in the important field of inquiry which engaged me—thus aiding me with much valuable practical experience in his professional capacity, acquired in a career of twenty years in selecting and laying out sites for the cantonment of troops and in the construction of barracks.

6th. *Amherst* was the first place we visited, and, in the absence of an island sanitarium, there is no doubt that it presents the most eligible site on the coast. In form it is a promontory of land washed on one side by the sea, and on the other by the Moulmien river as it disembogues into the sea. It is well elevated, and possesses an open porous subsoil, beneath a clayey superstratum. But it has the disadvantage of dense jungle and swampy ground to the north east and muddy water on the river and sea sides—yet with judicious clearing and draining, Amherst would doubtless, become a very desirable coast locality for invalids.

7th. *Calagouk* or "*Curlew Island*."

The Moscos, contiguous to the mouth of Tavoy river, *Tavoy Island*, half way between Tavoy and Mergui, and *King's Island*, opposite Mergui, came respectively under our inquiries.

Of these the first which occupies the subject of this report is that in every respect the most suitable for a sanitarium.

8th. *Curlew Island*, the head quarters of the Alguada Reef Lighthouse establishment, is situated in the gulf of Martaban, thirty miles south of Amherst point, in latitude $15^{\circ} 52'$, and in longitude $97^{\circ} 42'$. It is eight miles long, exclusive of Cavendish Island, which lies at its extreme south end and which is half a mile in length.

The greatest breadth of the island is about one and a quarter miles; and on its highest part, which is about 500 feet above the sea, are the "remarkable trees," a point for navigators in making the coast, laid down in all charts.

9th. The base of the island is primary rock, the superstratum being a rich mixture of open porous soil, composed of sand and vegetable mould. Its formation is very peculiar—the northern and southern portions differing considerably. The northern half, on the western side, is composed of a long granite ridge, with an average perpendicular drop to the sea, varying from 200 to 300 feet. To the least the

ground descends to the sea in gentle, or abrupt slopes. The opposite side of the island is broken into alternate or isolated hills, with level well raised, the intervening spaces forming three bays; the first, Quarry Bay, where the stones are now being prepared for Alguada Lighthouse, is the deepest. At high water the beach is sandy, but at ebb-tide, an extensive mud flat, covered in places with mangrove, is exposed; the somewhat narrowness of the channel between the island and the main land on this side, tends to the accumulation of mud.

10th. The southern half of the island differs entirely from the northern, inasmuch as both sides are broken into bays. To the west, Retreat Bay, Rocky Bay, Sea Bay and Fish Bay, are beautiful, hard, sandy beaches, well protected by high land on each side, and open to the ocean, with a fine rolling surf on the beach, and only divided from one another by projecting rocky points; and from the corresponding bays on the eastern side by well raised necks of land, sloping east and west, free from all swampy ground and ascending north and south to the hills which divide the bays. The eastern bays look over Bentic Sound on the distant main land, rising in bold outline on the horizon. These very much resemble the western bays, in fact differ only by the mud uncovering at half-tides—the rise and fall at spring-tides being 22 feet. All the bays on the eastern side are perfectly protected from the south-west monsoon, while during the north-east monsoon, the bays on the western side and the deep water close up to the ridge on the north, afford a free, open, and safe place for yachting and boating. The bays on both sides are peculiarly well suited for bathing, the water on the western side especially being always pure and clear.

11th. Ascending from Retreat Bay, the ridge referred to in paragraph 9 is reached. This ridge, and, indeed, the entire island, is clothed with fine primeval forest, with trees of immense dimensions and height. Under their overshadowing branches, a well shaded road might with ease be carried along the ridge, having the open ocean on one hand, with a view of the fine contour of the island itself, and the bold coast of the Tenasserim provinces in the distance beyond on the other; here and there, this ridge opens out into plateaus, forming beautiful sites for houses; and with the exception of a slight rise about the centre, the road would nearly run on an uniform level for a distance of five miles. The same road might thus be extended to the southward, encircling the bays and crossing the intervening points of land, and also to the northern part of the island, where there is a considerable space of garden and cultivable ground. The free percolation of air by means of these roads, judicious clearing for building sites, and the adoption of measures to facilitate the natural drainage, two or three years prior to the occupation of the island for sanitary purposes, are measures of the highest urgency and importance.

12th. The island has now been occupied by a large party of workmen since April 1860. Usually the pioneers or first settlers in every locality suffer considerably, especially when no prior arrangements have been made to guard against disease. In the present case, a large body of natives of India, Burmah, and China, European officers and subordinates, entered on operations of a harassing nature at the hottest season of the year. Quarry Bay, where they settled, is, sanitarily considered, by no means the best locality to settle on, but the presence of good stone, and the facilities for shipping these to the reef, induced the superintendent to fix his head quarters here. I append a Return of the strength of the establishment, the prevailing diseases, and the mortality from the 30th April 1860 to 30th April 1861, from which it will be observed that, everything considered, the sick and death rate have been unusually small. It must be borne in mind that the party for many months had little or no protection by night or by day, and that their huts occupied unwholesome sites in the midst of felled jungle; yet the report presents a gratifying immunity from the graver diseases. The fevers were chiefly of an ephemeral nature, the sick list being kept up by local injuries and their results, diseases not contracted on the island, and cutaneous affections from the want of antiscorbatic articles of diet.

DAILY AVERAGE per cent. of prevailing DISEASES from 30th April 1860 to 30th April 1861.

—	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	Averages.
Strength - -	212	209	295	367	400	433	495	502	480	480	705	710	440
Dysentery - -	·09	2·07	—	—	—	—	·10	·36	—	·14	—	—	0·23
Ulcers - -	·07	5·1	3·1	4·1	5·5	3·8	2·6	3·5	4·1	2·1	2·08	3·64	3·38
Fever - -	0·8	1·0	0·9	1·10	1·2	3·5	3·4	4·9	4·1	4·1	2·3	1·55	2·17
Other diseases -	5·05	8·61	6·13	6·14	7·05	8·01	4·25	8·99	8·30	16·74	11·99	22·22	6·13

There were nine deaths during the year from diseases contracted on the island, viz. :—

Three from dysentery in January,

Three from fever from exposure,—one in July, one in November, and one in January,

Three from accidents and other diseases.

No deaths occurred amongst the Europeans.

13th. During my residence on the island, in the months of May and June, the climate was exceedingly agreeable. The nights were cool, and no punkahs were necessary during the day; in fact, a refreshing sea-breeze was present at all times in every part of the island visited by me during the day, and a blanket was always grateful at night. The average thermometer at this period during the day was 75°; during the hot weather it is 88°, and Captain Fraser speaks in glowing terms of the climate at all seasons as compared with that in Calcutta. Water of an excellent quality is procurable at a depth of 15 feet, and a perennial spring of sweet water flows through the centre of the island. The rain fall, Captain Fraser thinks, is under that experienced on the main land opposite.

14th. One great advantage of this island is its proximity to Madras and Calcutta and to the principal stations in Burmah. The large town of Yea, and the village of Lemyne, are on the opposite main land, from whence small boats with supplies are constantly arriving, and as it is on the direct line of communication between Calcutta and the ports of Tavoy and Mergui, with properly arranged communications, there need be no difficulty in furnishing it with supplies. China junks bring fruit and other articles to the island, and fish of an excellent quality is procurable at the bays.

15th. Besides affording many beautiful localities for private houses, abundance of space is available for 1,000 men on eligible sites. But the planning and laying out of the island, so as to turn it to the best advantage, must be placed in the hands of a person well acquainted with its capabilities and who has an interest in the work. Captain Fraser's other duties constrain him to reside on the island for many months of the year;—we have gone together all over it, and by his report, which accompanies this, it will be observed how fully he concurs with me in its capabilities, and that with the sanction of Government, he is willing to undertake the superintendence of the preparatory improvements above recommended. No one is better qualified to undertake this important duty than Captain Fraser, for, in addition to his practical knowledge as an engineer, he takes a deep interest in the improvement of the place, with the view to its future occupation as a marine sanitarium. I beg, therefore, to recommend that Government avail themselves of the opportune residence of this able officer on the spot, and place a grant of money at his disposal, with full power to expend it to the best of his judgment. Mr. Cromarty, the surgeon in charge, an able and observant medical man, proffers his assistance in keeping careful meteorological observations, or in any other way that Captain Fraser may employ him.

16th. As I have already observed, no place has come under my observations within these tropics, during a long period of close inquiry, possessing the numerous advantages for a "watering place" or a marine sanitarium which this island presents. The equability of its climate, its protected sandy bays and beaches, and its pure sea-water, with the whole expanse of the gulf in front, make it a peculiarly desirable locality for bathing purposes. The numerous means of recreation that always present themselves on the sea-shore, its excellent water supply, well raised surface, eligible sites for buildings, and the fertility of its soil, its moderate dimensions, whereby the entire island can with ease be kept under satisfactory hygienic control, and the facility of its approach at all seasons, and above all, its already proved excellent qualities as a sanitarium, under many disadvantages, mark it as a most promising locality, especially where structural disease is threatened, and demand that Government take an interest in its development. In conclusion, I may state that no case of sickness or death has occurred amongst a large number of women and children, families of the working residents, since the first occupation of the island.

An eye sketch of the island accompanies this Report.

(Signed) D. MACPHERSON, M.D.,
Inspector-General of Hospitals,
Madras Establishment.

Office of Inspector-General of Hospitals,
Curlew Island, Gulf of Mataban,
24th June 1861.

From Captain A. Fraser, Royal Engineers, Superintendent
Alguada Reef Lighthouse, Curlew Island, (Calagouk,) 4th June 1861, to the Inspector-General of Hospitals, Madras Army.

I have the honour to acknowledge the receipt of your letter, No. 32, dated 27th May 1861, in which you requested a passage in the steamer *Setang* to Tavoy and Mergui, and desired my co-operation in the prosecution of your inquiries as to a fit position for the establishment on this coast of a sanitarium for the European invalid soldier.

2. My duties calling me to Tavoy enabled me to do as you wished, and it has given me much pleasure to afford you such information as my experience on this coast enabled me to give. I have since read your report, received with your letter, No. 35, of this date, as regards Calagouk, or Curlew Island, and I go with you in every word you have said on its capabilities for the end you have in view, and am of opinion that it is superior in position, in accessibility, in its moderate and therefore controllable size, and in the great variety of hill and dale, sandy beaches and perpendicular cliffs, to any place which I know on this coast for the purpose of forming a delightful and healthy residence for the European.

3. On the 1st September 1860 I had the honour of addressing the Secretary to the Government in the Public Works Department on this very subject, and I submitted to you a copy of the paragraph of my letter which specially referred to it. The Government passed no orders on that part of my letter, probably because it only formed a part of my regular half yearly report, and the matter was not brought specially to notice; and I have not since adverted to it, partly because the sickness of my workpeople, after last rains, was rather more than I had expected, partly because I felt that my remarks on such a subject would carry with them little weight, unsupported by eminent medical authority.

4. When you proposed to accompany me on my trip to Tavoy, I felt that I should have an opportunity of showing you the capabilities of this island, which I knew, from my own practical experience, were very great, and of securing, if I was right in my own judgment, that opinion which was alone necessary to cause the Government to appreciate the value of this island as a sea coast sanitarium. My only doubt was as regards Tavoy island, which I thought might be more suitable. I had never visited it, but had heard good accounts of it, and as one of my lighters had to go to Mergui, I was glad to tow her down, visiting with you that island "*en route*." I quite agree, however, with you that it is in no way equal to Calagouk for the purpose you have in view.

5. You have explored this island in a more complete way than I myself have ever had time to do before; you have carefully examined into the cases of sickness which have occurred in the hospital, and I am very glad to see that you came to the conclusion that such disease as we have had does not arise from the unhealthiness of the island, but from the nature of the work and the peculiarity of our position. All places are more or less unhealthy in Burmah, according to my experience, on their first clearance, and I have been obliged, to a great extent, to place my people with reference to the work they had to do, rather than to their sanitary condition. Had I had more time I might have placed them better, but the work I have now in hand is so far advanced, that it would be a pity to move, if it can be avoided; and with the advice I have received from you, I have no doubt that next year we shall not suffer so much even from the light diseases which troubled us last season. The state of the hospital at this very time could scarcely be more satisfactory.

6. Those who come here and go no further than the small space upon which my establishment is settled, know nothing of the beauties or capabilities of Calagouk; and those who only look at the number of sick, without going into the causes of disease, or making themselves acquainted with the constant exposure of all hands, both at the reef and at this island, are apt to think the situation unhealthy—but both the fever and the ulcers, the chief diseases from which we have suffered (the ulcers confined, however, only to the natives), may be traced to the nature of the work. Men come down here without any better clothing than they are accustomed to, and the constant cool wind which blows here gives them cold, and slight fever, and ague, while the constant working among sharp stones, causes bruises and abrasions of the skin, which, without a good vegetable diet, are apt to turn to ulcers. You are aware that the difficulties about vegetables can be overcome, for I know of no place which affords such facilities for gardening when the ground has been cleared. There would be no fever either, were sufficient time allowed for the malaria, con-

sequent on the clearance, to pass away before men were located here.

7. If the Government saw fit on your report to adopt this as a sea coast sanitarium, I do not see that much cash expenditure need be gone to. I should be most happy to take general charge of the work, and if I were allowed another assistant, a smart young infantry officer who has passed for the department, I could well work the thing out, according to your views, with 200 convicts (who could be kept separate from my own workpeople, to the south of the island) from Moulmein. These I have no doubt Lieutenant Colonel A. Fytche, the Commissioner of the Tenasserim and Martaban provinces, would willingly consent to give, as it would tend so greatly to the general improvement of the provinces under his control—but in my opinion no large bodies of troops should be located here till the third year after the clearance of the jungle, though it will be doubtless possible to erect private bungalows at a much earlier date.

8. I have already done a little towards opening up the island—the quantity of wood I require for my steamer enables me to do so—I shall be truly happy if the Government allow me to do more, as I shall feel that I shall be doing that which will prove a lasting benefit to the European community and soldiery of India.

9. So accessible is Calagouk that, were it properly laid out, and well known, I feel sure its pure air and sea bathing, combined with the beautiful scenery, would induce all, whether from Calcutta or Madras, or the chief towns and stations of Burmah, to make it their resort for the renovation of health, whether of mind or body.

10. In conclusion, I beg to thank you most sincerely for the trouble you have taken, and the advice you have given, for the improvement of the sanitary condition of our present settlement, and I have no doubt that by carrying out the measures you have suggested, as far as our means will allow, we shall reap the benefit thereof by improved health next year.

REMARKS by Lieut.-Colonel J. E. ROBERTSON, commanding 1st Battalion, 6th Royal Regiment.

SIR,
New Barracks, Gosport,
7th August 1862.
HAVING commanded a wing of my regiment eight months on the Darjeeling hills, I consider that the efficiency of the Army in India would be wonderfully increased if a portion of it could always be stationed on some hill station.

The benefit that was experienced by the wing of my regiment during the year it was stationed at Sanchal, on the Darjeeling hills, was incalculable, as the following statement, showing the admissions into hospital of the men of my regiment at Sanchal and at Barrackpore in 1861, will prove.

RETURN showing the Sickness of the Wings of the 1st Battalion 6th Royal Regiment quartered at Barrackpore and Darjeeling during the Year 1861.

		Strength.	Fevers.	Dysentery.	Hepatic.	Pulmonic.	Rheumatic.	Diarrhœa.	Ophthalmia.	Skin Diseases.	Ulcers.	Gunshot Wounds.	Other Injuries.	Venercal.	Punished.	Other Diseases.	Total.	Average Daily Sick.	Ratio to Strength per Cent.
January	Barrackpore	492	12	11	3	7	4	17	2	—	—	—	—	30	—	30	116	52.9	10.7
	Darjeeling	398	12	3	1	7	3	9	—	—	1	—	1	4	—	3	44	15.5	3.8
February	Barrackpore	498	11	1	—	2	2	6	—	—	—	—	1	9	—	8	40	45.2	9.5
	Darjeeling	387	2	—	1	5	2	1	1	—	—	1	—	4	—	—	17	8.5	2.2
March	Barrackpore	479	9	5	4	2	9	22	2	—	—	—	1	6	—	9	69	38.8	8.1
	Darjeeling	386	1	5	1	2	3	1	—	—	—	—	—	2	—	3	18	9.8	2.5
April	Barrackpore	478	26	6	2	1	4	26	—	—	—	—	—	12	—	13	90	51.2	10.7
	Darjeeling	384	7	1	1	3	—	—	—	—	—	—	2	4	—	1	19	8.3	2.2
May	Barrackpore	472	17	6	1	1	—	27	—	—	1	—	—	7	—	18	78	43.4	9.1
	Darjeeling	389	6	—	—	1	2	1	—	—	—	—	5	4	—	5	24	14.7	3.7
June	Barrackpore	470	24	10	—	3	1	26	1	—	—	—	—	1	1	14	81	38.3	8.1
	Darjeeling	388	4	1	—	—	—	2	—	—	1	—	1	14	—	1	24	17.7	4.5
July	Barrackpore	470	27	10	—	5	4	50	1	5	—	—	—	10	—	32	144	61.6	13.1
	Darjeeling	386	5	—	—	4	4	4	—	—	—	—	—	7	—	5	29	27.8	7.2
August	Barrackpore	464	21	16	3	4	6	20	—	2	1	—	—	10	—	17	100	59.1	12.7
	Darjeeling	386	7	—	1	—	3	1	—	—	—	—	—	8	—	2	22	20.1	5.2
September	Barrackpore	457	28	11	2	4	2	15	1	—	—	—	—	3	—	10	76	48.6	10.6
	Darjeeling	387	6	1	1	7	—	3	2	—	—	—	1	5	—	6	32	21.1	5.5
October	Barrackpore	455	16	8	—	3	—	16	—	1	—	—	—	1	—	11	56	37.5	8.1
	Darjeeling	386	5	1	1	—	1	3	—	1	1	—	2	7	—	9	31	16.5	4.2
November	Barrackpore	448	9	8	1	3	4	11	—	2	—	—	1	2	—	19	60	33.5	7.3
	Darjeeling	385	1	—	—	3	1	—	—	—	1	—	1	3	—	2	12	13.2	3.4
December	Barrackpore	448	12	4	—	1	—	4	—	—	—	—	—	6	—	10	37	26.5	3.1
	Darjeeling	385	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

No hospital on the march to Barrackpore.

N.B.—In 1860 the average proportion of officers absent from the Regiment on sick certificate was 9.77 per cent., the proportion of men 3.33 per cent.

A. PEILE CAHILL, Surgeon,
1st Batt., 6th Royal Regiment.

A regiment should be located on the hills during the hot weather and rains (or say, for one year, so that the men should enjoy the frost and snow,) once in every four years. If a regiment, or even a wing of a regiment, was quartered on the hills, I consider that the convalescent establishments might be abolished, and that the invalids who are sent up periodically to the hills for change of air might be attached to the troops stationed there. This would be a great saving to Government, and the invalids would be equally well cared for. The climate of the Darjeeling hills is superior to that of England. The men are as robust as they are at home, and they should be required to perform the same offices for themselves as they would be in England or in the colonies. The native establishment allowed by Government is not necessary on the hills, and if dispensed with would also be a great saving to the State. The soldiers should be obliged to cook, and their wives to wash for the men as they do at home. The expense of feeding the troops in the

hills was very great in 1861; this was owing to the commissariat not being prepared for so large a number of men being stationed there, and also from the food being carried up on coolies' backs. Roads are, however, now being cut through the hills, and the expense on that head will soon diminish. Soldiers suffer much from ennui on the hills (especially during the rains, when they cannot move out of their rooms) and as exercise is indispensable to their health, workshops should be encouraged as much as possible. The men could repair barrack furniture, barracks, and drains, which latter are constantly getting out of repair from the heavy rains which wash away portions of the road. Reading rooms, gymnastics, coffee rooms, &c., are indispensable at all hill stations.

(Signed) J. E. ROBERTSON, Lt.-Col.

To Sir R. Martin, C.B., F.R.S.,
&c. &c.

Dr. A. Campbell, late Civil Superintending Surgeon at Darjeeling, has informed me that during the Sikkim campaign in 1861, the 1st battalion of the 6th served under Lt.-Col. Gawler through February and March without attendants of any kind, and even without tents. The

regiment returned to Darjeeling in perfect health, and so remained until Dr. Campbell's departure six months subsequently.

J.R.M.

EXTRACT from REPORT of the PRINCIPAL INSPECTOR-GENERAL MEDICAL DEPARTMENT, FORT SAINT GEORGE, 3rd February 1862, No. 18, to the ADJUTANT GENERAL of the ARMY, FORT ST. GEORGE.

THE large military station of Secunderabad was some years since notorious for the prevalence of syphilitic diseases, but for some years past, a system has been in force, of sending diseased females to the Civil Dispensary for treatment, and the result was on the whole so satisfactory, as to lead Government to establish similar regulations for other military cantonments. During the year under review, venereal disease at this large station was no doubt kept down by the existence of the Lock hospital. From the medical officer's report, the form of disease at this station is stated to be chiefly of a mild nature, and this has, no doubt, resulted from the care with which the diseased women have been treated, for some years past.

At Bangalore, a large number of women have been treated. The building is too small for the purpose of a hospital, and was over-crowded. An epidemic of cholera broke out amongst the inmates (the disease being prevalent at the time in the station) several of whom died. At this station there has been a lengthy correspondence in reference to the proper duties of the police, and of the officer in charge of the Lock hospital, which it is unnecessary now to refer to, as under the new regulations, approved of by the military authorities and the acting Commissioner of Mysore, the institution is working well, and venereal disease diminishing amongst the European soldiery. The "voluntary system" has had a fair trial at Bangalore, and has utterly failed to check the ravages of syphilitic diseases. The large expenditure at Bangalore and Cannanore for perishable articles and diets in comparison with similar institutions elsewhere, will doubtless attract notice. The attention of the medical officer has been called thereto, and explanation requested.

The Lock hospital at Cannanore during the short time it has been in existence, has worked well, and a decrease in the number of venereal admissions amongst the European soldiers has been the result. The cost of dieting, however, has been high.

The hospitals at Trichinopoly, Wellington, Bellary, and Vizagapatam, it will be apparent from the observations of the various medical officers, have in the short space of their existence effected much good, and I have no hesitation in recommending the introduction of similar establishments wherever European troops are located, and especially in the several stations of Burmah, where from the recent importation of numerous prostitutes from the Coromandel coast, venereal diseases are on the increase.

The good to be effected by Lock hospitals must, in a great measure, depend upon the cordial co-operation of all officers of Government concerned in promoting the welfare of European troops. The necessity for some well defined regulations touching the conditions on which prostitutes are permitted to reside within range of European troops, is apparent. The regulations now in force at Bangalore appear to have been judiciously framed, and if acted up to, will leave little or nothing to be desired. Copy of these is appended. The rules appear to be well adapted for all stations where military and civil come into contact.

Extracts from Reports of Medical Officers in charge of Lock Hospitals.

Bangalore.—Stringent measures are quite as necessary here, as elsewhere, and unless some principle be adopted for the registration, examination, and treatment of the prostitutes who overrun this cantonment and garrison, it is quite impossible to preserve the troops from the maladies, which destroy the vigour and undermine the health of the soldiers at this station; whereas it is shown that the troops quartered at Brussels, where such stringent regulations exist, are preserved almost wholly free from the maladies which constitute one-third or more of the total sickness of the

English army. It therefore rests with the authorities to initiate some such principle of action *without delay*, under the control of the officer commanding the division, and under properly defined police regulations, which do not at present exist.

Trichinopoly.—That the Institution has been attended with a fair portion of success, and has lessened the prevalence of venereal disease amongst European soldiers, is satisfactorily shown by comparing the admissions under that head, in the 2nd European light infantry, for the years 1859 and 1860, *viz.*, 207 admissions in 1859, and 129 in 1860; showing in the past year a decrease of nearly one-half. It is to be regretted that a similar comparative return of the European battery of artillery stationed here, cannot be obtained, owing to its more recent arrival.

Wellington.—The Lock hospital at Wellington was opened for the admission of patients June 7th, 1860. From this period to December 31st, 157 cases have been treated, making a daily average of $11\frac{1}{2}$; of these 69 cases of primary syphilis have occurred, four of which were accompanied with bubo; the remainder, 88, were cases of ordinary gonorrhœa. It is gratifying to be able to state that, since this Hospital has been established, venereal disease in every form has been very rare at this station. During the seven months of the year 1860, only 19 cases of venereal were admitted into the hospital 3rd battalion, 60th rifles; 13 cases of syphilis primitiva, and six of gonorrhœa.

Rules for the Police and Lock Hospitals.

1. A Register of all prostitutes who cohabit with European soldiers, and who reside within the limits of the Cantonment, to be kept in the Police Office. This Register to show the name, age, caste, and place of residence of each woman.

2. A copy of the Register to be furnished to the officer in charge of the Lock hospital.

3. Whenever the officer in charge of the Lock hospital, or other medical officer, or an Officer commanding a regiment or company, has reason to believe that any woman, whose name is not in the Register, ought on account of her known habits, to have her name entered therein, he should send a Memorandum showing name, age, caste, and place of residence of such woman to the Superintendent of Police, who will be responsible that thorough inquiry is made into the case, and that her name is entered in the Register if she is found to be a prostitute who cohabits with European soldiers.

4. Neither the police nor the subordinates of the Lock hospital shall be permitted to call upon any woman to allow herself to be examined except at the Lock hospital, and no woman *whose name is not* in the Register, shall be taken to the Choultry or Lock hospital, except by the order of the Superintendent of Police.

5. There are at present about 108 women whose names are registered. One day in every week may be set apart, upon which one-fourth of the women shall be compelled to attend at the hospital to be examined.

The Lock hospital peons, who should be furnished with a list of names, aided by the police at the various Tannahs, should be employed in personally warning each woman to attend on the day fixed at a certain hour, 7 A.M.

Any woman who neglects to obey this summons, shall be at once apprehended by the police, and taken to the Lock hospital. If she is infected, she will of course be detained, but if not, she will be sent to the Choultry to be fined eight annas.

Should any woman systematically neglect to attend when summoned, she will, after due warning, be expelled from the place.

EFFECTS of the CLIMATE of the DARJEELING HILLS on the CONSTITUTION of EUROPEANS.

By J. C. COLLINS, Esq., Civil Assistant-Surgeon.

In considering this subject, so important in its bearing on the question of the colonization of these Hills, I shall divide my remarks into three heads:—

1st.—The character of the climate.

2nd.—The influence of the climate on the European constitution in its normal or healthy state.

3rd.—The influence of the climate on the European constitution in its abnormal or unhealthy state—especially in

reference to the diseases to which Europeans are liable from a long residence in the plains of India.

1.—*The Character of the Climate.*

The climate of the station of Darjeeling, about 7,000 feet above the level of the sea, the mean average temperature of which is about 54° Fahr., and the average annual fall of rain 124 inches, may be taken as a type of the climate of the whole district above 4,000 feet, allowing for the difference of temperature and moisture of the atmosphere at various elevations. The climate is essentially a temperate one—remarkable for its humidity, equability, and immunity from violent atmospheric phenomena and strong winds; there is, at all times of the year, more or less cloud and fog, and in the rains the atmosphere constantly attains the point of saturation. The amount of mist and cloud has, however, very much diminished of late years, in consequence of the extensive clearing of forest which has taken place on all sides for the purposes of cultivation.

The year may be conveniently divided into three seasons—the Spring, the Rainy Season, and the Winter.

The Spring commences in March and terminates about the end of May, the average temperature being about 55°, and the greatest variation in any 24 hours 12°. This season is marked by the usual characteristics of spring in Europe; the mornings are cold and bright, the days warm and balmy, the birds fill the forests with their cheerful notes, and all nature is ready to burst into life. Storms of rain and hail are of frequent occurrence, accompanied by a considerable development of electricity. These showers of rain, always of a higher temperature than the surrounding atmosphere, are most grateful and necessary after the long drought of the cold season—the country which had become brown and parched is soon covered with the richest verdure. The atmosphere at this time is not generally clear, but filled during the day with a kind of dry mist, which circumscribes the view and diminishes the brilliancy of the sun, indeed, often obscures it. The density of this mist is much increased by being mixed with a quantity of smoke which comes up from the side of every mountain and valley where the jungle is being cleared by burning.

The Rainy Season commences at any time from the 1st to the 15th of June and lasts until the end of September, during which period the average fall of rain is over 100 inches. The rains generally set in with lightning and thunder, but the atmosphere soon becomes calm, and the rain falls steadily for hours, and often for days together, not heavily, but quietly and continuously. There is generally an interval more or less clear morning and evening, and two or three breaks of fine weather occur in the season when the sun shines out so hot and bright as to remind one of its power in the plains below.

There is always at this season, of course, a large amount of cloud, and the atmosphere is often saturated, the prevailing winds being south-east and east. The average temperature during these months is 60°, and the greatest variation in any 24 hours 9°. The climate, from its excessive moisture, is somewhat relaxing, but not unhealthy, especially as long as the sky is covered with clouds and fog, which ensure uniformity of temperature; but if there is an interval of bright clear weather, coughs, colds, and sore-throats are prevalent.

The Winter may be said to extend from the 1st of October to the end of February, when the temperature ranges between the freezing point and 55°—the average of the five months being 46°, and the greatest variation in any 24 hours 12°. This is a truly delightful and enjoyable season. The days are bright, the nights cold, frosty, and brilliantly clear; the air is crisp, bracing, and most pleasant to the feelings. In January and February, however, and sometimes in the latter end of December, the weather becomes thick and cloudy for a few days, and there is, generally, a slight fall of rain or snow; the latter remains only a few hours on the ground, being speedily dissipated by the brilliant sunshine, which is certain to succeed the fall.

It is not to be supposed, however, that because the nights are frosty and snow does fall once or twice in the year, that the winter is a severe one; on the contrary, compared with the European winter, it is very mild—to prove which, I need only mention that, at 7,000 feet, many English vegetables are in perfection. Peas and cauliflowers blossom beautifully, and I have plucked from my own garden in December or January, every year, one or two large well-ripened strawberries. I have appended to this paper an abstract of the Meteorological observations taken four times a day at the Observatory for each month in the year 1857, which gives a very fair idea of the climate.

2.—*The effects of the Climate on the European constitution in its natural or healthy state.*

It would be difficult to imagine a climate more likely, on the whole, to be suitable to the maintenance of good health

in the European than that of Darjeeling. It is temperate, not subject to any great extremes of heat or cold, is out of the influence of malaria, and is not productive of any peculiar class of disease liable to weaken the frame or destroy life. The water is excellent in quality, the mountain air purity itself, and such in reality it is found to be. European adults, both male and female, thrive admirably. The possibility of being in the open air at all times without inconvenience from the effects of the sun, induces habits of active exercise, which render the body muscular and vigorous; the skin is clear, the complexion ruddy, and corpulency is almost unknown either amongst the European or native community.

But it is for children more especially that the climate is peculiarly well adapted. They enjoy the most robust health—their rosy faces, exuberant spirits, and activity of mind and body, show that they cannot be in better physical condition.

Dr. Hooker writes thus:—"I believe that children's faces afford as good an index as any to the healthfulness of a climate, and in no part of the world is there a more active, rosy, and bright young community, than at Darjeeling. It is incredible what a few weeks of that mountain air does for the India-born children of European parents; they are taken there sickly, pallid or yellow, soft and flabby, to become transformed into models of rude health and activity."

I cannot illustrate this part of my subject better than by mentioning an extraordinary fact respecting the health of the children at the Convent, which has come to my knowledge as medical attendant of that establishment. The institution was established 13 years ago, and has had a yearly average of 28 children and 11 adults resident within its walls; yet, during this period, not one death has occurred, nor has it been necessary to send away either child or nun for change of air on account of sickness.

To estimate this fact at its true value, it must be remembered, that very many of the children have arrived from the plains in a most delicate state of health from fever, spleen, dysentery, and diarrhoea, and that most of the nuns have been transferred from the Calcutta Convent as invalids, in some cases suffering from most serious disease. This very satisfactory sanatory condition of the establishment may perhaps, in some measure, be due to the excellent system of management adopted by the ladies at its head, but could not be obtained, under the most judicious and careful treatment, in any but a most healthful climate.

The following table, kindly furnished me by the Lady Superioress, exhibits the number of adults and children resident in the Convent for each year since its establishment:—

CONVENT DARJEELING, Established 1846.

—	Children.	Adults.
1846	6	6
1847	17	5
1848	24	10
1849	28	9
1850	18	9
1851	18	8
1852	26	8
1853	20	7
1854	31	17
1855	36	17
1856	42	17
1857	54	17
1858	48	17
Average	28·30	11·30

3.—*The effects of the Climate on the European constitution in its abnormal or diseased condition.*

The indigenous diseases of Darjeeling are few, and generally mild in character, being chiefly those which affect the air-passages, as is the case in all damp climates. The diseases, however, which are most constantly met with, are those contracted in the plains, such as fever, dysentery, and diarrhoea. I shall proceed to notice these under their respective classes, in reference to the influence of the climate in effecting their cure.

Fevers.—Fevers of all kinds come under treatment, but those of the intermittent type are the most common. They yield rapidly to careful treatment, and the effects of the climate, in restoring the patient to health, are most marked where no organic disease exists.

Eruptive Fevers.—Scarlet fever and measles I have not seen here, though I believe cases of both diseases have occurred in a mild form.

Small-pox is the scourge of the native population of these hills; it makes its appearance, more or less, almost every year about the middle of the winter, being introduced by inoculators from Nipal, who perambulate the whole district, spreading the loathsome disease wherever they go. Europeans do not often get it, as they are protected by vaccination, and are careful to avoid the infection.

Diseases of the Lungs.—Coughs and colds are prevalent at the changes of the seasons, but severe diseases of the lungs are seldom met with. I have not met with a serious case of pneumonia, or bronchitis, or pleurisy in the European, and but few cases amongst the natives, neither have I seen a bad case of croup or sore-throat.

One case only of asthma has come under my observation; it commenced in the plains, and was not at all benefited by a residence of many months in Darjeeling and its neighbourhood; the climate probably, from the rarity of its atmosphere and humidity, is not adapted for persons subject to this obstinate disease.

I have seen two fatal cases of phthisis pulmonalis, one in a half-caste, and the other in a young Lepcha woman, who had led a most dissipated life. The subject of the former case was educated in England, where tubercles became developed, and he was sent to this country for change.

I have treated many suspicious cases, and am of opinion that the climate, from its uniformity of temperature, is decidedly a good one for persons who have, what are called, delicate lungs.

Diseases of the Liver.—Where the disease is only functional, a residence of a few months in this climate is most beneficial, but where there is any considerable organic lesion, little improvement can be expected.

Diseases of the Stomach and Bowels.—Cases of dyspepsia rapidly recover with a sufficiency of exercise in the open air and careful diet. Numbers of the visitors of Darjeeling arrive suffering from dysentery and diarrhoea, and in the majority of cases derive immediate relief; children especially get rid of these diseases in a remarkable manner, and seldom suffer a relapse. Two cases of dysentery have only proved very obstinate—these have existed on and off for three years, but such is the extraordinary effect of the climate on the general health, that the patients have, during this period, attended to their respective occupations almost without interruption, and the disease in both cases seems nearly to have worn itself out.

Diarrhoea, in a mild form, occurs at the beginning of the rainy season, and is to be attributed to the use of impure water for drinking purposes; many of the springs dry up in the winter, and are only called into activity again when the rains commence, by the surface water, which percolates through all the decayed vegetable matter of the forests, and is consequently unwholesome.

This cause of sickness is easily avoided by using water from the permanent springs, which is of the very purest description. Diarrhoea, in a severe form, is not a frequent disease here, and Darjeeling, in this respect, enjoys a very great and peculiar advantage over all the other Himalayan Sanatoria, where it prevails to such an extent as to do away with much of the advantage to be otherwise derived from a residence at those stations. I have not met with a case in any way resembling the disease described, as it occurs at Simla and its neighbourhood, by Dr. A. Grant, in the 1st Vol. of the *Indian Annals of Medical Science*.

Diseases of the Brain.—Persons afflicted with such complaints should not come to Darjeeling for relief, or they will certainly be disappointed; the elevation is too great, and the air too rare. In these cases, headache, a sense of fullness, and vertigo, are always complained of.

Rheumatic Affections.—It would be supposed that the climate of Darjeeling, from its dampness, would be abundantly productive of rheumatic affections, but my experience proves the contrary to be the case. In the dry seasons, there is no reason why they should prevail, whilst in the rains, the evaporation is so slight, that a complete wetting is scarcely ever followed by an attack of rheumatism.

I have seen many cases completely recover, and in one case of severe acute rheumatism, the cure was remarkably rapid and permanent.

Spleen.—Cases of spleen usually do well here, provided the disease has not become hopeless. The accompanying fever soon disappears, the general health improves, and, as a natural consequence, the diseased organ resumes its normal state.

For the last three years the average mortality amongst the European community has been something over one per cent. per annum, that is, out of an average number of about 200 persons residing in the station, there have been seven deaths. This mortality, under any circumstances, small, becomes extraordinarily so when it is considered that the place may be justly compared to a large hospital; the visitors generally arrive either suffering from actual disease or very much debilitated from a long residence in the plains of Bengal; the majority also of the residents are invalid or retired officers who, though they enjoy good health here, have found it impossible to live in the plains.

If we, moreover, analyse this mortality, we shall find that neither of the deaths can be fairly attributed to the climate. They were as follows:—

No.	Disease.	Remarks.
1.	Phthisis pulmonalis -	Arrived in articulo mortis, and died in three days.
2.	Remittent fever, with bronchial complication.	Fever contracted in the plains. The disease of the lungs was of long standing.
3.	Serous apoplexy - -	The third attack seven days after child-birth.
4.	Intermittent fever; the spleen and liver enormously enlarged.	Died about six months after arrival.
5.	Small-pox - - -	Three young children of the same family; they were unprotected; the other members of the family having been vaccinated, recovered.
6.	Small-pox - - -	
7.	Small-pox - - -	

In conclusion, I have endeavoured to give a fair and unprejudiced account of the climate of Darjeeling, and its adaptability to the European constitution, founded on an experience of three years' uninterrupted residence as Civil Assistant-Surgeon, and I can conscientiously say, that although brighter and perhaps more pleasant climates may be found, yet, in point of salubrity, I believe it to be unsurpassed, and I feel sure that the only thing required to make it a favourite place of resort for the European community of Calcutta, and Bengal generally, is a good road to the foot of the hills, with easy and rapid communication.

For statistics of health and mortality amongst the European soldiers at the Jellapahar Depôt, I must refer to the Reports of Drs. Withecombe and Domenichetti, published in No. VII. of the *Indian Annals of Medical Science*.

Darjeeling, February 1st, 1859.

OBSERVATIONS ON VENEREAL DISEASES, with Suggestions for the Amelioration of this Army Pestilence, by WILLIAM ACTON, Esq.

For many years past I have attempted to call the attention of the public to the condition of our soldiers, who suffer so severely and frequently from venereal affections.

I append the following tables taken from my work on "Prostitution, &c." (pp. 38 et seq.):—

"MILITARY HOSPITAL EXPERIENCE.

"ADMISSIONS into Hospital for Venereal Affections among the " Dragoon Guards and Dragoons serving in the United Kingdom during Seven Years and a Quarter previous to " 1837.

"From the 'Statistical Reports on the Sickness, Mortality, and " Invaliding among the Troops in the United Kingdom, the " Mediterranean, and British America,' presented to Parliament " in 1839, I extract the following table:—

" Syphilis primitiva - - - -	1,415
" Syphilis consecutiva - - - -	335
" Ulcus penis non syphiliticum - - - -	2,144

" Bubo simplex - - - - -	884
" Cachexia syphiloidea - - - - -	4
" Gonorrhœa - - - - -	2,449
" Hernia humoralis - - - - -	714
" Stricture urethræ - - - - -	100
" Phymosis et paraphymosis - - - - -	27

" Total cases during seven and a quarter years -	8,072
" Total aggregate strength for ditto - - -	44,611
" Annual mean strength for ditto - - -	6,153

" Thus 181 per 1,000, or about one man in five, appear to have " been attacked. Primary ulcers on the penis were more numerous " than discharges from the urethra, the numbers being 3,559 " primary ulcers, 2,449 cases of gonorrhœa; say about one " soldier in 12 suffered from the former, one in 18 from the latter, " once during the period."

The above table was printed in the last edition of my work "On the Diseases of the Generative Organs." I 3 Q

extract the following table from a subsequent report on army diseases from 1837 to 1847 :—

“ADMISSIONS into Hospital from Venereal Disease and Deaths among the Dragoon Guards and Dragoons, the Foot Guards and Infantry of the Line, serving in the United Kingdom from 1st April 1837 to 31st March 1847.

	Cavalry.	Foot Guards.	Infantry.	Total.	Deaths.	Artillery.
Aggregate strength	54,374	40,120	160,103	254,597	—	—
Syphilis primitiva	1,396	4,769	6,157	12,322	1	—
Syphilis consecutiva	462	536	2,085	3,083	8	—
Ulcus penis non syphiliticum.	2,920	883	13,380	17,183	1	—
Bubo simplex	1,495	989	6,635	9,119	1	—
Gonorrhoea	3,725	2,198	12,988	18,911	—	—
Hernia humoralis	1,019	558	2,768	4,345	—	—
Stricture urethrae	131	92	198	421	4	—
Cachexia syphiloidea	5	—	7	12	2	—
Phymosis et paraphymosis.	52	18	217	287	—	—
Total	11,205	10,013	44,425	65,633	17	—
Number of men per 1,000 of strength admitted during 10 years.	205	250	277	257	—	463*

That I might judge for myself, of the condition of venereal among the troops in London, during the last twelve-month, Mr. Bostock, surgeon-major to the Scots Fusilier Guards, kindly took me over his hospital, of the arrangements of which I cannot too highly speak. I found, as I expected, that syphilis has been for many years, and continues to be, a very plague in the regiment. During the first few years after enlisting, many a promising young soldier is laid up in hospital with some of these affections. In spite of all the measures hitherto taken to induce men to apply early, large numbers are constantly being sent into hospital and found to be suffering from the severest forms of disease, inducing a long course of mercury, which depresses the vital powers and disposes to other complaints. After a long convalescence, and in spite of all the precautions that can be taken by the medical officers, such men become invalided, and no statistical tables can give any accurate idea of the number of good soldiers thus lost to the service.

The following figures will give some notion of the form of disease existing when I visited Mr. Bostock's wards :—

November 1859.	Remained from last Month.	Admitted during the Month.	Total Treated.	Discharged.	Died.	Total Discharged and Died.	Remained under Treatment.	—
Syphilis primitiva.	14	6	20	4	—	4	16	Strength of the regiment of Fusilier Guards in London during the month of November 1859.
Syphilis consecutiva	11	3	14	8	—	8	6	
Ulcus penis non syphiliticum.	10	11	21	10	—	10	11	
Gonorrhoea	9	6	15	9	—	9	6	
Hernia humoralis.	—	4	4	3	—	3	1	
Bubo	12	4	16	7	—	7	9	
Phymosis	—	2	2	1	—	1	1	
Total	56	36	92	42	—	42	50	1,500.

To enable the Commission, however, to compare the diseases as they affect our household troops in London, I append the following table which Mr. Bostock has obligingly obtained for me:—

VENEREAL AFFECTIONS in the three Regiments of Foot Guards during twelve Months, from April 1, 1858, to March 31, 1859.

Strength.	Scot Fusiliers, 1,600.	Cold-stream, 1,600.	Grenadiers, 2,400.	Total, 5,600.	Total in Groups.	Average.
Non Specific.						
Gonorrhoea	118	176	169	463	519	1 in 10
Hernia humoralis.	26	17	52	95		
Bubo	64	59	77	200	—	—
Phymosis et paraphymosis.	1	—	—	1		

* See "Edinburgh Review," July 1858.

Strength.	Scot Fusiliers, 1,600.	Cold-stream, 1,600.	Grenadiers, 2,400.	Total, 5,600.	Total in Groups.	Average.
Primary Symptoms.						
Syphilis primitiva	104	540	556	1,200	1,367	1 in 4
Ulcus penis non syphiliticum.*	116	19	32	167		
Secondary Symptoms.						
Syphilis consecutiva.	36	64	68	168	168	1 in 8
Total venereal treated	465	875	954	2,294	—	—
Total sick treated	1,224	1,762	2,272	5,258	—	—

It appears from the above table that almost every man comes into hospital once a year, or, what amounts to the same thing, the same men enter several times; for we find 5,258 as the total sick treated out of a strength of 5,600 men. The remarkable fact appears that 2,294 of the 5,258 were afflicted with venereal disease. In other words, nearly half the cases admitted during 1859 depended upon some of its varieties; and the no less remarkable deduction from these statistics is, that, could we eradicate it we should at once remove half the complaints for which our London troops come into hospital. If we divide our tables into non-specific and specific affections, we shall find that the non-specific amount to 519, thus showing that one in 10 men suffers from gonorrhoea and its consequences. The same arrangement proves that every fourth man becomes affected with one of the forms of chancre. If we carry our investigation further, we learn that in the English army secondary symptoms are very common, as out of 1,367 cases of primary syphilis, as many as 168 men subsequently suffered from constitutional syphilis, making it evident that one in eight cases of chancre is followed by secondary symptoms.

The frequency of this form of complaint is no less marked than its severity. Mr. Bostock pointed out to me a soldier in the hospital at Vauxhall, whose body was covered with sores (tertiary ones), following the worst form of sloughing chancre. A case more severe than this could not have existed in the epidemic of the 14th century. It had the character of those sores which occurred in our army during the last Peninsular war and were called by our troops the "Black Lion of Portugal." The frequent occurrence of swelled testicle among our foot guards is another notable fact. If in private practice we were to find that one out of three or even four cases of gonorrhoea was followed by this painful affection, a London surgeon's reputation would be lost; but the fact is, that the soldiers conceal their venereal complaints as much as possible, and it becomes difficult for the surgeon to detect gonorrhoea, which is checked, or attempted to be checked, at its onset by injections. The too common result is, that a man enters hospital with swelled testicle.

THE REMEDIES.

The question will be doubtless put to me by you, as it has been by others, "Do you propose to introduce the "foreign system of examining public women into London?" I disclaim at once any such intention. Whatever may be my private opinion of its advantages under despotic governments, I am fully convinced that, however unobjectionable or even positively desirable they might privately think it, such a system would, from the great majority of influential men in and out of Parliament in the present day, meet with public opposition. Nevertheless, it is possible that the present agitation of the matter may, in the course of years, cause some modification of the foreign system to be introduced into this metropolis.

It is idle to deny that one of the greatest difficulties of attempting any remedy consists in the fear of injuring the very morality which a remedy proposes to protect. This fear is felt, and loudly proclaimed by a large number of well-meaning men, who, ill-informed on the causes and consequences of vice, and having their own feelings under control, think that the mass of mankind can, and therefore ought to, and therefore will, exert self-restraint. The result is a kind of apathy that leads even the best men to shrink from action, or even discussion of what they admit is the monster social evil of the day, from a vague dread of some unforeseen moral result. I assume that you do not sympa-

* I am glad to find that this supposed distinction between syphilis primitiva and ulcus penis non syphiliticum is no longer expected from the army medical officers. In a recent minute the late Mr. Alexander, the Director-General, called upon his staff to register all venereal affections under one of the following heads:—Primary syphilis, secondary do., inflammation of the iris, gonorrhoea, bubo, swelled testicle, stricture.

thize with this timidity. We may, therefore, dare here to ask, and endeavour to discover, if there be any remedies within our reach, other than the continental system of regular licensing and periodical inspection.

We must remember the class of men for whom we have to legislate. In reply to my inquiry, Dr. Robinson, battalion surgeon to the Scots Fusilier Guards, says:—"I am now in a position to afford answers to the queries. The serjeant-major quite concurs in the view I expressed to you, viz., that young soldiers, whether good or bad, addicted to drink, or otherwise well-conducted, are all, with few exceptions, equally subject to syphilis in the early years of their service, and accordingly find their way into hospital." He (the serjeant-major) also agrees with me, that "habitual drunkards, and therefore the *mauvais sujets* of the regiment, are more obnoxious to the disease, by falling into the hands of prostitutes more readily. This occurs, perhaps, at a later period, when men have sown, or ought to have sown their wild oats, and settled, as the better set do, into steady soldiers."

The Commission will remark that this picture is drawn by a friendly hand, and is supported by the preceding tables. Continental statistics prove that, as to the young soldier,—French or Austrian, Protestant or Catholic,—his leisure will in all countries be spent in riotous living. This observation is not confined, of course, to soldiers alone. The indulgence of the sexual passion is not confined to any class or condition of life. In spite of education and religious culture, incontinence is a very widely spread evil.

But it is our present business to consider, if (as I maintain) we are unable to do so completely, yet how we may, to some extent, guard the young soldier against the consequences of his evil passions, which, as shown in the above statistics, no fear of consequent disease or of permanent ill-health will induce him to restrain. In answer to the moral objections, I would submit that incontinence and resulting disease are such widely spread and destructive evils that no greater can arise from the introduction of any reasonable preventive measures. All must admit that our efforts have hitherto completely failed. As neglect will not succeed, we are justified in hoping that a scientific investigation will in this, as in other sanitary matters, assist us in devising plans for ameliorating an evil of great importance both in a social and a military point of view.

I stated above that I am in no way disposed to recommend the abrupt adoption of anything like the foreign system, of abating the evil. Nor are we reduced to this alternative. There are several measures which have only been partially tried, and which, were they thoroughly and effectually carried out, would tend towards that end. In the first place, I would offer facilities for local abluion in the different barracks in London. Within the last year I have visited one of the largest of them, and the want of proper accommodation in this respect is very great.

In an extensive underground, dark room, on a raised platform, were arranged large iron basins, in which soldiers might wash their faces by means of cold water drawn from a tap. The only other means of local abluion I could hear of in this, one of the latest erected barracks in London, consisted of five baths, supplied from the waste water of the steam engine. Now I should suggest that in each barrack, but in some secluded part, say near the urinals, a few partitions similar to those at a railway station, should be set aside, where a soldier might retire daily, and, finding the water laid on, make use of a small zinc basin, and employ local abluion, if so disposed, in as much privacy as can exist in barrack life. I shall not stop here to discuss the difficulties attending the introduction of this system; suffice it to say, the plan has been tried and found successful, for it was not long since in operation at the then East India recruiting depôt at Warley.

My friend Dr. Stewart, surgeon-major at that depôt, was kind enough to show me the arrangements there, and I would recommend those desirous of seeing a model establishment to visit it.

In a recent communication that officer wrote to me:—"Since the completion of these lavatory arrangements in proximity to the barracks, and the enforcement of their daily use by all the men, as a matter of primary discipline, the fresh cases of venereal disease which come into hospital are all of the most trifling description, chiefly excoriations, mild gonorrhœas or balanitis, which are quickly cured, as well as punished, by six days' hospital diet and stoppages, confinement to a straw bed, and dry lint dressings. The only severe cases admitted have been among

"men bringing the disease with them from the district where they enlisted."

The arrangements, then, that have been found to answer so well at Warley, might, I fancy, be introduced into other barracks with equal advantage and facility.

In all garrison towns of a moderate population I would suggest that the civil and military authorities should come to some understanding about rendering assistance to prostitutes who are publicly known to be diseased.* When soldiers accuse particular girls, or the medical officer finds a sudden outbreak of syphilis traceable to a particular house or woman, on information being given to the civil authorities, they should by their agents offer an asylum to the infected.† Such assistance would, I presume, be thankfully accepted, as prostitutes have no special interest in maintaining their own diseased condition.

If some such understanding as this existed, we should not again witness such disastrous outbreaks of syphilis as are continually happening wherever a body of troops is centred. Here again I can cite a precedent for my recommendation. Sir John Liddell, the Director-General of the Naval Medical Department, in a communication with which he has favoured me, says:—"The lock wards at Portsmouth, which consist of 30 beds, are always kept full by the women that present themselves at the hospital for admission, who require no other recommendation than being syphilitic. The Admiralty have erected the wards at an expense of 1,800*l.*, and pay 500*l.* a year for the maintenance of 20 beds, which our medical officers at Haslar visit regularly. The army authorities pay for the remaining 10 beds under the same conditions as our own, and I am in hopes that we shall establish similar wards in connexion with the Civil Hospital at Chatham which is being erected.

I am of opinion that were such facts, figures, and opinions as I have given above—and they are but a portion of what are ready for collection—thoroughly ventilated, a degree of pressure would follow by professional as well as amateur army reformers, economists, and, in fact, all desirous of an efficient army, to warrant the outlay of public money in two shapes, upon the arrest of this pestilence. In the first place, I would begin by treating the women, who, it seems, are no less potent agents of destruction than shot and steel. I would next advocate, with Dr. Stewart, a regular organized system of abluion (compulsory rather than none) of unmarried soldiers, with very few exceptions.

I have no hesitation in stating, that if these suggestions could be carried out, we should no longer find one in every four men suffering from the primary symptoms of syphilis, a complaint so miserably detrimental to the efficiency of the service.

I indulged a hope some time ago, that the agitation in which I took an active part towards regulating prostitution, would have been attended with good results, and thus have somewhat diminished the evils we have to complain of. Now, however, that the agitation has died away, I regret to find that we are again lapsing into our old apathetic system of looking with almost indifference on this national disgrace, and I fear we must wait years yet before we can hope for any general amendment in that direction. But your Commission, regarding the army and its title to preservation from a professional point of view, may possibly arrange special provisions in its behalf, which will no doubt attract the attention and may perhaps prepare the way for farther progress in the same direction.

(Signed) WILLIAM ACTON,
17, Queen Ann Street.

To the Secretary of the
Royal Commission on the
Sanitary State of the Army in India.

* I would wish to remark that this portion of my suggestions is not original, inasmuch as Dr. Robinson proposed to a general officer, two years ago, that somewhat similar precautions should be taken with reference to syphilis at Windsor. His letter will be found in the "Medical Times" for March 12, 1859; and as far back as 1853 the late Dr. Rose published some letters in the "Lancet," advocating the establishment of lock hospitals for the benefit of the service.

† A surgeon to one of our penitentiaries lately told me, that out of 63 women he examined for admission into his asylum (not a hospital) 59 were so seriously diseased, that he could not give his sanction to their being taken into the institution until they had been cured. Every one who has been present at the examination of the applicants to our *foul wards* at hospitals need not be reminded of the self-evident fact, that the way in which these women neglect themselves or are neglected is deplorable. The most striking instance within my own knowledge is the one which occurred at Windsor, where during the summer before last the 1st battalion of Fusilier Guards was quartered. Out of 600 men, 64 were laid up in hospital with venereal affections. This state of things arose from the infected condition of the women of that town, as was well known to the men, officers, and police authorities, yet, as far as I can learn, no steps were taken by the latter to cure them or diminish the evil.

MEMORANDUM.

During a long period of service in India with Her Majesty's 38th, 16th, 44th, 62d, and 21st Fusiliers, extending from 1822 to 1847, I had ample opportunities of witnessing the effect of venereal diseases in both European and Native troops, being frequently in charge of lock hospitals. I have invariably noticed that just in proportion to the efficiency of these hospitals and their concomitants, the weekly inspection of the bazaar women, was the prevalence or diminution of venereal diseases.

On the abolition of lock hospitals venereal diseases, which were, if not entirely suppressed, reduced to a minimum, rapidly spread broadcast over the country, filling our hospitals with venereal cases, and seriously affecting the healths and efficiency of the troops; indeed the soldiers were so well aware of the advantage of the lock hospitals, that in one regiment (the 38th) the unmarried soldiers offered to contribute one rupee each monthly towards their re-establishment.

On an occasion of visiting my hospital (62nd regiment) at Moulmein, the late Bishop Wilson expressed himself shocked at the preventive measures used, thinking they gave an indirect encouragement to prostitution, but on

seeing my returns, and the good effect resulting from inspection of the bazaar women, and other preventive measures, he gave them his most unqualified approval.

On joining the 21st Fusiliers at Dinapore, in 1842, although lock hospitals and the inspection of bazaar women had long been abolished; the commanding officer approved of my having the native women belonging to the regimental bazaar brought weekly to the hospital for inspection and treatment. The same system was pursued at Kamptee in 1843, 1844, and 1845, at Agra and Cawnpore in 1846, and at Calcutta prior to the embarkation of the regiment for England in December 1847.

I have, therefore, no hesitation in stating that by the means of weekly inspections and treatment of the native women, I was enabled to greatly lessen or keep under the venereal diseases, as can be clearly proved by reference to the statistical returns of the corps.

(Signed) JOHN DEMPSTER,
Inspector-General Hospitals.

To Sir Ranald Martin, C.B., F.R.S.
London, 3rd March 1862.

EXTRACT BENGAL MILITARY CONSULTATIONS,
June 8, 1835, Nos. 15, 16, 17.

MINUTE by the GOVERNOR GENERAL.

Military Department, May 9, 1835.

I BEG leave to lay before the Council the accompanying paper, presented to me by Mr. J. R. Martin, one of the presidency surgeons, the contents of which appear to me to merit attention, and such further proceedings as the Council may be disposed to authorize.

(Signed) C. T. METCALFE.

(Enclosure No. 16.)

1. It is proposed that the medical boards at each presidency be directed to require from all medical officers, civil and military, serving under their orders, a report on the medical topography of the province, district, city, or cantonment, with the localities of which they may happen in course of service to be best acquainted, in which they may be serving at the time.

2. The reports, when furnished from the various provinces, districts, and cities to be collected by a committee of surgeons at each of the presidencies chosen by the medical board, and formed into a memorial, to be printed, and a copy furnished to all staff surgeons and officers of the Quartermaster-General's Department; new additions of the same to be made periodically as the knowledge of the medical topography of the country advances.

3. The following notices are chiefly from the work on military surgery, and that on medical topography, by the late Doctor Hennen, Inspector-General of the Medical Department of the Army in the Mediterranean, who justly considered that to the military surgeon especially, the subject is only second in importance to the right treatment of disease itself; and it were well for our armies if officers, both military and medical, had been duly impressed with this fact, a knowledge of which would have prevented the sacrifice of many lives during almost every campaign that has been undertaken in India, a sacrifice much greater than that produced by the casualties of actual war; as familiar instances of which one need only adduce Arracan, during the late war with the Burmese, and that of the fatal island of Edam off Batavia, from which, as related by Johnson, the officer in command was warned by "an eminent surgeon on the spot, but (without the shadow of reason, military or political) his suggestions were disregarded or over-ruled." The consequence was that (exclusive of seamen) from a wing of His Majesty's 12th regiment "only sixty-two re-turned out of the whole detachment, the rest having fallen ingloriously without drawing a sword."

4. To these I could add many facts that fell under my personal observation on actual service in this country and in Asia (and one such mistake was committed by one of the most intelligent officers, in other respects, I ever knew); but I need not multiply instances to show how necessary such information is to the safety of troops, and how often our officers are wanting in it; neither need I repeat well-known facts to show how often this ignorance has caused enormous expense in money to Government, though

the abandonment of stations, after the horrible expense in lives had in the first instance been but too well proved.

5. But it is not in war alone that the neglect or ignorance of such subjects is pernicious. The choice of camps and cantonments, if ill-directed, leads to the most fatal consequences; and out of instances beyond number, I shall only mention Berhampore, where, because quarters were once fixed by some person very ill qualified for the duty, men have ever since been crowded, and more Europeans have already been lost there than would be sufficient to reconquer India.

6. Finally, the advantages to all classes of the community of having a record that points out the localities which to choose and avoid throughout the several provinces of India, would be of such obvious public benefit that I need no longer dwell on it; and whilst surveys of all kinds are carried on in every part of the country, something of the kind proposed might easily be executed; and as I feel confident it would be second to no survey in point of utility especially to troops, so it would surpass all of them in this respect, viz., that of being attended with little or no cost.

7. Among the objects of inquiry on which the reports should be particular in the details, I shall select from the works above mentioned a few of the most important; many more may be added according to the talent for observation, or opportunities of the individual reporters; and, by following the arrangement about to be pointed out, a collection of the most useful information may be made in a very short time.

TOPOGRAPHICAL DETAILS.

1st. Situation, boundary, elevation, and mode of communication with the place described; general direction of the prevailing winds, &c.; mountains.

2nd. Seas, rivers, lakes, wells, morasses, drainage, state of canals, &c.; these are all matters of great importance, and comprehend a variety of details.

3rd. The climate, its physical character and medical effects, &c., with the highest, lowest, and medium states of the thermometer, barometer, and hygrometer, &c.

4th. The soil, its general nature, its elevation above the adjacent seas and other waters; nature of the waters; the periods of the year when noxious exhalations arise from the soil in greatest abundance, and the extent to which evaporation has proceeded when these exhalations become most deleterious, &c.

5th. Vegetable, animal, and mineral products.

6th. The state of agriculture.

7th. Roads and communications.

8th. The population, with description of the dwellings in common use; the clothing, bedding, and furniture, fuel, diet, &c.; the employments, customs, amusements, &c.; the morals, education, and cleanliness, &c.; the peculiar modes of cure adopted by the inhabitants, &c.; the police; the state of the poor; mode of rearing children.

9th. The diseases, endemic and epidemic, and those that may be hereditary; the diseases of particular classes of manufacturers, of prisons and poorhouses. Tables of marriages, births, diseases, and deaths.

10th. The diseases of cattle and others of the lower orders of animals.

11th. The diseases of plants and other articles used as the food of the people, and those of plants used by cattle.

12th. Longevity, with a general view of mortality among all ages and sexes.

13th. Military surgeons should report, in addition to the above:—

1st. On the state of the barracks, their situation, the date of their erection, their form, whether built in square or parallel lines, or in detached houses, and whether of wood, brick, or stone; quality of supply of water, whether from springs, wells, or rivers.

2nd. Nature of the soil on which they are built, and of that immediately around; their state in regard to damp, cold, or exposure to particular winds, and their general aspect; drainage of the grounds of the barracks.

3rd. Size of the rooms in feet, as to height, length, and breadth; number of windows and doors.

4th. State of the bedsteads; how many the barracks will accommodate on the war, and on the peace establishment.

5th. State of the kitchens, waste-houses, &c.

6th. State of the places of confinement, as to situation, dryness, &c., and whether any particular disease has ever been traced to them.

14th. The hospital, the same questions as relating to the barracks.

1st. Distance of the hospital from the barracks, and whether there be a separate airing ground for the convalescents.

2nd. State of the store-rooms, the surgery, the wash-house, dead-house, &c.

3rd. Whether any patients have ever laboured under any diseases that could fairly be attributed to the locality of the hospital.

P.S.—In the above I have only proposed the heads of the most important points for description, many more will suggest themselves to the intelligent observer of nature, who must, however, always recollect, that it is on the innate features of the country itself, and not on its mere geographical position, that its climate and salubrity depend; and that a fair estimate of the influence of *detached spots* upon the health of the troops or other inhabitants is what is most wanted for a topographical memoir.

(Signed) J. R. MARTIN,
Presidency Surgeon.

Calcutta, March 26, 1835.

Ordered, that the following letter be written to the Medical Board.

No. 113.

(No. 17 to the Medical Board, June 8.)

From Colonel W. CASEMENT, C.B., Secretary to the Government of India in the Military Department, to the MEDICAL BOARD, dated June 8, 1835.

(Military Department.)

GENTLEMEN,

I AM directed by Government to transmit the accompanying paper by Surgeon J. R. Martin, proposing that the medical officers at each presidency be required to furnish a report on the medical topography of the province, district, or city, with the localities of which they may be best acquainted, to be afterwards collated by a committee of surgeons, and formed into a topographical memoir; and to request that your Board will favour Government with your sentiments on Mr. Martin's proposition, stating whether information on all the points enumerated in his paper should be required in the reports from medical officers, and offering at the same time such suggestions as in your opinion may tend to improve and more completely effect the object in view.

2. Be pleased to return the enclosure with your reply.

I have, &c.
(Signed) W. CASEMENT, Col.,
Secretary to the Government of India,
Military Department.

Council Chamber, June 8, 1835.

EXTRACT BENGAL MILITARY CONSULTATION.—

November 23, 1835.

No. 211.

From the Members of the MEDICAL BOARD to his Excellency the Honourable Sir C. J. METCALFE, Bart., Governor General of India in Council, dated June 18, 1835.

HONOURABLE SIR,

We have duly had the honour of receiving a despatch, No. 113, dated the 8th instant, from Colonel Casement, C.B.,

Replying to a letter from Colonel Casement, Secretary to the Government of India, Military Department, dated 8th instant, forwarding a proposition from Mr. Surgeon Martin, relative to a topographical description of the whole of India, and reports for the information of Government on the proposition.

make known to us in furtherance of its views.

3. The importance of medical topography, as mainly contributing to the general healthiness and consequent efficiency of its troops, is now admitted by the concurrent testimony of every European government, nor has the subject been wholly overlooked in this country; many facts of great local interest are to be found recorded in the writings of Hamilton, Breton, Wade, and others, and we have no doubt but that to these, the labours now contemplated are destined to add much very valuable information.

4. Mr. Martin's plan would, however, seem to embrace a far wider range of investigation, and we are compelled to confess ourselves less sanguine in anticipating a favourable result from the zeal and industry of our medical brethren, should their labours not be confined to an investigation purely of a topographical nature.

5. Your Excellency need not be told, that to the task of forming a general idea of the statistics of India, a rare combination of talent is requisite, add to which, besides other advantages, the gifted individual must possess a degree of leisure which may enable him to give his individual attention to each subject under review, together with a facility of locomotion, which it is needless to say, is altogether incompatible with the duties of medical men in this country.

6. The opportunity enjoyed by medical men attached to corps, will of necessity be almost confined to the immediate neighbourhood of cantonments, or at most limited to the line of route between one station and another.

7. To the civil surgeon, however, this objection does not apply with equal force, and it is from him, in concert with the well-directed inquiries of the local authorities, that we should be disposed to look for a mass of material from which the statistics of each particular locality might be gleaned.

8. In conclusion, the Board have nothing better to propose than the formation of a Presidency Committee, together with subordinate local committees at all the principal stations, whose duty it should be to receive all communications, as well as to collect whatever has already been written upon each particular locality.

9. It may almost be unnecessary for us to say, that we shall be found ever ready to offer the best means in our power towards the successful termination of the labours of the committee; and further to add, that the records of our office will be found to contain scattered notices on the prevalence of disease, as connected with locality, which notices will not be held without their value, when it is considered that they are the result of experience on the spot, and in a manner corroborated by the fact of the superintending surgeon deeming them of sufficient importance to include them in his annual report.

We have, &c.

(Signed) J. LONGSTAFF,
First Member, Medical Board.

(Signed) — SWINEY,
Second Member, Medical Board

Fort William, June 18, 1835.

P.S.—The enclosure received with Colonel Casement's letter under reply is herewith returned.

Ordered, that the following reply be given to the Medical Board.

No. 364.

From Colonel W. CASEMENT, C.B., Secretary to Government of India, Military Department, to the MEDICAL BOARD, dated November 23, 1835.

GENTLEMEN,

WITH reference to your letter, No. 211, of the 18th June last, reporting on Mr. Martin's paper relative to topographical memoir of India, I am directed to forward a memorandum, copies of which your Board will be pleased to circulate to officers on the medical establishment of this Presidency.

2. In calling the attention of the service to the importance of this object, your Board should make no distinction whatever between those in the civil and military branches,

for it ought to be recollected, that it is chiefly for the care of its armies that surgeons are sent to India by the Home Government.

3. The subject of the present memorandum should be generally known to all medical officers, and in no countries are opportunities for observation more extended and various than in India.

4. Although but incidental to the main objects, the following subjects will prove highly important, and may be noticed with advantage by officers whose previous habits or opportunities for observation may have qualified them for the task.

1st. The population within the range of inquiry, with description of the dwellings in common use, the clothing, bedding, and furniture, fuel, diet, &c.; their employments, customs, amusements, &c.; the peculiar modes of cure adopted by the inhabitants; the state of the poor, and mode of rearing children.

2nd. Tables of marriages, births, diseases, and deaths, when procurable without difficulty; due discretion being used in making such inquiries as may be necessary for the purpose amongst the natives.

3rd. The diseases of cattle and others of the lower order of animals.

4th. The diseases of the plants and other articles used in the food of the people, and those of plants used by cattle.

5th. Longevity, with a general view of mortality among all ages and sexes.

6th. States of thermometer, barometer, and hygrometer, &c.

7th. These and other questions affecting the subject will suggest themselves to your Board; and in calling on those under your orders for topographical memoirs, it should be impressed on their minds, that it is not on mere geographical position that climate and its salubrity depend, and that a fair estimate of the influence of detached spots on the health of the troops or other inhabitants is what is most wanted.

I am, &c.

(Signed) W. CASEMENT, Col.,
Secretary to Government of India,
Military Department.

Council Chamber,
November 23, 1835.

SUPPLEMENTARY OBSERVATIONS, by JULIUS JEFFREYS, Esq., F.R.S.

It having been notified to me that remarks supplementary to my evidence before H.M. Sanitary Commissioners on the Army in India would be acceptable, I beg to tender the following upon points of importance:—

ON THE SIMPLEST MEANS FOR PURIFYING WATER.

The first observation I have to offer relates to means for rendering water a more wholesome and grateful beverage than it usually is to European soldiers in a tropical climate.

In the first place, wherever the quality of the water is doubtful, or hard from the presence of bi-carbonate of lime, or whenever an epidemic, especially cholera or dysentery, prevails, water ought to be boiled (if not distilled) and be filtered before use.

The chemist is aware that the soluble bi-carbonate of lime may be at once reduced to an insoluble carbonate by mixing a solution of quick-lime (lime water) with water holding the bi-carbonate in solution, which may thus be separated from it by filtration or gradual deposition. This is Dr. Clark's process, by which the water of the Kent waterworks is purified. But it is not so well applicable in common use, where water from different sources varies so much in the quantity of earthy matter present, and where, on this account, and from carelessness, an excess of lime water (more injurious than the bi-carbonate) would often be used. Moreover, it is only by boiling that organized beings, animalculæ, the larvæ of insects, and cells, vegetable and animal, can have their dangerous vitality destroyed, and be reduced to common organic proximate principles.

The filter.—Native red earthen spheroidal jars (*j'halas*) of from thirty to forty gallons capacity are procurable almost everywhere in India, and used to cost from eight annas to one rupee each. For a small advance on the usual price the potters would supply them *thus modified*—each filter would consist of two *j'halas*, one placed over the mouth of the other, but supported by a wooden stand consisting of three or four diverging legs enclosing the lower jar, and having a boarded top with a circular hole in which the upper jar would rest, the lower jar being propped up on bricks, with its mouth close against the conical bottom of the upper jar, so as to be closed by it, and keep mosquitoes and other insects from entering and breeding, and by decaying in the water, rendering it fetid. The lower jar has a hole near to the bottom, passing through a boss of baked clay for receiving a wooden tap or a cork. The upper jar has an inch hole in the centre of its bottom, about six inches above which there rests a circular moveable false bottom of baked clay perforated by small holes like a colander, and having flanged edges for strength. This bottom is divided into two halves, small enough to pass through the mouth of the jar, and then be fitted in their place. On the colander bottom is to be laid half an inch of coarse well-washed pebbles, the size of a pea; on that again a similar layer of smaller pebbles, and then a third layer sieved the size of wheat. Crushed *vitrified* brick will yield these several pebbles. On this upper layer must be placed one or two inches of river sand, previously heated red hot and well washed; on this sand must be spread two or three inches of coarsely ground charcoal, the size of wheat. Above the charcoal should lie another layer of sand, followed by pebbles, and these may be kept down by another earthen colander. The whole layers may occupy eight inches besides the colanders: the uppermost colander being about 15 inches above the bottom hole. In a large *j'hala* there will remain above the filter a depth of three

feet or more for water, and the depth may be increased by mounting on the jar an earthen cylinder, in size like a large chimney pot.

The mouth of the jar should be made with a massive edge, having round it a groove three-quarters of an inch deep to receive the lower edge of the cylinder; a circular disk of cotton cloth of several layers being previously placed upon the jar's edge, and then wedged into the groove by the cylinder.

When the jar is filled with water up to the top of the cylinder a head of water is obtained, which presses with such force on the filter, that this may be of considerable thickness and closely packed,—points of much importance; most filters being defective in not having over them a sufficient head of water. Some oozing of water through the cloth joint at the bottom of the cylinder will take place, and forms part of the design. This water trickling down the outer surfaces of both jars aids the porosity of the jars by encircling them with an evaporating surface of moisture, which, if the jars stand in a thatched shed, well sheltered from the sun, but open to all currents of air, will bring the filtered water, in the course of a day, nearly down to the dew point. The top of the cylinder or jar should be always well closed with a lid.

Such filters are very easy of construction; they cost but a trifle; and the jars, with care, will last a long time. The filtering mass is easily accessible for periodical renewal of the charcoal and sand, and for well washing and sieving again of the gravel. Care must be taken that the circular holes in the wooden stand carrying the upper *j'hala* must be of such size, that when a cushion of cloth or straw is placed around it, it shall press against the jar at the level of or just below the false bottom or lower colander within, so as to guard against the jar's being burst or crushed by the load within, which bears against that part of the vessel pressed by the colander.

METHOD AND APPARATUS FOR ECONOMICALLY CONVERTING RAPID WATER INTO A GRATEFUL AND REFRESHING BEVERAGE.

Thus may be obtained water as good as can be commanded, without distillation, and also cool; but having been boiled, it will be as rapid as distilled water. It needs to be impregnated again with atmospheric air, or, still better, with carbonic acid to the small extent which forms the lately fashionable beverage, "Carrara water."

This may be easily and cheaply effected in India thus:—Fruits yielding vegetable acids abound there, and at a low price. Their juice may be expressed rapidly and thoroughly by any press made on a right principle. I filled with lemon juice, in a short time, with the labour of a few coolies, twenty-five or thirty wine pipes of the largest size. The press was inexpensive, but space for the shortest description cannot be here afforded.

Three casks and a few yards of small india-rubber tubing form nearly all the apparatus which would be needed. First, an acid barrel of, say, nine gallons (the hoops previously varnished to prevent their rusting) is set on end upon a stand five feet high. Near it, and suspended a foot lower than its bottom, a barrel of from 18 to 24 gallons is hung by cords reaching from each end of it to a horizontal bar (supported by walls or posts), three or four feet above it. This barrel is easily agitated longitudinally, each end striking against spring posts set in the ground. From the top of this cask, near the bung-hole, proceed two india-rubber half-inch tubes to the first (the acid barrel), one tube entering the top of this barrel, the other its bottom.

These tubes hang loosely enough to follow the movement of the larger, the gas-generating barrel, when it is agitated. The tube proceeding from the bottom of the acid barrel to the top of this barrel is compressible partially or completely by means of a fork astride of it, made of two slips of wood hinged together at one end like a lemon squeezer, and brought together at the other end by a cord or screw.

A third cask (a hogshead or butt) is to be suspended a few feet from the generating cask, at about the same level, and slung to a beam in the same manner, by ropes at each end of it, four or five feet long, but *diverging* to hooks in the beam, twice as far apart as the points of attachment to the cask. This divergence of the ropes will cause each end of the cask, as it is oscillated, to plunge alternately downward, which, with the blow against a padded spring post at each end, will cause a violent agitation of the liquid in the cask.

From the top of this cask a rubber tube proceeds to the top of the generating barrel, near to where the other tubes enter it from the acid barrel.

This is all the apparatus, I think, necessary for making Carrara water in quantity.

It is to be put in action thus:—The acid barrel is to be filled with any vegetable acid, as lime juice, or a strong decoction of any of the many acid or unripe fruits abounding in India; the lower tube from the barrel being previously closely compressed.

Into the generating barrel should be poured, through the bung-hole, about twenty pounds weight of ground "*kunkur*," the common stalagmitic limestone of India; or, better still, with ground chalk, of which vast quantities are brought out to India as ballast. The bung-hole is then well closed.

The large impregnating cask is to be filled to about two-thirds with the coolest water from the filters. A gallon or two of acid is allowed to run from the acid barrel into the generating cask, which is then well oscillated to favour its action on the limestone powder or chalk. Gas will immediately begin passing over into the impregnating cask, which is to be rapidly oscillated, that the gas may be absorbed as fast as it flows in. As the water takes it in the flow of gas is to be increased by agitating the generating cask from time to time, and by allowing acid to flow into this cask more or less quickly through the tube from the acid barrel, partially compressed by the forked sticks.

There ought to be a pressure gauge screwed into one end of the impregnating cask to denote the tension, and a vent peg or flute-key valve to be opened when it should exceed the working pressure of the cask, which ought to be gas-tight and strong enough to bear one and a half or two atmospheres.

A cask would answer made twice the substance of a wine cask, and with twice as many hoops, or a well hooped wine cask, if protected by a safety valve, and having each end supported by a stout plank, backed by a bar of wood, the two bars being drawn towards each other by means of two iron rods running lengthways outside the cask. The cask ought to be well charred on the inside before it is hooped together, otherwise the wood will for some time give an unpleasant flavour to the liquor.

Thus may be formed a grateful beverage, which, with the addition of syrup of ginger, orange, or lemon (all of them to be made in India for a trifle), might equal capillaire in attractiveness. It will be observed that only one strong cask and two barrels, with a few yards of rubber tubing and of rope, constitute all the apparatus necessary for making sixty or eighty gallons at a time. There is no forcing gas pump, no brass joints, no agitating apparatus with stuffing boxes, all of them liable to leak and get out of order; and no cocks, saving one tap to the impregnating cask for drawing off the liquid. If lime or lemon juice be employed for generating the gas, and the limestone be fully saturated with the acid, the refuse *citrate of lime* would be worth perhaps one shilling a pound, which ought to pay the cost of the prepared beverage, and of the syrups, if this indulgence is added. As malic acid is said to be acquiring in England much value in dyeing, and must abound in the sweet fruits of India in their unripe state, a malate of lime might prove an interesting product of the process, which, as well as the citrate of lime made at other times, if neglected by the commissariat as beneath its notice, might be allowed to form an encouraging perquisite to the soldiers who undertook to prepare the beverage for their comrades and themselves.

I have not at any time made so simple an apparatus as the above for impregnating water with gas; but an acquaintance with such chemical processes enables me to recommend it without any doubt of its answering well, if ordinary attention be paid to the directions for the construction and use of it.

I have in my evidence mentioned the low cost at which I succeeded in producing sulphuric acid in India by placing

the acid chambers under ground, and by other provisions. If this acid should be employed, the *acid barrel* may still be made of wood, *if it be well coated within with shell lac*, which will for a long time bear the action of sulphuric acid of the degree of dilution best suited for generating carbonic acid from chalk or ground limestone; but a small leaden tube might have to be substituted for the vulcanized india-rubber one.

I do not think there will be found any simpler or cheaper means for quickly and surely impregnating a large quantity of water with carbonic acid than the above. Neither the old apparatus of Dr. Wolf or of Dr. Noothe, or the latter in its modern form of the "*Gasogene*," would on a large scale be at all comparable with it in cheapness or effectiveness; for brisk agitation of the fluids is essential for making the liquid take into its pores the gaseous one with adequate rapidity, especially where the water is not very cold; for it has to be borne in mind that at a temperature of 90° water is indisposed to take up any carbonic acid spontaneously.

There is one other process by which I have no doubt carbonic acid might be obtained in an available form from materials costing scarcely anything, viz., by burning together in a stove, or chafing dish of suitable form, good charcoal and limestone, in the proportion, say, of one of the former to eight or ten of the latter, and drawing up the products into a large gasometer. These would consist of atmospheric air deprived of about half its oxygen and largely charged with carbonic acid, both that expelled from the limestone and that yielded by the combustion of the charcoal.

There would also be present a little carbonic oxide, resulting from the necessity of limiting the air feeding the combustion to not more than the double of the theoretical quantity necessary. When the mixed gases in the gasometer had cooled down they would have to be driven into the impregnating cask by a forcing pump, the incondensable nitrogen and oxygen being allowed to escape through the safety valve with such carbonic acid as was not taken up.

A gasometer for the purpose may be made of the thinnest sheet iron, with the lines of junction perfectly air-tight, without either lap-soldering or riveting, by employing a joint, I have found very effective for all such purposes, and to require little labour or skill, while it gives to the whole the stiffness of a framing. But though the materials yielding the gas would cost less by this process than by using either vegetable or mineral acid to discharge it (unless, indeed, the vegetable salt of lime resulting were sold), the apparatus would be so much more cumbrous and costly that I refer to this plan rather as a last resort, should acids at any place not be procurable, than as comparable with acid as a means of expelling the gas from a carbonate of lime.

ON THE MAKING OF ICE AND COOLING OF BUILDINGS BY THE EVAPORATION OF ETHER.—MR. HARRISON'S PROCESS.

The next subject upon which I venture some remarks is Mr. Harrison's freezing process, by the evaporation of ether,—an invention admirable in its design, and in the manner in which it is being given effect by the intelligent engineer who is making the machines, which promise to confer no small boon upon residents in the tropics.

Having, at Sir Proby Cautley's suggestion, examined the machine with some attention, both as an instrument for freezing water, and, suitably modified, for cooling buildings as has been proposed, I am led to think the following observations, prompted by Indian experience, may place these questions in a light suggestive of considerations of some practical importance. For this view we need not here occupy ourselves with the capacity for latent heat of the ether employed, nor the capacity for heat of temperature of the brine; we need not look to these, the intermediate agents in the series, but may direct attention only to the *condensing water* at the commencement of the series as the agent upon which falls the burden of absorbing all the heat given out, either by the *water to be frozen* at the end of the series, where ice is to be the product, or by the *air to be tempered*, where the object is the cooling of buildings. In addition to this duty the condensing water must take up the large quantity of heat which the surrounding air will be constantly imparting at all points to a bulky and cold apparatus working in a hot climate.

Water taken at a temperature of, say, 80° or 85° must lose about 200° of heat (latent and thermometric) before it is firmly frozen; all of which heat must be taken up by the water condensing the ether. Again, as the ether is, I am informed, condensed in the machine at a pressure of about 26 inches of mercury, its condensing temperature will not exceed 90°. Now in the hot months water is not to be had below 80°, excepting from wells 30 or 40 feet deep. From these it may be obtained at, say, 70° or 75°. Since

the condensing current cannot, without a loss of time and effect, be detained against the ether tubes long enough for the condensing ether to warm it up to its own condensing temperature of 90° , it will not in practice have more than 10, or possibly 15, degrees of cooling action available. Therefore, to freeze a given quantity of water at the other end of the series, twenty times that weight of water must be employed at the commencement to condense the ether; and in practice much more, in order to absorb also the heat leaking into all parts of the apparatus from the air descending constantly over the apparatus as it is cooled by it. A supply of condensing water ought to be provided of at least 25 times the ice to be produced.

A large machine, making, as is stated, 1,000 pounds of ice an hour, would require 25,000 pounds of condensing water, and working eight hours 200,000 lbs. To supply this large volume of water in the dry months, it might take from 10 to 15 common wells, a yard in diameter, and nearly one horse power of the steam engine, for eight hours acting on forcing pumps, to raise it 40 or 50 feet, or eight pair of country bullocks attended by 16 men.* It would, therefore, be an act of provident economy to employ the condensing water afterwards for garden irrigation, the only cultivation taking place in the hot season. Of shallow surface waters, as of "jheels" and tanks with a temperature approaching nearly that of boiling ether, a vast quantity would have to be carried through the condenser in order to absorb the heat.

For various reasons I think that small machines, on a scale adapted to water power where it is available, or to that of cattle, would be preferable for the interior of India. The dispensing with a steam engine so troublesome to keep in order at a distance from engine factories, the more ready supply of condensing water for small machines, there being many instead of a single one to rely on, which if out of order might suddenly deprive a large station of the supply of ice, would, I think, taken together, more than counter-balance the greater proportional absorption of atmospheric heat into small machines,† and the greater friction in working the pumps as well as greater cost of cattle labour. Cattle tread-mills as employed in America would work the pumps in machines of an intermediate size with probably much advantage.

An apparatus devised many years ago, for both condensing and evaporating purposes, would, from its quick sensibility, prove, I believe, especially adapted for the ice machines of all sizes, more particularly for the smaller machines. Although this apparatus has not as yet been constructed, or, indeed, described, I cannot doubt that it would prove very far cheaper in its construction and more effective in action than the forms of apparatus usually employed for surface condensation.‡

With respect to the proposal to cool dwellings in India by these ether engines, suitably modified for the purpose, it has to be borne in mind that at the season and in the provinces in which the hot winds blow, *water evaporating upon tatties* (the whole cooling power of which is available in lowering the temperature of the ventilating current) would have to be rivalled by the *water condensing the ether* in the machine.

That this condensing water would bear no comparison with the former in cooling power will at once be manifest. We have seen above, that in the hot months, water, in quantity,§ is not to be had more than from 10 to 15 degrees below the temperature at which the ether is condensed;

and that practically not more than ten degrees of cooling action are available. Whereas when water evaporates from tatties into a hot wind entering the tatties at the temperature from 100° to 115° (that common in the hot winds), such water, *evaporating at those temperatures*, renders latent about $1,200^{\circ}$ of heat, all of which absorption of heat is effectual, and will cool a brisk wind in the moment of its permeating a tatty by 30° . Water at 75° or 80° evaporating on tatties is therefore at least a hundred times as effectual in cooling a ventilating current as it would prove when acting by condensing ether, or, in other words, to produce an equally cooling effect on a building *with an equally large amount of ventilation*, a hundred times as much water would have to be provided in the one case as in the other.

It will not be argued that the evaporating action of water might also be employed to condense the ether, for that would call for an impracticable multiplication of the metallic surfaces, and as the same current of wind would be needed to give effect to the evaporation in either case, to interpose an ether machine would be merely a circuitous and expensive way of cooling by "tatty" action. The machine-cooling, if employed at all, must be effected, as in the freezing process, by condensing the ether by water acting in its liquid state as a current of convection conducting off and absorbing heat from the metallic surfaces transferring it from the condensing ether.

The waste of water running down from fairly managed tatties forms an inappreciably small proportion of that effectively evaporated, as I have repeatedly proved by experiment; yet to cool the ventilating current of a large barrack, so prodigious is the quantity of water required, that the bullocks, well-men, and "bheesties," (water bearers), necessary for drawing the water from wells and conveying it to the tubs (where it is chucked on the tatties by boys with leathern mugs), constitute the chief expense, while the demand on the wells at hand oftentimes exceeds their power of supply. The hundredfold greater quantity which the ether process would require could scarcely be obtained at hand excepting on the banks of rivers, and at a cost for draught (*unless by steam power where fuel was cheap and machinery easily repaired*), for which no advantages could compensate so long as tatties can act. But at those seasons and in those regions of India, where often only a moderate elevation of temperature exists, but is rendered very oppressive from the stagnation and peculiar *temperament** of the atmosphere, great relief would be felt if the air of a barrack could be reduced only 10° or 15° , as from 85° or 95° to 75° or 80° . By no other means perhaps could this be effected so well as by the ether process. Where a reduction of only 10° or 15° in the temperature would materially mitigate the oppression of a stagnant and somewhat humid atmosphere, such as often prevails in Bengal, and where tatties are therefore unavailing, it may be well worth while to put in action the ether process, even though it should bring the atmosphere below its dew-point.

The interest and importance which attaches to the question having led me to consider how to apply the process in the most economical and effective manner for producing as well as cooling a current of ventilation, adequate for a wholesome supply to a large number of persons, I should feel tempted to intrude a description of the apparatus and arrangement which the conditions have suggested, did space permit it, and had not members of the commission, or others under their guidance, probably directed abler attention already to the question.

A FLOATING RIVER-POWER WATER MILL, AND A HYDRAULIC MACHINE FOR WORKING THE ETHER PROCESS.

I cannot, however, refrain from remarking that there are already several stations on the banks of rivers where a brisk stream is passing below a lofty bank, and where it seems to me the following instrument might be rendered

* Incredible as it may appear, I found, upon repeated trials, that a pair of ordinary "zumendance" bullocks, with the two attendant men, raising water by the bag and rope (in universal use in India where the depth to the water exceeds 20 feet), did not equal in effect more than about one-eighth of the estimated single horse power, and that the cost of irrigating land throughout Western India ranged, for the three waterings usual in the season, from one to three, and sometimes four rupees a bigah, more than double the Government rent on the land!

† If all parts of the machine were well jacketed with charcoal or blankets, it would no doubt materially reduce the entrance of heat.

‡ Vide note † in next column.

§ Cool water of deep wells cannot be obtained in any very great quantity within a distance at which it would retain its coolness in travelling. It has been suggested that the condensing apparatus itself might be sunk into one of the wells, and these all connected with each other by subaqueous tunnels. I have in earlier writings proposed connecting wells for irrigation in this manner to a central well containing a hydraulic machine; but each such tunnel would cost more than several native wells. In the present case the main objection would be rapid heating of the water by the ether undergoing condensation. As water is drawn off from a well it is rapidly replaced by water flowing in from the surrounding sandstratum. All the water in eight wells, each one yard in diameter, and having ten feet deep of water (an unusual quantity in the hot season), would not exceed 35,000 pounds, so that if the water of all the wells could be thoroughly raised it would be heated up in less than an hour and a half, and would not cool again perhaps in a week. As to any plunging process for enforcing a circulation of the water through the earth around, it would be found, to be at all effectual, quite as laborious as, and more expensive than the previous necessary, than raising the water at once, and it would soon exhaust the cooling power of any such area of soil as it would be possible to force the water through. Moreover, it would endanger a rapid destruction of the wells. In the plan for cooling air in wells described in a former part of this evidence, 120 wells are provided for one barrack, and the effect is aided by a certain amount of evaporation.

* A term I ventured to introduce in earlier writings to denote its state with respect to warmth, moisture, and electricity combined.

† I may briefly remark that the apparatus for producing ventilation by means of a cooling current would be placed above the ceiling, and act on the principle I have elsewhere advocated of a downward ventilation of cold heavy air. By employing the sensitive apparatus referred to in the preceding column the air might be cooled directly by the evaporating ether, without the intervention of a liquid medium such as the *brisk current* in the *ice-making apparatus*; but without such an especial and very sensitive apparatus a large volume of so poor a heat-conducting medium as air could not be cooled directly by the ether, even though the latter would be evaporating all much below the freezing point, indeed below zero. As to the condensation of the ether afterwards by the outflowing current of air, when at a temperature of at least 80° (i.e., as it was being discharged from the building), it is an action which could not be secured without a conducting surface of metal of great extent, bearing some such proportion to the surface needed for condensing by water, as do, inversely, the small capacity for heat and small heat-conducting power of air bear to the vastly greater capacity for heat and conducting power of water, especially when the capacities of air and water are estimated by volume, and certainly mechanical means for urging the air current would be needful.

very effectual for the object in view. It was contrived many years ago (while I was conducting experiments on irrigation) for supplying the wide and elevated plains of rich but thirsty land through which the Ganges, Jumna, Gogra, Soane, Chumbul, and many another river cut their way, throughout western and central India.

It was my purpose at one time to have constructed this moveable engine of irrigation, and put it in action at different places, to demonstrate to the natives what a spontaneous source, in many a place, of power and of water they were neglecting. The instrument is briefly this:—The large massive boats built at PHILIBET, near BAREILLY, are, or were, to be bought second-hand at five pounds each and even less. A pair of these placed parallel, fifteen or twenty feet apart, are to be strongly bridged to each other by cross and diagonal spars or the stoutest bamboos. This twin boat is to be anchored near the shore at a spot where the stream is stiffest. The rush of water between these boats may, if desired, be increased by a spreading hoarding of planks or bamboo matting, well supported by bamboos, so tethered in front of them as to collect and direct into the channel between them a current of double width.* The whole width of the channel between the boats is to be occupied by an undershot waterwheel having deep boards. From a large drum or band wheel on the same axis with it proceeds a broad leather band obliquely upwards and backwards to a much smaller drum wheel, mounted on an axis at the top of a gallows or lofty frame. This frame is formed by two masts on each boat, converging towards each other, as they rise up to a yard or more above the level of the river bank, whatever its height may be.

This water-mill has not been constructed, but the hydraulic apparatus to be driven by it has, and with complete success. It is a modification of the Persian, or rather, Egyptian wheel and endless chain of buckets.

In the Persian wheel and buckets (generally earthen pots from ancient times employed in that country and throughout the rest of Asia, especially in Western India), the water is poured centripetally into a trough below the axis of the wheel. Much of it is consequently spilt, and nearly all would be carried down again into the well, were not a very slow motion maintained; but so slow a motion necessitates the keeping in motion of a great load of water for a comparatively small delivery. This *centripetal* delivery is a defect also pervading, I believe, all the improved modifications of the machine employed to raise water in Europe.

Observing that the natives of India confine their employment of the Egyptian wheel and pots to raising water only at depths within about 20 feet, owing to the great weight of the pots and the water suspended, and that slow as the motion is a serious proportion of the water is spilt into the well again, I made an effort to improve this ancient machine, not only by adopting a *centrifugal* instead of a *centripetal* delivery of the water, but more especially by making the buckets of the shape B, B, &c., seen edgewise in Fig. 1 and broadways in Fig. 2, and with their mouths C, C, &c., at the outer side; and then attaching the buckets by cross rails *r r*, &c., to the two endless ropes R, R, &c., in such manner that the buckets shall hang *entirely on the inner side of the ropes*. The effect of these provisions will immediately appear. The ropes travel round two equal sized grooved wheels A, A, Figs. 1 and 2, fixed on the same axis (at the top of the masts) which carries the *band wheel* already named. These grooved wheels are fixed on the axis about an inch further apart than the breadth of the buckets, so that the buckets in ascending can pass between them, and lie entirely within the line of their circumference. Now, if the ropes are travelling at, say, six miles an hour, the water in each bucket will have, of course, a momentum due to that velocity; but as each bucket comes into the position of the uppermost one, B, X, its back or central side *e*, which extends half-way towards the centre of the wheel (the radius of which does not exceed twice the width of the bucket), has its velocity retarded by one half, and moves only at the rate of three miles an hour. The water, however, which it contains being, as a liquid, free to move, obeys its own momentum of six miles an hour, and leaping out into the trough, T, is all secured before the bucket has even descended to a level with the axis of the wheel.

If, on the other hand, the machinery should be moving very slowly, the whole water simply pours itself out into the trough before the bucket arrives at the position B 1; and at any intermediate velocities between that at which it will clear itself while the bucket is in the horizontal position B, X, and one so slow that it simply gravitates out of the bucket as the latter tilts towards a vertical position, the clearance is equally complete, and is due in part to momentum and in part to gravitation.

This hydraulic apparatus was tried on a full scale, and made as shown in the drawing. The principle of combining a *sudden retardation of the containing bucket with the centrifugal momentum of the water* is incomparably more effective

than any form of a *centripetal* delivery of the fluid (having elicited even from the apathetic Hindoos expressions of surprise on seeing the water leap out of its bed at the right moment). The trough stands quite clear of the apparatus, the buckets never touching it; and the water has to be raised only a few inches above the point of delivery. This, with an absence of the friction and a freedom from the wear of pumps, especially by water turbid with silt or sand, and an independence of all frame-work, confers on this apparatus great advantages, even where the height is within that of sucking pumps, and still greater where lifting or forcing pumps would be required. It is also far cheaper than pumps, especially in India; and, I venture to think, so peculiarly adapted for irrigation, the purpose for which it was contrived, that at a time when a cotton famine in England is spoken of as threatening to follow upon the heels of a famine of corn in India, in both of which cultivations defective means of irrigation play a serious part, a description of this hydraulic apparatus may not be without interest, even should it not be made serviceable, as I should hope, for rendering the ether process of Mr. Harrison economically available for the cooling of buildings.

Besides this apparatus tried on the full scale, a model was made, in which, in lieu of two ropes travelling in grooved wheels, two endless leather bands were carried by band wheels, having as usual a slightly convex edge. I think bands are preferable to ropes in grooves, which to avoid slipping must wedge themselves in a V-groove sufficiently to create a little resistance in its leaving the groove on the descending side of the wheel, causing some little wear and friction; whereas broad leathern bands (wetted as they would always be in passing through the water below) adhere to the surface of a wheel with ample force, and yet leave it with no resistance when detached by the *peeling-off* action of a band leaving the clearing side of a wheel.

Whether double ropes or bands are employed, it is very necessary that there should be one or more of what may be termed "compensating breaks" in the endless circuit, as seen at E, Fig. 2, where a stout bar F, F, crosses from one rope to the other, and at the middle of it a leathern strap E, loops up to it the front bar of the next bucket below it sufficiently for the strap to receive all the weight, and to cause a looseness in the ropes on each side of about an inch. However nearly the carrying wheels may correspond in their size, and the two ropes in their length, at least one such break in the circuits would be needed, otherwise there would be sure to result a slight inequality in the two circuits, which, being constantly increased by repetition at every revolution of the ropes, would cause an entire derangement of the system; whereas any inequality is always corrected at the next break by its compensating or splinter bar action instantly equalizing afresh the lengths of the two circuits, and keeping all the cross bars horizontal. The ropes require only to be slackened a little in the looping up by the break-strap. They should not be severed, since they are wanted to check any tendency in the system of buckets below the break to twist sideways. The buckets are suspended to their cross bars by central pins P, P, P, &c., which admit of such play that if any bars should, from any irregularity in the ropes, be slightly out of the horizontal, the buckets may hang true. This last provision, though not necessary, may as well be made.*

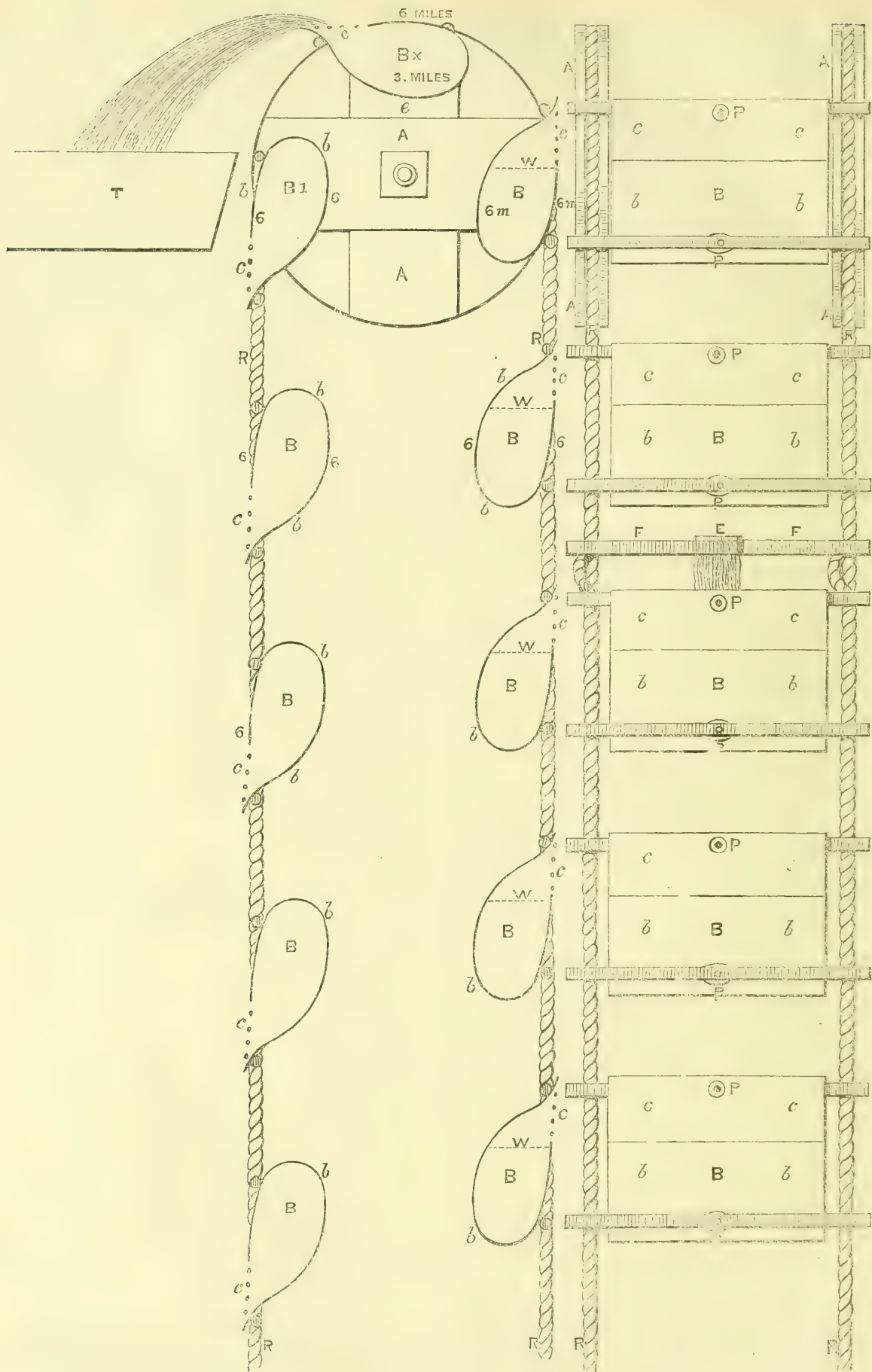
With the exception of a brief verbal reference to this hydraulic principle many years ago before the British Association for the Promotion of Science, and in addresses upon the resources of India before the Liverpool and Manchester Indian Associations, no other opportunity has been taken to call attention to this apparatus in England.

Returning to the employment of this hydraulic machine to give effect to the ether process, it is plain that the driving band proceeding from the large drum wheel on the axis of the great water wheel up to a smaller drum wheel on the axis of the hydraulic machine, would bring the whole power of the water wheel to bear upon raising water to the top of the mast-frame of the boats. The trough T, there receiving

* It may be well to explain that the construction of the buckets is very simple and easy. The two ends of each bucket are formed by flat pieces of board half an inch to one inch thick, about 15 inches long, and six or seven wide; and shaped as the ends B, B, &c. of the buckets in Fig. 1. Pieces of very thin sheet iron sufficiently long, and about 18 or 20 inches wide, the distance of the end-boards apart, including their thickness, are lapped round the edges of the boards and nailed down to them, so that the iron forms the front, back, and curved top and bottom of the bucket, shutting it in all round, excepting at the mouth C. Strips of felt or paper tarred, or cemented with white lead, are placed between the wood and iron during the nailing on, to make the work watertight. Such buckets are therefore cheap enough and very durable.

The dimensions named are about the sizes of the buckets which were tried. A few much larger were made, but not tried, as no water-mill to work them was constructed. Such long buckets, or even larger ones, to carry a hundredweight of water each, might suit mills as powerful as many of the river rapids of India could set in motion.

Another model was constructed with buckets or pouches made of leather, as more portable and somewhat cheaper to make in India than those of wood and iron, though they would be much more costly in England. The pouches acted upon a somewhat different principle.



the water, would be continued on a bamboo scaffolding to the top of the bank, and from thence the water might flow in a pipe so well encircled with charcoal, and then covered in by earth, that it would reach the ether machine in a barrack at hand but slightly raised in temperature. Having flowed in copious volume through the condensing passages of the ether machine and fulfilled the duty of absorbing all that heat which, instead of oppressing the inmates of the barrack had been drawn out of their ventilating current by means of suitable apparatus, adapted to Mr. Harrison's

ether process, the stream might then travel back towards the river, and pouring itself in its way over the bank into the cylinder of a *turbine*, or Barker's mill, might keep it in motion, and this mill might work the evaporating pump of the ether machine. At all large stations where a river flows under a high bank there are rapids offering to a capacious undershot water wheel abundant motive power, and of uninterrupted action which might therefore be employed during the day and till midnight in cooling the building, and from that time for eight or nine hours in making ice,

The power, moreover, would take effect twice over; first, in raising a superabundant supply of condensing water, and then by the descent of this water again, in aiding to work the evaporating pump through the medium of the *turbine*. In the rainy season when the rise of the river up the bank might render it necessary to remove the turbine, the undershot wheel might be well able to perform the double office of raising the condensing water necessary and working the evaporating pump. For the power of the wheel would in some places be increased by the greater force of the current, and the duty of raising the water at the same time much lessened by the higher level of the boat's floatation, bringing them nearer to that of the bank, and permitting the frame carrying the bucket-wheel axis to be shifted lower down the masts; the length of the band and number of the buckets being reduced in proportion. There are multitudes of spots on the numerous rivers of India where, under a bank healthily and securely elevated high above the level of the water, the current runs perpetually with a force which requires the united force of the crews of two or three boats to tow the boats, one at a time, past the rapid—a rapid of ample width and depth to drive a five or six horse wheel, night and day, gratuitously. The floating mill would not cost one-fifth, perhaps not a tenth part as much as a steam engine of equal power, with all its fixtures and engine house, and in the repairs afterwards, even supposing it possible to have a steam engine always repaired on the spot. Supposing that river power for a single mill, of not more than three or four horse power, could only be found in one spot in the locality, these floating mills might be indefinitely multiplied at one or two hundred yards apart.

Since the river might thus afford an unlimited supply both of water 10° or 15° below that of the condensing ether, and of power to condense the ether (if need be, under a pressure equal to 35 inches of mercury, *i.e.*, at a temperature above 100° , should the river water rise to nearer 90°), and since all this supply of power and of water would cost nothing; or, in other words, since all the elements of an unlimited cooling of barracks (each perhaps of the reduced size recommended by Sir John Lawrence), and of officers' dwellings, and also of an unlimited supply of ice, are offered by nature spontaneously, and require only the medium of Mr. Harrison's ingenious plan, and the simple but powerful floating mills to give them effect, I cannot but think the question may be found to merit the attention of the Indian authorities. From the time this water mill was first contrived (nearly 30 years ago), and the hydraulic principle had been successfully tried a year or two earlier, it has been impossible not to lament, especially during periods of famine, that the thousand river rapids of India should run unheeded and waste their power under a desert bank. But how much additional cause will there be for regret if an oppressive atmosphere which they might be made to mitigate shall continue to act as an auxiliary to the pestilence which succeeds famine, and often prevails without it.

It will, I hope, be understood that this plan is not proposed to compete with the cooling power of *tatties* when a dry hot wind is blowing at 110° or 115° , which must be cooled 30° or 35° before it can be admitted into a house, but that it is proposed to take effect during the much longer portion of the year when the temperature is below 100° , and there is neither wind nor dryness enough in the atmosphere to give effect to *tatties*. Also it is not supposed that the water which would condense a given quantity of ether from a state of vapour, would, in falling 30 feet, enable a Barker's mill to enforce the evaporation of a like quantity of ether. It is only proposed that the condensing water should, as far as it will go, perform the double office. To work the evaporating pump a large amount of power must be transferred from the water mills directly to the pumps, without the intervention of the hydraulic bucket apparatus. It may be worth while to remark that the ether condensing apparatus might itself be sunk in the river. The stream flowing through the apparatus would at once do the work of condensation effectually. But the safety of the apparatus would be endangered. It would with difficulty be protected against drifting trees and wrecks, especially in the rainy season, when the river rose perhaps 20 feet, though, if fixed between the twin boats behind the water wheel which supplied power for driving the ether pumps, it might rise with the boats as the river rose. The pipe connecting it with the ether pumps on shore, as well as the return pipe for the condensed ether, would require to have each at least two universal joints, which must be narrowly watched lest they should leak ether vapour largely.

ON CHARCOAL INSTRUMENTS PLACED BEFORE THE BREATH-PASSAGES AS PROTECTORS FROM INFECTION.

The next point upon which I think it becomes me to remark, is the proposal to employ in the form of a respirator, the resolving, and, therefore, probably disinfecting

power of charcoal, as a preservative against the effects of malarious or otherwise impure atmospheres.

Having myself witnessed the fatality of the "*oul*" of the *terai* jungles below the Himalayas, no one would rejoice more in the establishment, by adequate trial, of protective virtue in an intercepting medium of charcoal acting before the mouth and nostrils; and I much regret that an instrumental form should have been adopted which must render the charcoal worthless as a disinfectant, that it should have been made *subjectively* a respirator—an article respired through.

It appeared to me, therefore, a duty, on the first appearance of this instrument, to invite the attention of the leading members of the profession to its construction as destructive of any specific virtue in charcoal, and to urge the necessity, before any reliance on a charcoal instrument as a protector from infection could be entertained, that it should not be given the form of a respirator, but of an instrument to be inspired through only; that for this purpose it should be so provided with valves as to transmit through the charcoal the entering breath only, the outgoing breath being discharged through another channel.

Some months afterwards Dr. Forbes Watson described, in the Journal of the Society of Arts, an instrument answering these requirements as well, I think, as the case admits of, though I have not seen one. He informs me that its efficiency has not yet been tried. It is to be hoped that this, which may be named the charcoal *inhaler* or *inspirator*, will alone be trusted with a trial, and not the charcoal *respirator*.

For it is very needful upon a sanitary question so closely connected with India as protection from malaria, that a warning should be pronounced against the placing of any reliance upon charcoal *when respired through*, as possessing any but a momentary disinfecting power.

ON THE IMPORTANCE OF INSTRUMENTS FOR THE RELIEF OF IRRITABLE BREATH-PASSAGES ON MILITARY DUTY.

This pulmonary question is not without an important sanitary application to Europeans in India, soldiers as well as others.

Persons with breathing organs unduly susceptible, on suddenly changing the relaxing climate of the plains for the keen though bracing air of the hills, are too likely, from the want of temporary protection of these organs until their systems are invigorated, to suffer attacks in them which, under such circumstances, are liable to run a rapid and fatal course. Such instances have occurred. And, on the other hand, I have received from India itself accounts of benefits from the action of the respirator of a like character to those which sufferers in Europe are prompted by their feelings to send me.

It is well known that when pulmonary disease originates in India in the persons of Europeans, it is generally induced by previous disease in the liver. While the latter affection urges them to seek a temperate climate, the extreme susceptibility of the breath-passages when the hepatic irritation is extended to them (which suffer even in the cold weather of the plains), renders them quite unfit to cope with any but the summer air of stations on the hills. An officer of distinguished gallantry, and once of a fine constitution, on suffering from chronic liver disease induced by relapses of fever, proceeded to the hills, for a change of climate, in the month of March, but found a cough, which had commenced in the plains during sharp weather in January, rapidly aggravated, and he died in four months (in July 1828) of abscess in the lungs.

There can be little doubt such cases will frequently occur now that the British force in India is greatly increased, and a recourse to the climate of the hills will be more generally substituted for that detention in the plains and repeated admission into hospital which necessarily terminates in an early destruction of many a constitution, which by better measures might be long sustained, and in no small proportion of cases thoroughly restored.

The change, of a transfer of irritation from the liver to the lungs on leaving the plains for the hills,—of destruction upon Scylla on escaping from Charybdis,—would greatly decrease if the principles upon which the *real* respirator is based were in all such cases given effect, not merely without doors, as they are, in ignorance of their virtues, for the most part only employed, but within doors also whenever irritation manifested by cough shall indicate it.

It is not an opinion only with which the Commission is being here troubled, but the statement of an incontrovertible fact, that not in India only, but still more in other parts of the world, more particularly in the case of troops suddenly exposed to a Canadian winter, or, as in the Crimea, in winter trenches, not to include *real* respirators in military stores for men with irritable breath-passages, is simply to consign to death annually many a score of soldiers, and to

cause a loss of many a thousand pounds to the nation. Many men, not a few of them possessing great muscular power, and quite equal to military duty, suffer from a temporary or chronic delicacy of the chest, whose breath-passages cannot endure exposure to the conjoint *chilling* and *drying* action of air inhaled at all at a low temperature. It induces asthmatic or bronchitic symptoms, and an instinctively restrained admission of breath by contracting the nostrils and closing the teeth, whereas in marching or walking any distance the exercise demands an increased respiration. This diminution of the healthy volume of the breath lessens the irritating effect of keen air in proportion as the entrance of such air is restrained; but any such partial advantage is purchased at the price of a partial suffocation, the whole blood suffers damage, and its effete matters cannot be evolved from it and thrown out by the lungs. The "supplementary" portion of the "resident"* air of the chest gradually decreases, the lungs become condensed in a portion of their texture, or, from a plugging of certain tubes, *emphysematous* (broken-winded), and, where there is any tendency to tuberculous disease, consumptive. To keep sending men so circumstanced into hospital, to have their lungs repeatedly patched up by drugs, however skilfully administered, and again exposed to their atmospheric enemy, is a system, religiously continued down from the earliest days of drug-treatment, which, most assuredly, cannot face the light of a sound pathology.

When the whole body is immersed in any climate warm and soft with moisture, the lungs of such men are for the most part at ease, unless through their health suffering materially from the relaxing effects of the climate upon their bodies. Does it not stand to reason, when they are in a cold climate, that if you can supply such a soft atmosphere as the former to the lungs only, and wrap up the body warmly, they may best escape the injurious effects upon their susceptible breath-passages of this otherwise bracing climate?

In a normal state of health various natural agents exercise a beneficial stimulus on the system, any habitual avoidance of which may induce delicacy, *i.e.*, too great sensibility towards it; but in an abnormal state, when any one of these agents, instead of healthily stimulating, causes the smallest distress in an organ, let it be the eye, ear, chest, or any other part, the more early, thoroughly, and uninterruptedly the suffering organ is protected against the irritant, the sooner is nature enabled to restore it to its normal state, fitted to thrive under what again becomes to it a healthy influence.

It has been objected that although since the expelled breath occupies a volume of 20 or 30 ounces, no appreciable quantity of its *gases* can be detained in an instrument in which there is not an inch of unoccupied space, the impurities in the moisture of the breath, which is freely condensed in the instrument, may, on returning with the entering current, prove injurious. The apparent plausibility of this objection will vanish on reflecting that any embarrassment of the respiration tends to accumulate effete matters in the system to a far greater extent than can any trifling return of them in respiring through a proper respirator; one of the most marked effects of which, when employed of the right temper, is to set the respiration free, inviting, through the softness given to it, full indraughts of air, the first mouthful of which would otherwise excite cough, and often a suffocative asthmatic spasm in the breath-passages.

The condensation of distilled moisture from the breath is as essential a principle of the respirator as is its absorption of caloric. In an enfeebled and irritable state of the air passages, the *natural* evolution of moisture from them diminishes, and does not keep pace with that absolute demand of moisture, in obedience to physical law, which each entering breath makes directly upon the delicate membrane lining them, and, secondarily, upon the portion of it extended over the air cells,—a membrane requiring to possess such delicate texture that through its pores, the air and the blood in the vessels on either side of it shall sustain the animal life by a barter of their elements,—a membrane of such delicate texture that a state allied to semi-liquidity is a necessary condition of its existence. To preserve this condition it has to lubricate itself perpetually with a thin fluid, which owes its unctuousity to mucus largely diluted; but which, when dried into obstructive phlegm, and still worse when into a solid state, becomes itself an irritant vying with the air in exciting cough. It is the inexorable demand of the entering breath to be sup-

plied with moisture due to its rise in temperature, which alone causes this drying of the lubricant; a demand large in proportion as the air enters cold, and greater, therefore, even in the foggiest winter weather than in the driest summer. It is true that a cold fog is more distressing to many persons than a keen dry air; but such distress is caused by its sudden evaporation in the breath-passages robbing them of heat rendered thus latent and lost to temperature. But however foggy air may enter the lungs at a temperature of 30° or 40°, it will become dry by the moment it rises to 40° or 50°; and in rising up to near 100° will absorb 50 more degrees of moisture; whereas summer air dry at 75° will not, in rising to near 100, demand more than 30 to 35 degrees of moisture.

In *acute* bronchitis or pneumonitis the supply of moisture falls so far short of the demand that it would much more often prove fatal did not nature take on providentially a *specific* action, causing the membrane to throw forth quantities of soft phlegm in the one disease, and to plaster itself with a glutinous matter in the other (which it has constantly to discharge, indeed to maintain life through its pores). In such *acute* states a respirator is of little use, *if*, as is often the case, *it cannot condense any moisture*. Indeed, if the air of the room is by other means fully warmed, it may, *while condensing no moisture*, prove oppressive.

This specific action, often repeated in renewed attacks, is liable in some cases to be resolved into a chronic weeping, from the air-ward membrane, loading the passages with a watery fluid, as in watery cough, an abnormal substitute for the healthy evolution of moisture. In such cases the warmth but not the moisture of the respirator is needed. But these cases are the exception.

CLIMATE-CHAMBERS FOR THE LUNGS ALONE, FOR HOSPITAL USE.

To meet the urgent need of an uninterrupted fomenting action which this breath membrane lies under, in common with every other air-ward surface, as that of the skin or eye, when inflamed, and in affording which it was plain from the first that the respirator (lacking moisture in such acute cases) must fall short, I was led to propose, 20 years ago, a construction which I think it right again to refer to briefly; for if such an apparatus were made portable and introduced into military hospitals (as indeed into others and into private practice), acute attacks in the chest would far less often terminate either fatally or in chronic disease. The proposal was, an apparatus which should perform the work of respirators, in that it would afford to the lungs artificial climates suited to them, without involving the whole body in atmospheres relaxing and oppressive to it; just as would be continuous immersion to the neck in a tepid or hot bath, where only a local fomentation or poultice was required. It is this *immersion* in the soothing element which is the great drawback to the soft insular climates in tropical and semi-tropical oceans, in which softness irritable breath passages would otherwise delight. For this end it was proposed the head alone should lie in a chamber of several cubic feet contents, formed of air-proof curtains, enclosing the neck. Through this chamber would flow gently an atmosphere compounded (in proportions to suit the particular case) of hot and cold air and vapour of water (impregnated or not with medicaments as was thought desirable), such atmosphere being mixed previously in the feed pipe of the chamber by a conflux of these three constituents, severally admitted from separate sources in the proportions determined. The proportions of vapour and of hot and cold air would be variable in any degree, either by an attendant or by the patient himself, by merely tightening or easing certain endless cords, acting like that of a roller blind, but commanding valves instead.

The value of such an apparatus, especially in the acute stage of disease, could scarcely be exaggerated. It has, indeed, of late years become a not uncommon practice to keep, on the fire of a patient's chamber, a kettle with a long spout discharging steam into it, and with a beneficial effect, so great, considering the rude uncertainty of the operation and its affecting the whole room, as to be an earnest, though an imperfect one, of what might be the curative power of the complete apparatus.

Until such an apparatus shall be constructed it is much to be desired that the military hospitals of hill stations in India, as well as in other cold climates, should be supplied with kettles spouted from the top, the spout, which need not be long, terminating in a long flexible tube, which should be conveyed near to the face, but with its mouth so directed as not to endanger any gush of steam being blown against and scalding the face.

The more perfect apparatus, chambering a distinct climate for the lungs when in bed, might also be employed in cases of *chronic delicacy*, in lieu of sleeping with respirators, when the luxury of such a chamber could be com-

* Terms here employed as having been accepted by subsequent authors, they having been first introduced in "The Statics of the Chest," as appearing to me suitable for denoting certain volumes of pulmonary air not then defined by name though previously also noticed by Dr. Calvert, Holland and others. The *resident* air includes the supplementary and the *residual*, which last cannot be expelled; the term "residual" having been long introduced by physiological writers to denote the air remaining in the lungs after death.

manded at all times, but, in the absence of it, no cougher at night ought to neglect to wear a respirator. It has been worn with great relief by some who in the day time have actually not required the respirator out of doors, though this of course is not usually the case. Some judgment is required in selecting between the nasal, oral, and orinatal instruments, according as the nose, mouth, or both passages are breathed through in sleep. For night use the nasal is, with myself, the favourite instrument.

To this in-door employment of respirators no small number of persons within my own field of observation owe an exemption from attacks which would long since have proved fatal.

CHOLERA.—SUGGESTIONS, CURATIVE AND PREVENTIVE.

The last subject upon which I desire to offer practical suggestions, based upon what appears to me may be believed with respect to the mysterious character of the disease, is CHOLERA. I would that the matter under this head partook of the pathological and practical certainty attaching to the preceding head, but *here* all that can be offered is but conjectural and suggestive.

The deplorable severity with which the recent epidemic has fallen upon the British troops in India, in some localities carrying off in a few days from a tenth to a fifth of the number present, and prompting the appointment of a fresh commission of inquiry into the nature of the disease, would leave without excuse any one who should at the present moment neglect to impart information having any promise of value, as being the result of considerable early experience in this disease, and subsequent reflection upon it.

In venturing the following remarks, I desire to be mindful that it is sanitary and not medical evidence which is sought by the Commission, that its objects are the prevention rather than the cure of disease. At the same time it will not, I hope, be considered out of place if theory shall be introduced, so far only as is necessary for giving weight to the suggestions which form the substance of these observations.

Having from an early period entertained the conviction that* the capillary vessels are not mere passive channels to the circulating fluids, but are scarcely less active and important in maintaining the circulation at the extremity of the vascular system than the heart is at its base, an opinion, I believe, now generally received, it has long appeared to me that there may be founded upon this doctrine a satisfactory explanation of the phenomena, if not also of the nature of Asiatic cholera, and that such an explanation may offer some clue towards the prevention and the treatment of the disease.

To be very brief, attention is invited to the great mucous surfaces of the body, which may be termed the air-ward and the food-ward; the former being opposed to and having commerce with the air, namely the skin of the body's surface and the skin of the lungs' air passages; and the latter being opposed to and dealing with the ingesta, the food, namely the skin of the whole alimentary canal, from the upper orifice of the stomach to the lower one of the bowels. We find this large expanse of membrane, the air-ward and food-ward skins, to consist of a great development of the capillary system, namely, of multitudes of the extreme vessels filled with blood, (red or colourless, according to their size and duty), and also of innumerable extreme nerves charged with nervous influence, *i.e.*, vital electricity, and therewith giving impulsion to the capillaries.

The flow of this vital electricity is, in their normal state, so admirably adjusted between the air-ward and food-ward membranes, that their respective circulations are duly balanced, and their respective functions rightly performed. A mutual nervous sympathy tends to preserve this balance, and a reciprocity of action to provide against any temporary disturbance of it. With these truths, couched in other terms, the physiologist is familiar. They are clothed in the present, as conducive to the explanation in hand.

While, then, such is the natural state, it will be readily conceived that through some morbid agency the healthy distribution of the vital electricity over these two great capillary surfaces might be utterly deranged, that the current of nervous influence might desert the air-ward and become accumulated upon the food-ward surfaces; their nervous tissue, by a morbid vital induction, becoming surcharged with the influence withdrawn from the nervous tissue of the air-ward surfaces, becoming as in a state of positive vital electricity to the latter as in a negative state. All this is so reasonable, that but for the custodiary arrangements

of Providence, a more frequent occurrence of it might be expected.

When it did occur, what but the following would be the phenomena to be expected? A death-like state of the air-ward surfaces, their capillaries being empty and paralysed, and the circulation in them suspended; a cold and cadaverous skin, a ghastly countenance, a cold breath. On the other hand, intense congestion and irritability in the food-ward surfaces, the blood from without being driven in upon them by the inward impulse of the nervous action: in other words, the inward tension of the vital electricity. To relieve this congestion, and as a consequence of the irritability (*i.e.*, in obedience to the accumulated nervous influence), either a great secretion of watery fluid (which might be expected to have a specific character), or in the absence of such secretion an increase of the inward tension and distress. To remove this fluid, and from their own irritability, much action of the stomach upwards and of the bowels downwards. The glandular viscera, the liver and kidneys especially, would in severe cases be also surcharged with blood, (a state to be found, I believe, after death in such cases, when the blood has not lost much bulk by a draining away of its watery portion,) and as a consequence of such congestion, the secretion of bile and urine would be suppressed; though bile previously existing in the bile vessels of the liver might (as would seem, take place in other affections also) be forced out of them into the gall bladder by the mere pressure against them of the turgid vessels forming the mass of the congested organ.

When a stoppage of the heart (death) puts an end to the circulation, and with it to the morbid *nervo-electric tension inwards*, the nervous influence,—the vital electricity,—might be expected, in diffusing itself outwards, to act again on the air-ward capillaries for a time, stimulating them to a false effort towards restored action. The corpse would then look less cadaverous than had the living man, the countenance would be less ghastly and the skin less sodden. Such a change I have myself noticed. Even heat might be developed at the surface as the consequence of this attempted restoration of action in the air-ward capillary system. The occurrence of this startling phenomenon has been well established.* It challenges both physiology and pathology for an explanation. What other can they offer than this?

Such a view derives much support from the fact that a disturbed state of what may be termed the *inorganic* electricity exterior to the human body, especially of the atmosphere around, is the most persistent of meteoric phenomena during a prevalence of epidemic cholera, and that it has led others to infer that electricity is in some way concerned as an agent in this disease.

A deficiency or disturbance of atmospheric electricity may sufficiently account for that rapid decomposition of organic matters and evolution of foetid gases which may be observed in such seasons. This electric state may determine the generation of a poison which, acting upon the air-ward surfaces, is the specific cause of their corpse-like state of suspended circulation, and it may prove a direct auxiliary to it by favouring an inward tension of the vital electricity.

Whatever view may be taken of the *causes*, the *fact* that in a confirmed attack of cholera the blood deserts the air-ward surface and becomes accumulated in the food-ward, can scarcely be doubted by any one who has studied the disease by the bed side, more especially in cases of rapid collapse in full blooded persons, from whose circulation but little had been detracted by discharges from the stomach or bowels.

The occasional extraordinary effect of copious blood letting, in removing the disease by relieving this inward congestion in cases in which to outward appearance the loss of an ounce of blood would appear hazardous, places this fact beyond a question. Almost the only case not fatal out of a large number which occurred in the worst week of a very fatal epidemic affecting H.M.'s 44th regiment, fresh from England in 1823, was that of a man of very large size and full blooded, who, within four hours of the attack, looked as if he had been drained of blood, although little fluid had passed from him in excess of what he had swallowed. No less than 50 ounces of blood were with difficulty obtained from him by two successive bleedings, each from both arms. Though on each occasion he appeared to have been killed by it, the lost pulse was gradually restored at the wrist, and his recovery was complete. Such critical treatment was only justified by the utter hopelessness of any other at that period. Though never able to perceive in choleraic collapse affecting Europeans much value in any other treatment, except indeed counter irritation, I have no doubt a fatal issue has not unfrequently been

* It is true that a contrary doctrine has been extensively accepted through the influence of able German physiologists, more especially of Müller. In papers in "The London Medical Gazette" in 1842, and in a work already referred to, on "The States of the Chest and Animal Heat," are contained the reasons for which it appeared to me the doctrine that the capillaries are passive vessels is quite untenable.

* Vid. Sir J. R. Martin, C.B., on Cholera, in his important work on the Diseases of Europeans in Tropical Climates.

precipitated by blood letting when it failed to restore the balance of the circulation.

Having too often witnessed and experienced the failure of blood-letting, and of outward as well as inward stimulants, on reflecting upon the subject, about 20 years ago, the possibility occurred to me of relieving the inward pressure and promoting an outward flow of the circulation, and with it an immediate relaxation of the nervo-electric tension, by reducing the atmospheric pressure over a *large portion* of the body.* This impression having gained strength, I had a pair of loose jack-boots made of strong sheet tin, each in two lengths meeting at the knee, and long enough to include the whole thighs, as well as the legs. Spare metal rings of different sizes were provided to fit round the thigh and round the mouth of each boot; and to close the junctions here and at the division of the boots at the knee, and make them air-tight, circular bands of *ordinary* india-rubber were made; vulcanized rubber, a better article for the purpose, not having been at that time introduced. The spaces inside the boots were made to communicate with each other and with an air-pump by means of tubes, governed by stop-cocks. I tried this apparatus on myself, and found that a few strokes of the pump produced as much effect as I could bear without endangering syncope. This apparatus was laid aside for an opportunity of proposing a trial of it in cholera. On describing the plan, some time afterwards, to the late Dr. Baron of Cheltenham, he informed me that a French physician had recently proposed an apparatus for the leg on the same principle, though not for use in cholera; and Dr. Hensley, of Bath, subsequently showed me one of these he had brought from Paris. Finding the principle was before the medical world, though the apparatus was very limited in its extent of action compared with that I had for some time possessed, I have hoped that a proper trial of it in cholera would suggest itself to some medical body possessing the authority and opportunity for giving it effect.

Impressed with the conviction that the effects upon the collapse in cholera ought to be ascertained of an agent so powerful, and at the same time so entirely under control that its action could be revoked in an instant, by restoring the atmospheric pressure; and not being aware that any trial has been afforded it in cholera, I venture to think it cannot be out of place, even before a Commission whose field is amongst *prophylactics* rather than *therapeutics*, to tender this long-constructed apparatus for experiment in India, where this dire epidemic has been recently emptying military hospitals, and lending its powerful aid towards breaking down the spirits of a soldiery at no time very buoyant, unless when their senses are becoming lost in drink. The apparatus, though so long made, requires but little to put it in order. To ensure a due trial of it, I shall be happy to present it complete to the Royal Commissioners, the Council of India, or any medical authorities who, entertaining a like opinion with myself as to the expediency of a well-directed tentative effort, shall be prepared to direct the application of it in a sufficient number of cases, to decide the question of its utility as a remedial agent.

The following suggestion, having a *preventive* object only, may be viewed as falling more directly within the range of sanitary inquiry.

Amongst the, doubtless many, causes co-operating to produce the disease, it is manifest that such as have the *atmosphere* for their channel can only find access to the animal system by way of its *air-ward* tissues; and experience has shown that comparatively slight differences as to exposure and other circumstances do oftentimes determine the accession of an attack, or an escape from it.

Twelve years ago, in a case of pulmonary disease, and more recently in one of tropical dysentery, and in another of serious renal derangement, the whole skin from head to foot, after a daily scouring, was so well plied with the limpid oil of almonds, in one of the cases rendered moderately stimulating by about a twelfth part of the essential oil of lemons, as to effect a considerable absorption of the oil, and at the same time to interpose, between the too sensitive skin and our raw atmosphere in winter, a film of oil to serve like a second scarf-skin. The result, sufficiently encouraging in the dysenteric case, was in both the others so remarkable that, had the opportunity been offered of establishing the effect of such universal and persevering inunction, in a sufficient number of instances to justify an absolute conclusion as to its certain value, the publication of these cases would not have been neglected. Mention is only made of them now to raise the following suggestion above the position of an altogether untried idea.

I venture, then, to suggest that, whenever cholera, and perhaps also when dysentery are epidemic, it might be well to require all the men of a garrison, immediately after an early scouring of the skin every morning, to rub themselves over from head to foot with a sweet limpid oil, such as oil of poppy seed, or almond, or even olive, well charged with oil of lemon or of limes. This process need not amount to much inunction of the oil (as was required in the cases instanced above), but should be sufficient for a protective coating with it.

There can be little doubt that, if a body of men could be deprived of their scarf-skin, their susceptibility to the influence of atmospheric poisons would be seriously aggravated; even the natural action of the atmosphere would be unendurable. So, on the other hand, the interposition between the atmosphere and the too-open pores of the skin in a tropical climate of the additional protection of a film of oil can hardly fail to retard the entry of atmospheric poisons, and especially their action upon the sensitive nervous tissue. Moreover we are not without examples in the matter. Every Hindoo who can afford it oils his skin after his daily ablutions. It would be a point worthy of inquiry whether the greater susceptibility to cholera of the poorest classes in India may not be traced, in some degree, to their omitting to oil themselves regularly, as well as to their inferior diet and other causes.

To rouse the nervous tissue to resist depressing influences by gently stimulating it by aromatic oil added in small proportion to the bland oil, is a measure which may be left to commend itself to the judgment, especially as the trial cannot prove injurious in any case. Furthermore, the volatility and antiseptic properties of these essential oils is such that each person so treated would impregnate the atmosphere around him with an odorous vapour which might in some degree, prove protective to the lungs, and perhaps as stimulating to them as might be desirable without appending before the mouth or nostrils an instrument impregnated with antiseptics, which few would consent to wear without a manifest necessity.

The oil of limes recommends itself, not only as an article easily and abundantly producible in India at, practically, a nominal cost, but especially as an aromatic, perhaps the most generally grateful of any. While an offensive odour, which may not in itself be poisonous, will often lend effect to an inodorous poison; so doubtless, on the other hand, grateful aromatic odours are not only antiseptic, but tend also to fortify the nervous tissue, more or less, against a poisonous influence, a fact noticed from the earliest times, though, doubtless, formerly the subject of an over-strained reliance.

An apprehension that oiling the skin must tend to check the due action of its exhalent vessels would be ill-founded, especially in a tropical climate where they are liable to suffer exhaustion and relaxation on the one hand, or on the other to have their orifices and the scarf-skin over them obstructed by absolute exsiccation, producing more or less of the mummy-like skin of the "old Indian." If agglutination be guarded against by scouring off every morning the excretions and dried oil of the previous day before renewing the application (and the operations might be repeated at night), its tendency will be to keep the skin in a state of healthy freedom and moderate action, while a film of oil left on the surface cannot but aid the epidermis in checking the impression of depressive morbid influences on the nervous tissue, especially if that oily film be rendered antiseptic, slightly stimulating, and grateful through the presence of an aromatic.

CONCLUSION.

In concluding evidence so discursive in the range of its subjects, and in the exposition of them, I desire to explain that a large portion of it has been offered consequent upon my being favoured with a recent invitation to add any evidence I believed to be conducive towards the objects of the Commission; and that my endeavour has been to restrict my remarks to such as served to elucidate or strengthen the evidence. The fact that much of this matter is now published for the first time, will not, it is hoped, appear to result from any doubt as to the reasonableness of the views and plans proposed, but, as is the truth, from an indisposition to occupy public attention in fields from some of which I have, long since, professionally withdrawn, and with others of which (as mechanics and hydraulics) though very inviting to me, I have not been professionally connected. Relying upon the hope that amongst the many persons ably officiating at the various shrines of science concerned, and more constantly consulting her oracles, each useful truth would become elicited and be more influentially enforced than by myself, I have hesitated to intrude upon the public all that has been presented to my own observation as appearing to be such.

* The diminution of the pressure over the whole surface, as by ascending mountains, could it be effected, would, of course, be altogether different in its effect. The pressure upon the body, and by way of the lungs, is necessary to drive blood into the thighs and legs, which, as in dry cupping, would become a temporary receptacle for the fluid, to the relief, it may be hoped, of the vitals oppressed by it.

REMARKS and COLLECTED FACTS on the CLIMATE of INDIA; on the GEOLOGICAL FEATURES of the COUNTRY; and some TABULATED VIEWS of the POPULATION: to show the comparative density of inhabitants in proportion to area.—By R. M. MARTIN, Esq.

CLIMATE.

A country extending through 26° of latitude, and with elevations from the coast-level to the height of three or four miles above the sea, must necessarily possess great variety of temperature. About one-half of India is inter-tropical, comprising within its limits the three principal stations of Calcutta, Madras, and Bombay; in fact, all the country south of a line drawn from Burdwan on the east, through Bhopal, to the gulf of Cutch on the west, a distance from Cape Comorin of about 1,000 miles. All the region north of this line, and extending 800 miles from Cutch to Peshawur, is outside the tropic of Cancer; the area of the inter and extra-tropical territory is nearly alike. Mere distance from the equator will not convey an adequate idea of the climate of any district: other circumstances must be taken into account, such as elevation above the sea, aspect in reference to the sun and the prevailing winds, more or less vegetation, radiation of terrestrial heat, quantity of rain falling,* or siccidity of atmosphere, proximity to snow-covered mountains or great lakes, drainage, ventilation, &c.;† all these, varying in collateral existence or in degree of operation, cause a variety of climate and thermometrical range, which latitude will not indicate. Regions contiguous to the equator, at or near the sea-level, possess a high but equable temperature. The mercury, on Fahrenheit's scale, exhibits in the shade at Singapore, a flat island in 1° 17' N., a heat of 73° to 87° throughout the year. As we recede from the equator north or south, a wider caloric range is experienced, not only throughout the year, but within the limits of a single day. In the N.W. provinces

of India, and the S.E. settlements of Australia, the mercury not unfrequently rises in the summer season to 90°, and even 100° Fahr., and shows a fluctuation, in twenty-four hours, of 24°; but this extreme torridity, when the circumambient fluid seems to be aeriform fire—is but of brief duration. Animal and vegetable life are re-invigorated, for a large part of the year, by a considerably cooler atmosphere. Indeed, at New York and Montreal, I found the heat of June and July more intolerable than that of Jamaica or Ceylon; but then snow lies on the ground, at the former places, for several weeks in winter. Again, moisture with heat has a powerful and injurious effect on the human frame, though favourable to vegetation and to many species of animal life. Speaking from my own sensations, I have lain exhausted on a couch with the mercury at 80° Fahr. during the rainy season in Calcutta, Bombay, and Hong Kong, and ridden through the burning forests of Australia, on the sandy Arabian plains, and over the sugar-cane plantations of Cuba, with the mercury at 100° Fahr. So, also, with reference to elevation: in the East and West Indies, at a height of several thousand feet above the sea, I have enjoyed a fire at night in June; and yet, in April and September, been scorched at mid-day in Egypt, Northern China, and Eastern Europe. These observations are made with a view of answering the off-recurring inane question, without referring to any locality, "What sort of a climate has India?" In order, however, to convey some idea of the thermometrical range, and the quantity of rain falling at different stations, the following table has been collated from different sources:—

METEOROLOGICAL MONTHLY OBSERVATIONS for different Parts of India; showing the Latitude, Number of Feet above the Level of the Sea, average Thermometer, and Rain in Inches.

Places, Latitude, and Elevation above Sea.	THERMOMETER.												Mean of Year.
	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	
Calcutta, 22° 34', 18 ft. - -	69	73	78	87	88	83	82	82	82	82	71	68	79†
Madras, 13° 5', sea-level - -	78	78	82	88	92	87	88	86	86	84	82	78	83
Bombay, 18° 57', sea-level §	77	77	80	82	85	85	81	84	79	84	84	80	84
Tirhoot, 25° 26', 26° 42', little elevated - - -	60	66	76	85	89	86	84	85	81	73	—	61	78
Goorgaon, 28° 28', 817 ft. - -	70	72	80	—	104	98	85	84	89	87	75	66	—
Delhi, 28° 41', 800 ft. - - -	53	62	70	79	82	82	82	80	80	73	62	56	72
Rajpootana, || about 500 ft. - -	70	73	82	82	74	90	85	—	—	—	90	66	—
Nagpore, 21° 10', 930 ft. - -	68	75	83	89	90	84	79	79	79	79	73	72	79
Hyderabad, 17° 22', 1,800 ft. -	74½	76½	84	91½	93	88	81	80½	79	80	76½	74½	81½
Bangalore, 12° 58', 3,000 ft. - -	71	73	79	78	79	75	74	74	74	71	71	70	74
Hawilbagh, 29° 38', 3,887 ft. -	47	55	61	60	73	76	78	79	75	69	60	52	—
Kotagerry, 11° 27', 8,600 ft. - -	59	60	61	62	62	64	64	65	64	62	60	59	61
Ootacamund, 11° 24', 7,300 ft. -	54	56	60	64	64	59	56	56	56	56	55	53	57
Mussoorie, 30° 27', 6,282 ft. - -	—	—	—	—	77	70	68	68	67	61	56	—	—
Landour, 30° 27', 7,579 ft. - -	41	46	55	65	68	66	68	66	64	57	46	47	—
Darjeeling, 27° 2', 8,000 ft. - -	40	42	50	55	57	61	61	61	59	58	50	43	53
RAIN IN INCHES.													Total.
Calcutta - - - - -	0·05	0·48	1·77	3·52	12·86	3·04	12·44	8·15	8·19	3·68	0·06	2·57	56·61
Nagpore - - - - -	0·40	0·50	3·84	1·01	0·21	6·25	14·93	7·51	16·32	—	2·89	0·13	53·99¶
Bangalore - - - - -	—	—	35	4·16	5·89	3·24	5·88	4·13	13·97	5·10	1·30	—	—
Kotagerry - - - - -	2	3	6	10	2	2	4	2	2	10	2	5	50
Ootacamund - - - - -	1	1	2	5	6	8	7	6	7	9	5	3	60
Darjeeling - - - - -	1	—	1	2	9	26	25	29	15	8	—	—	122

* The quantity of rain in the tropical or temperate zones varies with the elevation of the land above the sea. In India the maximum fall on the Western coast is about 4,500 feet altitude; beyond this height it diminishes. This is shown by Colonel Sykes, in his *Meteorological Observations*: thus, on the western coast of India the fall is at sea-level (mean of seven levels)—inches, 81; at 150 ft. altitude (Rutnagherry in the Concan), 114; at 900 ft., Dapoolce (S. Concan), 134; at 1,700 ft. (Kundala Pass, from Bombay to Poona), 141; at 4,500 ft. (Mahabeshwur—mean of 15 years), 254; at 6,200 ft. (Augusta Peak, Utray Mullay range), 194; at 6,100 ft. (Kotagerry, in the Nellocheries, one year), 81; at 8,640 ft. (Dodabetta, highest point of Western India, one year), 101 inches. The same principle is observable in the arid lofty table-land of Thibet, and in the continuous elevated regions where rain seldom falls. So also in Chili and other parts of the Andes. Dr. John Fletcher Miller, of Whitehaven, adduces evidence, in his interesting account of the Cumberland Lake District, to demonstrate the existence of a similar law in England, where he considers the maximum fall of rain to be at the height of 2,000 feet.

† In 1829, I wrote and published in Calcutta a small brochure, entitled *The Effects of Climate, Food, and Drink on Man*. The essay was prepared in the hope of inducing the Government to adopt sanitary measures for the drainage and ventilation of Calcutta, where cholera had become permanently located. I predicted that unless the *nidus* of this fearful malady were destroyed in the Indian cities by the purification of their respective atmospheres, the disease would be extensively generated and waited with the periodical winds from Asia to Europe. The prognostication was ridiculed: sad experience may now perhaps induce corporations and citizens of large towns to adopt timely-effective sanitary measures. By so doing a healthy climate may everywhere be obtained, but no altitude or position will avail for the prevention of endemic diseases, or for lengthening the duration of life, wherever large masses of human beings are congregated, unless complete drainage, free circulation of air, and the removal of all putrescent animal and vegetable matter be made an urgent and daily duty.

† Abstract of the mean annual summaries of a meteorological register kept at Calcutta for ten years:—

Years.	Sunrise.	2-40 P.M.	Sunset.
1841 - - -	72·7	89·0	82·4
1842 - - -	73·3	88·0	82·1
1843 - - -	73·3	87·6	82·5
1844 - - -	72·7	87·6	82·3
1845 - - -	73·7	86·9	82·3
1846 - - -	74·3	86·3	81·9
1847 - - -	73·2	86·1	81·1
1848 - - -	74·1	87·4	82·5
1849 - - -	73·6	86·7	81·8
1850 - - -	73·1	86·1	81·4
Mean - - -	73·4	87·2	82·0

The annual fall of rain at Calcutta during six years, commencing with 1830, averaged 64 inches. In the wet season evaporation is very slight.

† Amount of rain at Bombay for six years:—

Years.	Inches.	Years.	Inches.
1845 - - -	54·73	1848 - - -	73·42
1846 - - -	87·48	1849 - - -	118·88
1847 - - -	67·31	1850 - - -	47·78

Average annual fall during thirty years, 76·08 inches. At Madras, average for eight years, 66·9 inches.

§ Between lat. 26° 54', and lat. 29° 23'.—(Boileau's *Tour in Rajwara*, pp. 394-317.)

¶ Situation, about 350 miles from nearest part of Bay of Bengal, and 420 miles from Indian Ocean. In 1826, and in 1831, the fall of rain slightly

The monsoons or prevailing winds within the tropics, as on the Coromandel and Malabar coasts, are denominated the South-west and the North-east; but, owing to modifying circumstances, the direction is in several places changed; at Arracan, the S.W. blows more frequently from the S., and the N.E. more to the W. of N. Lower Bengal, including the country around Calcutta, has a climate more trying than that of any other part of India. November, December, and January are tolerably cool, and Europeans may walk out during the day. In February, March, April, and May, the heat daily increases, until, during the last month especially, it becomes almost intolerable; not a cloud appears in the heavens to mitigate the burning rays of the sun, which seem to penetrate into the very marrow of an European. I have known men and beasts to drop dead in the streets of Calcutta. When the monsoon is on the eve of changing, before the *chota bursaut* (little rain) set in, the nights as well as the days are oppressive; respiration becomes laborious, and all animated nature languishes: the horizon assumes a lurid glare, deepening to a fiery red; the death-like stillness of the air is occasionally broken by a low murmuring, which is responded to by the moaning of cattle; dense, dark masses of clouds roll along the Bay of Bengal, accompanied with occasional gusts of wind; streaks of lightning, after sunset, glimmer through the magazines where the electric fluid is engendered and pent up; the sky becomes obscured with mist, and lowering; next, broad sheets of lambent flame illumine each pitchy mass, until the entire heavens seem to be in a blaze, while peal after peal of thunder reverberates from cloud to cloud, like discharges of heavy artillery booming through cavernous hills, or along an amphitheatre of mountains; thin spray is scattered over the coast by the violence of the increasing gale,—the rain commences in large drops, augments to sheeted masses, and sweeps like a torrent from the sky; the surf roars along the beach,—the wind howls furiously, screaming or groaning piteously, and every element seems convulsed with the furious conflict: at length the S.W. monsoon gains the victory, and the atmosphere becomes purified and tranquil. The monsoon is felt with varying degrees of intensity at different parts of the coast; but at Madras and at Bombay the scene is one of awful grandeur. During the rains the air is saturated with moisture, and the pressure on each square inch of the human frame causes extreme lassitude and mental depression; along the sea-shore the pernicious effects are mitigated by a sea-breeze, called the "Doctor," which sets in about 10 a.m. and lasts until sunset. As the country is ascended above the ocean-level, varieties of climate are experienced; but on the plains of the Ganges and of the Indus, and in some parts of Central India, hot winds blow nearly equal in intensity to those which are felt in Australia. In few words, some idea may be conveyed of the climate of several districts:—

Bengal Proper,—hot, moist, or muggy for eight months—April to November; remainder cool, clear, and bracing.

Behar,—cool in winter months; hot in summer; rain variable.

Oude,—fluctuating temperature and moisture; therm. range 28 to 112°; rain, 30 to 80 inches.

Benares,—mean temperature, 77°; winter cool and frosty sometimes; therm. at night, 45°, but in the day, 100°; rain variable—30 to 80 inches.

Agra,—has a wide range of temperature; in mid-winter night-frosts and hail-storms sometimes cut off the cotton crop and cover the tanks with ice; yet at noon in April, therm. reaches the height of 106° in the shade.

Ghazepore,—range in coldest months, 58 to 71°—April, 86 to 96°; May, 86 to 95°; June, 85 to 98°; July, 86 to 96°. In the *Dehra Doon*—range 37 to 101°. In the year 1841, December mean heat, 60°; June, 88°; whole year 74°. In 1839, total fall of rain, 67 inches; of which in July, 15; August, 26.

Cuttack and opposite coast of Bay of Bengal,—refreshed by a sea-breeze blowing continuously from March to July.

Berar,—moderate climate according to elevation.

Madras,—cold season of short duration in the Carnatic. Mercury in therm. higher than in Bengal, sometimes 100° Fahr. Heat tempered by sea breezes.

Arco,—high temperature, 116° in the shade, sometimes 130° Fahr. Few sudden vicissitudes; storms infrequent.

Salem, fluctuating climate—in January 58 to 82°; March 66 to 95°; May, 75 to 96°.

Trichinopoly,—has a steady high temperature, a cloudless sky, dry and close atmosphere, with much glare and intense radiation of heat.

Vizagapatam,—on the coast hot, moist, and relaxing; inland equally sultry, but drier.

Bellary is characterized by great aridity; rain 12 to 26 inches; therm. falls in January to 55° or 50°; thunder-storms frequent in summer months.

Cuddapah,—average max. temperature for several years (in the

shade), 98°; min., 65°; mean, 81°; mean temperature during monsoon, 77°; max., 89°.

Madura,—on the hills mild and genial in summer; therm. seldom below 50° or above 75°; in the plains, reaching 115° and even 130.

Travancore,—owing to proximity of mountains, humid but not oppressive.

Mysore,—table land cool, dry, and healthy; at Bangalore (3,000 ft. high), therm. range from 56 to 82°. The monsoons which deluge the Malabar and Coromandel coasts, have their force broken by the Ghauts on either side, and genial showers preserve the Mysorean verdure throughout the year.

Neilgherries,—the climate resembles that of the intertropical plateaux of America; at Ootacamund (height 7,300 ft.), mean temperature rather above that of London, but ann. range very small; not sufficient sunshine to bring the finer European fruits to perfection, but corn and vegetables thrive. Lower down the vales enjoy an Italian clime; at Coimbatore (height 4,483 ft.), during the cold season, max., 59°; min., 31°; in April, average 65°; May, 64° Fahr.; there are no sultry nights, a blanket being acceptable as bed-covering in all seasons. In the higher regions, the air beyond the zone of clouds and mists is clear and dry, as evidenced by the great distance within which sound is heard, and by the buoyancy of the human frame.

Coorg is a bracing mountain region. Daily range, 2 to 6°; ann. 50 to 80° Fahr.; annual rain, at Mercara (4,500 ft.), 119 inches; in June, about 40 inches.

Malabar coast,—warm but agreeable; therm. 68 to 88° Fahr.; ann. rain, 120 to 130 inches.

Canara and the Concans,—beneath the Ghauts are not, tropically speaking, unhealthy, except where marsh and jungle prevail, when malaria is produced.

Bombay,—hot; tropical heat diminished by sea-breezes.

Broach,—December to March, cool; average rain, 33 inches.

In *Goozerat*, which is the hottest part of W. India, the westerly winds are burning in May, June, and July; temperature high for nine months; average fall of rain, 30 inches.

Mahratta country,—near the Ghauts the clouds are attracted from the Indian Ocean, and a profusion of rain falls for three or four weeks without intermission, but often not extending 30 m. to the E. or S.

The *Deccan* table-land is salubrious; at Sattara, mean ann. temperature, 66°. Even in September I enjoyed the air of Poona, as a great relief from the sultry heat of Southern China. Ann. range of therm., 37 to 94°; fall of rain, light and uncertain—22 to 30 inches; among the Ghauts, 300 inches. Proceeding westward towards the Ganges, and northward through *Central India* plateau, there is a modified temperature (at Meerut, therm. falls to 32° Fahr.), with occasional hot winds, which prevail as far as Sind and the Punjab. Sind is dry and sultry; at Kurachee, 6 or 8 inches rain; at Hyderabad, 2 inches; at Larkhana, farther north, there was no rain for three years. Mean max. temperature of six hottest months, 98° in the shade.

Punjab,—more temperate than Upper Gangetic plain; from November to April, climate fine: summer heat, intense; hot winds blow with great violence, and frequent dust-storms in May and June render the air almost unbreathable. Rains commence in July; August and September sickly months. The Great Desert to the S. of the Punjab has a comparatively low temperature; at Bikaner, in winter, ponds are frozen over in February; but in summer the heat is very great; therm. 110 to 120° in the shade.

Candeish has a luxurious climate like that of Malwah.

Upper Assam has a delightful temperature; the heat bearable, and the cold never intolerable. Mean temperature of four hottest months, about 80°; of winter, 57°; mean ann. 67°; heavy rains, which commence in March and continue to October. The quantity which falls is unequal; at Gowhaty, it is about 80; at Chirra Poonjee, 200; and in the Cossya country, 500 to 600 inches=50 ft. At this latter place there fell in 1850 no less than 502 inches=42 ft.; in August, 1841, there were 264 inches=22 ft., in five successive days—30 inches every 24 hours. [Let it be remembered that the annual fall in London is 27; in Edinburgh, 24; in Glasgow, 32 inches.] The eastern side of the Bay of Bengal, to the Straits of Malacca, is more genial and agreeable than that of the Coromandel coast: the greatest heat is in April; therm., at Mergui, 100°; the monsoon is mild, but violent to the northward.

Lower Assam and Arracan a climate similar to Lower Bengal.

This rapid sketch will indicate the variety of climates in India; but it is in the loftier adjoining regions that the greatest extremes exist.

The *Himalaya* and *Hindoo-Koosh* slopes and valleys exhibit a very varied temperature, and corresponding diversity of products, from the loftiest forest trees to the stunted lichens and mosses, when the last trace of vegetable life disappears as effectually as it does at the Arctic or Antarctic Poles, snow being equally perpetual at an elevation of four to five miles (20,840 to 25,000 ft.) above the sea, as at the extreme northern and southern parts of our globe. On the southern, or Indo-Gangetic side of the Himalaya, which rises like a wall from the sub-Himalaya, the snow-line commences at 12,000 to 13,000 ft. on some of the spurs or buttresses; on the northern side of the same range,—tableland of Tibet 10,000 ft., above the sea, the snow-line commences at 16,000 ft., but in some places is not found at 20,000 ft. On the southern slope cultivation ceases at 10,000 ft.; but on the northern side, cultivation extends to 14,000 ft., where birch trees flourish; the limit of furze-bushes is at 17,000 ft. Vegetation, to some extent, indicates the more or less severity of this mountain clime: the *Deodar* has its favourite abode at 7,000 to 12,000 ft.—attains a circumference of 30 ft., and of great stature, and the wood will last, exposed to the weather, for 400 years. Various species of magnificent pines have a range of 5,000 to 12,000 ft.; the arborescent rhododendron, every branchlet terminated by a gorgeous bunch of crimson flowers, spreads at 5,000 to 8,000 ft.; the horse-chestnut and yew commence at 6,000 ft., and end at 10,000 ft.; the oak flourishes at 7,000 to 8,000 ft.; maple, at 10,000 to 11,000 ft.; ash, poplar, willow, rose, cytissus, at 12,000; elm, at 7,000 to 10,000; birch commences at 10,000, ceases on S. slope at 13,000 ft.; on N. side fine forests of this tree at 14,000 ft. Juniper met with occasionally at latter-

exceeded 65 inches; the greatest registered fall was 72 inches, and that was in 1809. Average fall of rain for eight years, 48.10 inches. Proceeding westward towards the Ghauts and Indian Ocean, the rains become heavier until reaching Mahabesht war, where the fall is probably unexampled in amount; in 1849 it was 294 inches. The mean annual quantity is 239 inches, of which 227 fell in the four monsoon months. The greatest annual fall was in 1834, when it amounted to 297 inches. Another report gives the mean annual fall, as deduced from the observations of ten years, at 229 inches; and the number of days on which rain falls at 127.

named height ; the grape attains great excellence at Koonawur, 8,000 ft., but does not ripen beyond 9,000 ft. ; the currant thrives at 8,000 and 9,000 ft. ; apricot, at 11,000 ft. ; gooseberry and raspberry, at 10,000 to 12,000 ft.

The decrement of heat in proportion to latitude and elevation is, as yet, imperfectly ascertained. Dr Hooker* allows one degree of Fahrenheit's thermometer for every degree of latitude and every 300 ft. of ascent above the sea ; at Calcutta, in $22^{\circ} 34'$, the mean ann. temperature is about 79° ; that of Darjeeling, in Sikkim, $27^{\circ} 2'$; 7,450 ft. above Calcutta is 53° , about 26° below the heat of Calcutta. The decrease of temperature with elevation is much less in summer than in winter : in January, $1^{\circ}=250$ ft., between 7,000 and 13,000 ft. ; in July, $1^{\circ}=400$ ft. ; the decrement also less by day than by night. The decremental proportions of heat to height is roughly indicated by this skilful meteorologist,—

$1^{\circ}=300$ ft. at elevation	1,000 to 8,000 ft.
$1^{\circ}=320$ ft. „	8,000 to 10,000 ft.
$1^{\circ}=350$ ft. „	10,000 to 14,000 ft.
$1^{\circ}=400$ ft. „	14,000 to 18,000 ft.

This must be affected by aspect and slope of elevation ; by quantity of rain falling, and permeability of soil to moisture ; by amount of cloud and sunshine, exposure of surface, absence of trees, undulation of the land, terrestrial radiation, and other local influences.

Within the tropics, in the northern hemisphere, the limit of perpetual congelation is 16,000 to 17,000 ft. above the sea ; in lat. 30° , 14,000 ft. ; in 40° , 10,000 ft. ; in 50° , 6,000 ft. ; in 60° , 5,000 ft. ; in 70° , 1,000 ft. ; and in 80° and further north, at the sea level. In the southern hemisphere, Georgia, which is in lat. 56° , exhibits perpetual frost.

At Kumaon, winter rigour is moderated by great solar radiation, and somewhat tempered by contiguous snow-capped mountains, whence a diurnal current of air sets in as regularly as a sea-breeze on a tropical shore, and with a nearly equally invigorating effect. Snow commences to fall at the end of September and continues until the beginning of April. During the absence of snow for five months, the mercury ranges at sunrise, 40 to 55° ; at mid-day 65 to 75° in the shade— 90 to 110° Fahr. in the sun. The heat of course diminishes as height increases, except during the cold season. At Almorah town, in $29^{\circ} 30'$, 5,400 ft. elevation, the therm. before sunrise is always lowest in the valleys, and the frost more intense than on the hills of 7,000 ft. elevation, while at noon the sun is more powerful ; extreme range in 24 hours, sometimes from 18 to 51° Fahr. Snow does not fall equally in every season ; the natives say the greatest fall is every third year. On the Ghagor range, between Almorah and the plains, snow remains so late as the month of May. At Mussoorie, 6,000 to 7,000 ft. high, the mean ann. heat is only 57° Fahr. ; indeed, at 4,000 ft. hot winds cease, and vegetation assumes an European character. Annual fall of rain at Almorah, 40 to 50 inches.

The northernmost part of Nepal valley, between 27 and 28° , and elevation of 4,000 ft., has a climate somewhat similar to that of the southern parts of Europe. In winter a hoar-frost commonly covers the ground, occasionally for three or four months, freezing the standing pools and tanks, but not severe enough to arrest the flow of rivers. In summer noon, the mercury stands at 80 to 87° Fahr. The seasons are very nearly like those of Upper Hindoostan ; the rains set in earlier, and from the S.E. are usually very copious, and break up about October, causing excessive inundations in some places from the mountain torrents. In a few hours, the inhabitants, by ascending the sides of the enclosing mountains, may exchange a Bengal heat for a Siberian winter.

At Darjeeling the atmosphere is relatively more humid than at Calcutta ; the belt of sandy and grassy land, at the foot of the Himalaya, only 300 ft. higher than in Calcutta, and $3\frac{1}{2}^{\circ}$ N. of that city, is during the spring months, March and April, 6 or 7° colder ; and though there is absolutely less moisture in the air, it is relatively more humid ; this is reversed after the rains commence. The south wind, which brings all the moisture from the Bay of Bengal, discharges annually 60 to 80 inches of rain in traversing 200 m. of land ; but the temperature is higher in advancing north-west from the Bay of Bengal, which may be caused from the absence of any great elevation in the Gangetic valley and plain, and its being walled in to the northward by the Himalaya mountains.

Elevation causes in Afghanistan a corresponding diversity of climate : at Cabul, which is considered to be very salubrious, and 6,396 ft. above the sea, the air is warmer in summer and colder in winter than that of England ; and the diurnal therm. range is great, amounting to 40° . June, July, and August are the hottest. December, January, and February the coldest months,—the mercury falling several degrees below zero Fahr. ; but the sun possesses sufficient power at mid-day to melt the surface of the snow, which, however, is again frozen at night. The seasons are very regular ; the sky is unclouded, the air bright and clear, with scarcely any rain ; in November a few showers are followed by snow ; and from the middle of March till the 1st of May there is incessant rain, which melts the snow rapidly, and causes a sudden transition from winter to summer (with but little spring), when thunder and hail-storms occur ; earthquakes are not unfrequent during winter in the immediate vicinity of the lofty ranges, but are said to be unknown at Candahar. Prevailing winds, N.N.W. and W. ; E. seldom ; winter, calm ; variable at breaking up of the season.†

Cashmere valley, by its elevation (5,000 ft.), has a cool climate ; in winter the celebrated lake is slightly frozen over, and the ground covered with snow to the depth of 2 ft. ; hottest months, July and August, therm. 80 to 85° at noon, when the air is sometimes oppressive from want of circulation.

But it is in the loftier regions that the peculiarities caused by altitude are most observable : at—

Bussahir,—the climate varies from that of the intertropical at Rampoor, 3,260 ft.† above the sea, to that of the region of perpe-

tual congelation : in parts bordering on the table-land of Tartary the air is at one season characterized by aridity greater than that of the most scorching parts of the torrid zone. In October, and later in the year, when the winds blow with the greatest violence, woodwork shrinks and warps, and leather and paper curl up as if held to a fire ; the human body exposed to those arid winds in a few minutes show the surface collapsed, and if long left in this condition life becomes extinct. Vegetation with difficulty struggles against their effects. Gerard found tracts exposed to them to have a most desolate and dreary aspect ; not a single tree, or blade of green grass, was distinguishable for near 30 m., the ground being covered with a very prickly plant, which greatly resembled furze in its withered state. This shrub was almost black, seeming as if burnt ; and the leaves were so much parched from the arid winds of Tartary, that they might be ground to powder by rubbing them between the hands. Those winds are generally as violent as hurricanes, rendering it difficult for the traveller to keep his feet. The uniform reports of the inhabitants represent the year as continual sunshine, except during March and April, when there are some showers, and a few clouds hang about the highest mountains ; but a heavy fall of rain or snow is almost unknown. The excessive cold and aridity on the most elevated summits cause the snow to be there so light, loose, and powdery, that it is continually swept like smoke through the air by the tempestuous winds. The limit of perpetual congelation in Bussahir ascends to the northward.

The direct rays of the sun are extremely hot at great elevations : inasmuch, that Jacquemont found the stones on the ground on the table-land of Tartary, at an elevation of 15,000 or 16,000 ft., become so hot in sunshine, as to be nearly unbearable by the hand ; at an elevation of 18,000 ft., Gerard found the rays of the sun so oppressive that he was obliged to wrap his face in a blanket.

At Bult or Little Tibet the atmosphere is very clear and dry. But though rain is almost unknown, snow falls, and lies from the depth of 1 to 2 ft. The cold in the elevated parts is intense in winter ; on the high and unsheltered table-land of Deotsuh, it at that season totally precludes the existence of animal life. The heat in the lower parts in summer is considerable, the therm. § ranging from 70 to 90° in the shade at noon.

At Ladakh the climate is characterized by cold and excessive aridity. The snow-line is so usually high in Spiti and Rupshu, at the south-eastern extremity of Ladakh, as to show the utter futility of attempting to theorise respecting the so-called isothermal lines, in the present scanty and imperfect state of our information as to the data from which they should be determined. Gerard says, respecting Spiti, in lat. 32° , that the marginal limit of the snow, which, upon the sides of Chimborazo, occurs at 15,700 ft., is scarcely permanent in Thibet at 19,000, and one summit, 22,000 ft. high, was seen by him to be free of snow on the last day in August. This absence of snow probably results, in part, from the very small quantity of moisture kept suspended in the highly rarefied atmosphere, in part from the intense heat of the direct rays of the sun, the latter cause being in some degree dependent on the former. "Wherever we go," observes Gerard, "we find the sun's rays oppressive." In one instance, in the beginning of September, at an elevation of 15,000 ft., a thermometer, resting upon the rocks, marked 158° ; in another, at 14,500 ft., the instrument, placed on sand, marked 130° ; and in a small tent, at an elevation of 13,000 ft., it indicated 110° . These phenomena he attributed to the rarefaction and tenuity of the atmosphere, from elevation and the absence of moisture,—circumstances which allow of such immediate radiation of heat, that at the same moment there will be a difference of more than 100° between places only a few hundred yards asunder, occasioned by the one receiving, and the other being excluded, from the direct rays of the sun. At Rupshu, at the elevation of 16,000 ft., it freezes every night, even at Midsummer ; but the heat of the day so far counteracts the cold of night, that the Lake Chamoreuil is free from ice during the summer months. At Le, having an elevation of about 10,000 ft., frosts, with show and sleet, commence early in September and continue until May ; the therm. from the middle of December to February, ranges from 10 to 20° ; even in June, the rivulets are often, at night, coated with ice. Moorcroft, during his Himalayan travels, found the therm., when exposed to the sun's rays at mid-day in July, to range from 134 to 144° . The atmosphere is in general dry in all parts of the country.

In the works of Gerard, Lloyd, Moorcroft, Vigne, Jacquemont, and Hooker, useful details are given on the meteorology of these lofty regions.

The climate of northern India is not inimical to the European constitution, that of Bengal and other low districts is very trying, especially to those who do not follow a strictly temperate course in all things ; but there are some instances of Englishmen living for a quarter of a century at Calcutta, and on returning to England, enjoying another quarter of a century of existence, preserving, to old age, a vigorous mental and bodily frame. In the hot and moist parts of India, abdominal diseases,—in the warm and dry, hepatic action or congestion prevail. Exposure at night, especially to malaria or the effluvia arising from intense heat and decomposing vegetable and animal matter, causes a bilious remittent (popularly called jungle fever), which operates as a poison on the human system, and becomes rapidly fatal if not counteracted by mercury, arsenic, or some other poison, or unless the morbid matter be expelled, and the patient have strength of frame to survive the fever.

The direct rays of a nearly vertical sun, and even those also of the moon, cause affections of the brain, which are frequently fatal, and when not so, require removal to the

* In his valuable work, *Himalayan Journals*, ii., 404.

† Notes of observations, 1st April, 1838, to 31st March, 1840, in Afghanistan.

—*Calcutta Jour. Nat. Hist.*

‡ The Choora district (valley of the Fapur, 4,800 feet) is a beautiful and fertile tract, with a delightful climate.

§ Thornton's *Gazetteer : Afghanistan*, &c., vol. i., p. 120.

|| Mr. W. C. Blaquiere, for a long period police magistrate at Calcutta, died there in 1854, at. 95 ; he arrived at Bengal in 1774.

temperate zone for their relief. The establishment of sanatoria at elevated and healthy positions, has proved a great benefit to Anglo-Indians, who at Darjeeling, Simla, Landour, Mussoorie, Mount Aboo, the Neilgherries, and other places, are enabled to enjoy a European temperature and exercise—to check the drain on the system from the cutaneous pores being always open—to brace the fibres and tone the nerves, which become gradually relaxed by the long continuance of a high temperature. As India becomes more clear and cultivated, and facilities for locomotion by railroads and steam-boats are augmented, the health of Europeans will improve, and their progeny will derive a proportionate benefit; but it is doubtful whether there is any part of the low country where a European colony would permanently thrive, so as to preserve for successive generations the stamina and energy of the northern races.

The diseases that prevail among the Indians vary with locality; low, continued fever is most prevalent in flat, and rheumatism in moist regions. Leprosy and other skin disorders are numerous among the poorest classes. *Elephantiasis*, or swelling of the legs; *beri-beri*, or enlargement of the spleen; torpidity of the liver, weakness of the lungs, and ophthalmia, are common to all ranks and places; goitre is found among the hill tribes; cholera and influenza sometimes decimate large masses of the people. Numerous maladies, engendered by early and excessive sensuality, exist among rich and poor, and medical or surgical skill are consequently everywhere in great request. The inhabitants of India, generally speaking, except on the plateau, and on the more elevated districts, have not the robust frames or well-wearing constitutions which result from an improved social state, or from the barbarism which is as yet free from the vices and defects of an imperfect civilisation; the inhabitants of the torrid zone do not generally enjoy a longevity equal to those who dwell in the temperate climates of the earth.

GEOLOGY.

It will require many more years of scientific research before an accurate geological map can be laid down for India.* Immense tracts covered with impenetrable forests, the few Europeans in the country occupied with military and civil governmental duties, the lassitude of mind and body which, sooner or later, oppresses the most energetic, and the malaria which inevitably destroys those who attempt to investigate the crust of the earth, overrun with jungle, or immersed in swamp,—these and other obstacles render the prosecution of this science a matter of extreme difficulty. All that can here be attempted is to collate the best known data, and arrange them in outline, for reference and future systematic exposition.†

Representatives of all the series found in Europe and other parts of the world are traceable in India. Mr. Carter has industriously noted the observations of various investigators; and the following summary is partly abstracted from his compilation:—

OLDER METAMORPHIC STRATA.—*Gneiss, Mica Schiste, Chlorite Schiste, Hornblende Schiste, Quartz Rock, Micaceous Slate, Talcose Slate, Clay Slate, Granular Limestone.*

Gneiss.—Most general and abundant,—occurring in different parts of the Himalaya; Oodeypore; near Baroda; Zillah Behar; Rajmahal hills; Phoonda Ghaut; Northern Circars; and more or less throughout “peninsula” (? Deccan) to the Palghat, and probably to Cape Comorin: it is frequently veined by granite, contains in most places specular iron ore: beds of garnets common everywhere; corundum in southern India, and beryl in Mysore. Composition varied in texture, compactness, and with more or less mica; colour—speckled, black, brown, reddish gray to white; sometimes tinted green where chlorite replaces mica: when very fine-grained and decomposing, gneiss bears a close resemblance to fine-grained sandstone.

Mica Schiste.—Southern Mahratta country, and western extremities of Vindhya range, passes into micaceous slate at the Phoonda Ghaut: veined with quartz, but no granite: being associated with gneiss and hornblende schistes, they pass into each other.

Chlorite Schiste.—Southern Mahratta country: it also contains garnets.

Hornblende Schiste, forms the sides of the Neilgherries, where it is from five to seven miles in breadth: garnets found in it. Southern Mahratta country, Salem; and often passes into mica schiste on the Malabar coast.

Quartz Rock.—Hills between Delhi and Alwar, and between Ajmere and Oodeypore; mountains around Deybur Lake, Chittoor, and at the western part of the Vindhya range, with mica slate; southern Mahratta country; more or less in the granitic plains of Hyderabad, and in the *droogs* of Mysore. The rock is compact and granular in the Ajmere mountains; and of a red, violet, gray, or brown colour; brilliantly white in the Mahratta country. Mica is

frequently disseminated throughout the rock in large masses; talc and chlorite, occasionally.

Micaceous Slate and Chlorite Slate.—Both at the Phoonda Ghaut; and the latter in the Mahratta country. The micaceous occurs in the Indo-Gangetic chain, Kunawur; and in the Soolumbur range, Oodeypore.

Clay Slate, appears to be of great thickness, and considerable extent, viz., from the Arravulli range, the lower part of which is composed of this formation; thence to Oodeypore, *via* the Soolumbur range, across the Durgawud valley to Malwa, on the Kistnah; southern Mahratta country, Nellore; and in the Eastern Ghauts at Jungamanipenta, a ferruginous clay-slate overlies the trap at Mahableshwur. In the Arravulli it is massive, compact, and of a dark blue colour. The Soolumbur range is almost entirely composed of this and chlorite slates. Micaceous passes into clay-slate at the Phoonda, and, farther south, the Saltoor passes (Western Ghauts). This also occurs at the Carrackpore hills (Behar), where the clay-slate is about twenty miles wide, and extends in the direction of the strata.*

PLUTONIC ROCKS.—*Granite, Diorite or Greenstone.*

Granite.—Himalaya; Ajmere and around Jeypoor, traversing the mountains in veins and dykes; the Arravulli range consists chiefly of granite, resting on slate; Mount Aboo; from Balmeir across the sands to Nuggur Parkur; the Gir; Girnar; between Oodeypore and Malwah, are all varieties: it extends more or less southward to the Nerbudda; on that river between Mundela and Amarkantak, Jubbulpore, Kalleenjor, Zillah Behar, Carrackpore hills; in Bhogulpore and Monghyr districts; near Baitool; Nagpore territory; Cuttack; Orissa; Northern Circars; Hyderabad; between the Kistnah and Godavery; Gooty; Neilgherries; Malabar coast at Vingorla; Coromandel; between Madras and Pondicherry; ending at Cape Comorin. The granitic rocks vary in structure and composition, as they do in colour: thus there are *syenitic, pegmatitic, and protogenic*. It is gray at Ramteak in Nagpore, red generally in the Deccan, but at Vencatigherry (Mysore), and at Vingorla, gray; in the Neilgherries it is syenitic.

Greenstone.—Hazareebaugh, Mahratta country, Mysore, Nellore, Chingleput, Madras, Trichinopoly, Salem, in the granitic plains of Hyderabad; and extensively throughout Southern India. In the Deccan the dykes may be traced continuously for twenty miles; about Hyderabad they are from 100 to 300 feet broad; about four miles from Dhoney, between Gooty and Kurnool, there is one 150 feet high, and 200 feet broad, passing through a range of sandstone and limestone mountains.

SILURIAN ROCKS.—*Greywacke.*—Ghiddore, Rajmahal hills; Kumaon. It is a quartzose sandstone; yellow colour, resinous lustre, and compact splintery fracture.

Transition or Cambrian Gneiss, is of great extent in Bhagulpore district, composing two-thirds of the country between the Curruckpore and Rajmahal hills, and the greater portion of the southern ridges of the latter group. It consists of quartz, more or less, hornblende, felspar, mica, and garnet pebbles.

OOLITIC.—*Limestone.*—Cutch; near Neemuch, Malwah; Bundelcund; on the river Sone; Fyzabad, on the Bheema; Kuladgee, in the southern Mahratta country; on the Kistnah; and as far south as Cuddapah. Though its principal characters are its uniform lithographic texture, solidity, conchoidal smooth fracture, and hardness,—dendritic surface, smoky gray colour, passing into dark smoky blue; and parallel thin stratification,—it differs when departing from its general composition, just as the shales differ which interlaminate it, the coal strata, and the sandstone, as being more or less argillaceous, bituminous, or quartziferous; of different degrees of hardness, coarseness, and friability of structure; and of all kinds of colours, streaked and variegated. It is occasionally veined, and interlined with jasper and light-coloured cherts, which, near Cuddapah, give it a rough appearance; also contains drusy cavities, calcedonies, and cornelian, north of Nagpore: in the bed of the Nerbudda between Lamaita and Beragurh, near Jubbulpore, of a snow-white colour, and traversed by chlorite schiste. It is frequently denuded of its overlying sandstone and shales in Southern India, and in this state is not uncommonly covered by trap, as near Ferozabad on the Bheema.

Thickness, 310 feet near Kurnool; 10 to 30 feet on the Bheema, with strata from 2 inches to 2 feet thick. In the part of the Himalaya examined by Captain Strachey, the secondary limestones and shales were several thousand feet in thickness, the upper portion being in some places almost made up of fragments of shells.

If the white crystalline marble generally of India is allowed to be metamorphic strata, this limestone exists in the Girnar rock of Kattywar; the lithographic form in Cutch, and between Neemuch and Chittore; the white marble about Oodeypore, and northwards in the neighbourhood of Nusseerabad, Jeypoor, Bessona, and Alwar; a narrow strip about 150 m. long in Bundelcund; again about Bidjyghur and Rhotasghur on the Sone; white marble in the bed of the Nerbudda, near Jubbulpore; in the hills north-east of Nagpore; near the junction of the Godavery and Prenzeta rivers; thence along the Godavery more or less to Rajahmundry; Sholapore district; on the Bheema; of every variety of colour, and greatly disturbed and broken up about Kaludgee, in the southern Mahratta country; along the Kistnah, from Kurnool to Amarattee; and more or less over the triangular area formed by the

* The late eminent geologist, J. B. Greenough, has made an excellent beginning by his large map on this subject, and by the voluminous materials he collected.

† See a valuable *Summary of the Geology of India, between the Ganges, the Indus, and Cape Comorin*; by H. J. Carter, Asst. Surg. Bombay Establishment, Aug. 1853; reprinted from Journal of Bombay British Asiatic Society, p. 156.

* In the neighbourhood of Calcutta a series of boring experiments to find water were carried on at intervals between 1801 and 1833; the results were, artificial soil at surface; next, as follows:—A light blue or gray-coloured sandy clay, becoming gradually darker from decayed vegetable matter, until it passes at 30 ft. deep into a 2 ft. stratum of black peat, apparently formed by the *debris* of Sunderbund vegetation, which was once the delta of the Ganges; below the peat a black clay, and in this and the gray clay immediately above the peat, logs and branches of yellow and red wood, found in a more or less decayed state. In one instance only bones were discovered, at 28 feet deep. Under blue clays, at 50 to 70 feet deep, *kunkur* and *bagiri* (apparently small land shells, as seen in Upper India). At 70 feet a seam of loose reddish sand,—75 to 125 feet beds of yellow clay predominate, frequently stiff and pure like potter's clay, but generally mixed with sand and mica; horizontal strata of kunkur pass through it, resembling exactly these found at Midnapore. Below 128 feet a more sandy yellow clay prevails, which gradually changes to a gray, loose sand, becoming coarser in quality to the lowest depth yet reached (176 feet), where it contains angular fragments, as large as peas, of quartz and felspar.

latter place, Gooty, and the Tripetty hills. Chunam, an argillaceous limestone, used for building in Bengal, Behar, Benares, &c.;* occurs in nodules in the alluvium, which, at Calcutta, is 500 to 600 feet thick. Near Benares, it contains fragments of fresh-water shells. South of Madras, a dark clay-abounds in marine shells, used in preference for lime-burning to those on the beach, as being freer from salt.

Sandstone,—appears to be composed of very fine grains of quartz and more or less mica, united together by an argillaceous material. It exists in Cutch; in the Panna range, Bundelcund; the Kymore hills; Ceded Districts; in lat. 18°, 15 m. west of the Godavery; on the banks of the Kistnah; plains of the Carnatic, and the districts watered by the Pennar river. It is present in the sub-Himalaya range, and in the Rajmahal hills. All the towns on the Jumna, from Delhi to Allahabad, appear to be built of this sandstone. The plains of Beekaneer, Joudpore, and Jessulmere, are covered with the loose sand of this formation. It borders on the northern and western sides of the great trappean tract of Malwah, and forms the north-eastern boundary of the Western India volcanic district.

Its thickness varies, either from original inequality or subsequent denudation. Its greatest depth, at present known, is in the eastern part of the Kymore range, where it is 700 feet at Bidjighur; and 1,300 feet at Rhotasghur; at the scarps of the waterfalls over the Panna range, it does not exceed 360 or 400 feet; from 300 to 400 feet is its thickness near Rylcherroo and Sundrogam, in the Ceded Districts. Its greatest height above the sea is on the banks of the Kistnah, 3,000 feet. Organic remains are very abundant in this formation. It has been ascertained that the great trap deposit of the Western Ghauts, rests on a sandstone containing vegetable remains, chiefly ferns.

VOLCANIC ROCKS.†—**Trap**.—The largest tract is on the western side of India, and extends continuously from the basin of the Malpurba to Neemuch in Malwah; and from Balsar, about 20m. south of the mouth of the Taptee, to Nagpore. This is probably the most remarkable trap-formation existing on the surface of the globe; its breadth is about 335 m. N. to S.; length about 350 m. E. to W.; and covers an area of from 200,000 to 250,000 sq. m.‡ Another portion extends from Jubbulpore to Amarkantak, thence south-westerly towards Nagpore. It constitutes the core of the Western Ghauts, and predominates in the Mahadeo and Sautpoora mountains.

Its two grand geological features along the Ghauts, where it has attained the highest elevation, are flat summits and regular stratification. Fourteen beds have been numbered in Malwah, the lowest and largest of which is 300 feet thick. These are equally numerous if not more so, along the Ghauts, but the scarps are of much greater magnitude. Besides its stratification, it is in many places columnar; as in the beds of the Nerbudda and Chambul; and the hill-fort of Singhar presents a surface of pentagonal divisions.

Wherever the effusions exist to any great extent, they appear to be composed of *laterite* above, then *basalt*, and afterwards *trappite* and *amgdaloid*.

Basalt.—There are two kinds of this rock; a dark blue-black, and a brown black. Both are semi-crystalline. Their structure is massive, stratified, columnar, or prismatic. Dark blue is the basalt of Bombay Island, brown-black that of the Deccan.

To this general description I may add what I have been enabled to glean of the specific structure of some of the principal positions:—

Himalayas.—Formations primary; the first strata, which is towards the plain, consists of limestone, lying on clay-slate, and crowned by slate, greywacke, or sandstone. Beyond the limestone tract, gneiss, clay-slate, and other schistose rocks occur; granite arises in the mountains near the snowy ranges. The peaks are generally composed of schistose rocks, but veined by granite to a great elevation. Kamet, however, is an exception, appearing to consist of granite alone. Greenstone dykes rise through and intersect the regular rocks. Strata fractured in all directions; slate as if crushed, and the limestone broken into masses. The soil is principally accumulated on the northern side.

The formation of the Indo-Gangetic chain, in Kunawur, is mostly gneiss and mica-slate; in some places, pure mica. On the left bank of the Sutlej, granite prevails, forming the Raldang peaks. Further north, it becomes largely intermixed with mica-slate; and to the north-east changes into secondary limestone, and schistose rocks, abounding in marine exuviae.§ In Kumaon, the Himalayas

are composed of crystalline gneiss, veined by granite; the range forming the north eastern boundary is believed to be of recent formation. The mountainous tract south of the principal chain in Nepal consists of limestone, hornstone, and conglomerate. The Sewalik (the most southerly and lowest range of the Himalayan system) is of alluvial formation, consisting of beds of clay, sandstone with mica, conglomerate cemented by calcareous matter, gravel, and rolled stones of various rocks. The supposition is, that it is the *debris* of the Himalaya, subsequently upheaved by an earthquake. The geology of the Sewalik is characterized by the occurrence of quantities of fossil remains.

Punjab.—Near the north-east frontier, in the vicinity of the Himalaya, is an extensive tract of rocks and deposits of recent formation; limestone, sandstone, gypsum, argillaceous slate; occasionally veins of quartz.

The Salt-range.—Greywacke, limestone, sandstone, and red tenaceous clay, with deposits of chloride of sodium, or common salt.

The Sufied-Koh is primary, consisting of granite, quartz, mica, gneiss, slate, and primary limestone.

The Suliman mountains are of recent formations, principally sandstone and secondary limestone, abounding in marine exuviae.

Central India.—Arravulli range, generally primitive, consisting of granite, quartz, and gneiss. Formation along banks of upper course of Nerbudda, trappean; lower down, at Jubbulpore, granitic; at Bhera Ghur, channel contracted between white cliffs of magneesian limestone; at the junction of the Towah, there is a ledge of black limestone; at and near Kal Bhyru, slate of various sorts; basaltic rocks scattered over channel. Ranges enclosing Nemaar, banks of rivers, and eminences in the valley, basaltic. Saugor and Nerbudda territory; eastern part, towards amarkantak, generally sandstone; from here it extends westward, forming the table-land bounding Nerbudda valley on the north, and is intermixed with marl, slate, and limestone. The volcanic tract commences about lon. 79°, and extends to about the town of Saugor, which is situate on its highest part. This (trap), with that of sandstone, further east, may be considered to belong to the Vindhya; and the former to the Mahadeo and Sautpoora ranges. In some places, primitive rocks appear through the overlying bed. The Bindyachal hills are of horizontally-stratified sandstone; Panna hills, sandstone, intermixed with schiste and quartz; and, to the west, overlaid by limestone.

Western Ghauts.—The great core is of primary formation, inclosed by alternating strata of more recent origin. These have been broken up by prodigious outbursts of volcanic rocks; and from Mahabeshwur northward, the overlying rock is exclusively of the trap formation; behind Malabar they are of primitive trap, in many places overlaid by immense masses of laterite, or iron-clay. The Vurragherry or Pulnag hills (Madura) are gneiss, stratified with quartz; in some places precipices of granite.

Nagpore.—North-western and western part, volcanic, principally basalt and trap. This terminates at the city of Nagpore, and the primitive, mostly granite and gneiss, rises to the surface.

Mysore.—The droogs, huge isolated rocks, scattered over the surface; vary in elevation from 1,000 to 1,500 feet; bases seldom exceeding 2 m. in circumference; generally composed of granite, gneiss, quartz, and hornblende; in many places overlaid by laterite.

SOILS.

Mainly determined by the geological character of each district, except in the deltas, or on the banks of rivers, as in the Punjab, where an alluvium is accumulated. The land in Lower Bengal is of inexhaustible fertility, owing partly to the various salts and earthy limestone with which the deposits from the numerous rivers are continually impregnated: it is generally of a light sandy appearance. The alluvium of Sinde is a stiff clay; also that of Tanjore, Sumbulpore, and Cuttack, by the disintegration of granitic rocks. A nitrous (saltpetre) soil is general in Behar; in the vicinity of Mirzapoor town, it is strongly impregnated with saline particles; and at many places in Vizagapatam. The *regur*, or cotton ground, which extends over a large part of Central India, and of the Deccan, is supposed to be formed by a disintegration of trap rocks; it slowly absorbs, and long retains moisture; and it has produced, in yearly succession, for centuries, the most exhausting crops. It spreads over the table-lands of the Ceded Districts and Mysore, flanks the Neilgherry and Salem hills, and pervades the Deccan, but has not been observed in the Concan. It is a fine, black, argillaceous mould, containing, in its lower parts, nodules, and pebbly alluvium. *Kunkur* (a calcareous conglomerate) fills up the cavities and fissures of the beds beneath it; and angular fragments of the neighbouring rocks are scattered over its surface. It contains no fossils. In some parts it is from 20 to 40 feet thick. *Kunkur* is common in the north-western provinces, the rocks often advancing into the channel of the Jumna, and obstructing the navigation. In the western part of Nutta district, it is mixed with sand: in Oude, some patches of this rock, which undergo abrasion very slowly, stand 70 or 80 feet above the neighbouring country, which, consisting of softer materials, has been washed away by the agency of water. Its depth, in the eastern part of Meerut district, is from one to 20 feet. In the Doab, between the Ganges and Jumna, and in many parts of the N.W. provinces, there is a light rich loam, which produces excellent wheat; at Ghazepore, a light clay, with more or less sand, is favourable

resembling the *unio*, which exists in great abundance at the foot of the lower hills and throughout the Doab. In the Neermal hills, north of the Godavery, on the road from Hyderabad to Nagpore, many very perfect fossil shells, mostly bivalves, and evidently marine, have been discovered imbedded in a volcanic rock, together with the head and vertebra of a fish; the formations around rest everywhere on granite; and there are several hot-springs holding lime in solution. Univalves and bivalves, particularly buccinum, ammonites, and mussels, abound in Malwah.

Most of the soils of India have a powerful absorbing quality; hence their fertile properties.

Kunkur.—A calcareous concretion, stratified and in mammillated masses of all sizes, which contains 50 to 80 per cent. of carbonate of lime, some magnesia, iron, and alumina: these nodules are interspersed in large quantities throughout extensive tracts of the alluvial and secondary formations, and are ascribed to the action of calcareous springs, which are of frequent occurrence.

* The British Residency at Hyderabad (Deccan) is a specimen; the Corinthian columns, &c., being executed in white chunam.

† Volcanic fires are said by the natives to exist among the loftier peaks of the Hindoo-Koosh and the Himalayan ranges, but earthquakes are of rare occurrence. A severe convulsion was experienced throughout a large extent of country on 26th August, 1833,—vibration from N.E. to S.W., with three principal shocks; first at 6:30 p.m.; second, 11:30 p.m.; and third, at five minutes to midnight. It was most severely felt at and near Katmandoo, where about 320 persons perished; the trembling of the earth commenced gradually, and then travelled with great rapidity towards the westward; and increased in violence until the houses seemed shaken from their foundation,—large-sized trees bent in all directions; the earth heaved fearfully; and while the air was perfectly calm, an awful noise burst forth as if from a hundred cannon. Probably in India, as in Australia, subterranean igneous action, which was formerly very violent, is now almost quiescent, or finds its vent through mighty chimneys at a height of four or five miles above the sea. The Lunar Lake, 40 m. from Saulna, is a vast crater 500 feet deep, and nearly five miles round the margin; its waters are green and bitter, super-saturated with alkaline carbonate, and containing siliceous and some iron in solution; the mud is black, and abounds with sulphuretted hydrogen; the water is, nevertheless, pure and void of smell.

‡ The rock in which the Ellora caves are excavated is said to be a basaltic trap, which, from its green tinge and its different stages from hardness to disintegration, is supposed by the natives to be full of vegetable matter, in a greater or less advance to putrefaction; the crumbling rock affords a natural green colour, which is ground up and employed in painting on wet chunam (lime plaster).

§ Dr. Gerard found some extensive tracts of shell formation 15,000 ft. above the sea. The principal shells comprised cockles, mussels, and pearl-fish; nummulites and long cylindrical productions. These shells, of which many were converted into carb. of lime, some crystallized like marble, were lying upon the high land in a bed of granite in a pulverized state: the adjacent rocks composed of shell limestone, the large blocks formed of a multitude of shells of different sizes, imbedded in a mass of calcareous tufa. Four classes of shell formation were distinguished: one in particular, a freshwater bivalve,

for sugar and for roses. As the Ganges is ascended before reaching Ghazepore, the soil becomes more granitic, and is then succeeded by a gravel of burnt clay, argite, and cinders, resembling what is seen in basaltic countries. Assam, which has been found so well adapted for the culture of tea, has for the most part a black loam reposing on a gray, sandy clay; in some places the surface is of a light yellow clayey texture. The soil usually found in the vicinity of basaltic mountains is of a black colour, mixed with sand. Disintegrated granite, where felspar predominates, yields much clay.

A sandy soil exists in the centres of the *Dooabs*, of the Punjab; more or less in Paniput, Rhotuck, and Hurriana districts: Jeypoor,

Machery, and Rajpootana; and in some parts of Sind; in Mysore a brown and rather sandy earth prevails; Trichinopoly is arid and sandy; and near Tavoy town, on the E. side of the Bay of Bengal, there is a large plain, covered with sand.

The soil of Nagpore, in some tracts, is a black, heavy loam, loaded with vegetable matter; red loam is found in Salem and in Mergui.

Tinnevely has been found well suited for the cotton plant, and the substance in which it delights looks like a mixture of lime, rubbish, and yellowish brickdust, intermixed with nodules of *Kunkur*.^{*} A chymical analysis of three of the best cotton soils in these districts gives the following results:†—

Cotton Soils.	Vegetable matter.	Saline and Extrac-tive.	Iron.			Carb. lime.	Magne-sia.	Alu-mina.	Silex.	Water and loss.	Remarks.
			Protox.	Deutox.	Tritox.						
Bundelcund -	2·00	0·33	—	7·75	—	11·90	trace	3·10	74·0	1·00	{ No peat or lignite; nothing soluble in cold water; silex in fine powder; kunkur in the gravel. Gravel, mostly silex, with some felspar, but no kunkur. Gravel, almost wholly kunkur; some carb. iron; half the soil of gravel.
Coimbatore -	2·30	traces	4·00	—	—	7·50	trace	2·80	82·80	0·60	
Tinnevely -	0·15	0·20	—	—	2·88	19·50	0·15	2·00	74·00	1·12	

Goozerat is generally termed the Garden of Western India. With the exception of Kattywar, and to the eastward of Broach, it is one extensive plain, comprising many different soils; the chief varieties being the black or cotton soil, and the *gorat*, or light grain-producing soil.‡ The former is chiefly confined to Broach, and part of Surat N. of the Taptee; the latter prevails throughout Baroda, Kayra, and part of Ahmedabad, becoming more mixed with sand to the northward; black soil abounds to the westward of the Gulf, and in many of the Kattywar valleys. The numerous vegetable products of India attest the variety of soils which exist there.

MINERALS.

Various metals have been produced and wrought in India from the earliest ages; the geological character of the different districts indicates their presence. So far as we have yet ascertained, their distribution is as follows:—

Iron.—Ladakh.—Mines in the north-eastern part of the Punjab,§ and in almost every part of Kumaon, where the requisite smelting processes are performed, though on a small scale, and in a rude and inefficient manner. Mairwarra; in veins, and of good quality, believed to be inexhaustible. Rajmahal; in gneiss. Lalgang, 16 miles south-west of Mirzapore city. Kuppudgode hills; in schistes, quartz, and gneiss: on the north-east side, one stratum of iron, 60 feet thick. Ramghur; hills abounding in iron, though not of the best quality. Hazareebaugh, in gneiss—flinty brown colour, pitchy lustre, and splintery fracture; 20 feet thick. Various parts of Palamow district; at Singra in inexhaustible quantities. Eastern part of Nagpore territory. Mine of good quality at Tendukhera, near Jubbulpore (were the navigation of the Nerbudda available, this would prove a most useful article of export for railways). Western extremity of Vindhya; in gneiss. Southern Mahratta country; in quartz: micaceous and magnetic iron-ore occur in the same district; in clay-slate. In all the mountains of the Western Ghats; in Malabar; in veins, beds, or masses, in the laterite (here extensively smelted). Salem, southern part (yields 60 per cent. of the metal fit for castings). Nellore district. In many places in Masulipatam. Rajahmundry; in sandstone hills. Vizagapatam. Abundant in many parts of Orissa. Tenasserim provinces; occurs in beds, veins, and in rocks. Between the Salem and Gyne rivers, it is found in sandstone hills. Most abundant between Ye and Tavoy, approximating the sea-coast; the best is at a short distance north of Tavoy town: it is there in two forms—common magnetic iron-ore; and massive, in granular concretions, crystallized, splendid, metallic, highly magnetic, and with polarity. The ore would furnish from 74 to 80 per cent. raw iron. In various places the process of smelting is rudely performed by the natives, but they produce a metal which will bear comparison with the best Swedish or British iron.||

Tin.—Oodeypore,—mines productive. On the banks of the Barakur, near Palamow; in gneiss. Tenasserim provinces. Tavoy, rich in tin-ore; generally found at the foot of mountains, or in hills; Pakshan river, soil in which the grains are buried, yields 8 or 10 feet of metal; at Tavoy, 7 feet: of superior quality in the vicinity of Mergui town.

Lead.—Ladakh. Kunawur. Ajmere; in quartz rocks. Mairwarra. Eastern part of Nagpore. In the vicinity of Hazareebaugh. Eastern Ghats at Jungamanipenta; in clay-slate—mines here. Amherst province. Fine granular galena obtained in clay-slate, and clay limestone on the Touser, near the Dehra-Doon.

* It is curious to note, in different countries, how plants seem to vary in their feeding: thus, at Singapore, the best cotton soil apparently consists of large coarse grains of white sand, mixed with something like rough charcoal-dust, and with fragments of vegetables and mosses of all sorts. A somewhat similar substance, mingled with shells and decayed vegetable matter, is the favourite habitat of the Sea Island cotton of Georgia, U.S.

† See an interesting Essay on the Agriculture of Hindoostan, by G. W. Johnston.

‡ See Mackay's valuable Report on Western India, p. 41.

§ Colonel Steinbach says that the mineral wealth of the Punjab is considerable; that mines of gold, copper, iron, plumbago, and lead abound, and that "properly worked they would yield an enormous revenue."

|| The natives of Cutch make steel chain armour, sabres, and various sharp-edge tools from their iron; the horse-shoes are excellent: the metal being more malleable, and not so likely to break as English iron.

Copper.—Ladakh. Kunawur, in the valley of the Pabur. Kumaon, near Pokree; but these mines are almost inaccessible, and the vicinity affords no adequate supply of fuel for smelting: others at Dohnpur,¶ Dhobri, Gangoli, Sira, Khori, and Shor Gurang. Mairwarra. Oodeypore; abundant,—it supplies the currency. Southern Mahratta country, in quartz; also in a talcose form. Venatigerry, North Arcot. Nellore district.** Sullivan's and Callagkiank Islands, in the Mergui Archipelago. This metal is most probably extensively distributed, and of a rich quality.

Silver.—In the tin mines of Oodeypore. In the lead mine, near Hazareebaugh, and other places.

Gold.—Sands of Shy-yok, Tibet. Ditto Chenab, Hurao, and Swan Rivers, Punjab. Ditto Aluknunda, Kumaon. Throughout the tract of country W. of the Neilgherries, amid the rivers and watercourses, draining 2,000 sq. m., this coveted metal abounds; even the river stones, when pounded, yield a rich product; it is usually obtained in small nuggets. In the iron sand of the streams running from the Kuppudgode hills, and from the adjoining Saltoor range. Sumbulpore; in the detritus of rocks. In moderate quantities in several places in the eastern part of Nagpore. Many of the streams descending from the Ghauts into Malabar; and in Wynaad. Gold-dust in Mysore.†† In the Assam rivers it is plentiful: near Gowhatti, 1,000 men used to be employed in collecting ore for the state. Various parts of Tenasserim provinces, but in small quantities. The geological structure of India indicates an abundance of the precious metals.

Coal.—The carboniferous deposits of the *oolitic series* in Bengal west of the Ganges and Hooghly, consist of coal, shale, and sandstone, but no limestone, and they appear chiefly to occupy the depressions of the granitic and metamorphic rocks which form this part of India, becoming exposed in the banks or beds of watercourses or rivers which have passed through them, or in escarpments which have been produced by upheaval of the rocks on which they were deposited. The coal occurs in strata from an inch or less to 9 or 10 feet thickness, interstratified with shale and sandstone; the whole possessing a dark black or blue colour, of a greater or less intensity. At Burdwan its character is slaty: the genera of plants are partly English, some Australian, some peculiar. The depth at the Curhurbalee field, situated 60 miles south of the Ganges, near Surajgurrah, is from 50 to 100 feet. Proceeding westerly, towards Palamow district, which contains many valuable and extensive fields, and where several shafts have been sunk, it has been seen about 16 m. from Chergerh, in Singrowla; at the confluence of the Sone and Tipan, about 30 m. E. from Sohajpore. Near Jeria, in Pachete district. Hills in Ramghur, abounding in coal. Jubbulpore, 30 m. S. from Hoosingabad; in Shahpore in the same neighbourhood; and abundantly along the valley of the Nerbudda. Traces of it are said to exist in the diamond sandstone north-west of Nagpore, and it has been found in the Mahadeo mountains. In the Punjab, at Mukkad, on the left bank of the Indus, and in the localities of Joa, Meealee, and Nummul. The extremes of this coal formation, so far as have yet been discovered in India, are,—the confluence of the Godavery and Preheta in the south, in lat. 19°, and the salt range in about 33° N.; Cutch in the west, and Burdwan in the east; and detached in Silhet, Pegu (recently found of excellent quality), and the Tenasserim provinces (plentiful, and possessing good properties). There are many other places, no doubt, in the country between Bengal and Berar, where this valuable mineral exists; traces of it have been observed in

¶ The gray ore found in Dohnpur affords 30 to 50 per cent. of copper; it is associated with malachite, and contained in a compact red-coloured dolomite, hence mining operations can be carried on without timbering or masonry.

** Mines discovered by Dr. Heyne, near Wangapadu. "A footpath, paved with stones, led up the hill to the place which was shown me as one of the mines. It is situated two-thirds up the hill, and might be about 400 feet above the village (Wangapadu). An open gallery cut into the rock demonstrated that it had been formerly worked; and as the stones, which lay in abundance near it, were all tinged or overlaid with mountain green, there could be no doubt that the ore extracted had been copper."—(Heyne, *Tracts on India*, p. 112.)

†† In excavating the disintegrating granite in the vicinity of Bangalore, to ascertain the extent to which the decomposing influence of the atmosphere will affect the solid rock (viz. 30 to 35 ft.) the contents of soil were frequently analysed. In blasting sientia at Chinapatam, 40 miles from Bangalore, on the road to Seringapatam, Lieutenant Baird Smith, B.E., observed considerable quantities of gold disseminated in small particles over the fractured surfaces. At Wynaad this metal was obtained from rich yellow earth in sufficient quantity to employ a number of labourers and to yield some return.

Orissa, but it has not yet been found available for use; it is not improbable that it extends across the delta of the Ganges to Silhet, distant 300 miles. It also occurs extensively in the grits bounding the southern slope of the Himalaya: it has been questioned whether this is the older coal, or only lignite associated with nagelfluë,—where the Teesta issues from the plain, its strata is highly inclined, and it bears all the other characters of the older formation. Analysis of Indian coal found in different parts, and near the surface, gave the following results:—Chirra Poonjee, slaty kind: specific gravity, 1.497; containing volatile matter, 36; carbon, 41; and a copious white ash, 23=100. Nerbudda (near Futtypore), near the surface,—volatile matter, 10.5; water, 3.5; charcoal, 20; earthy residue (red), 64=110. Cossyau hills: specific gravity, 1.275; volatile matter or gas, 38.5; carbon or coke, 60.7; earthy impurities, 0.8=100—(ash very small). Hurdwar: specific gravity, 1.968; volatile matter, 35.4; carbon, 50; ferruginous ash, 14.6=100. Arracan: specific gravity, 1.308; volatile matter, 66.4; carbon, 33; ash, 0.6=100. Cutch: charcoal, 70; bitumen, 20; sulphur, 5; iron, 3; calcareous earths, 2.

Sulphur.—Mouths of Godavery, and at Condapilly, on the Kistnah. Sulphate of alumina obtained from the aluminous rocks of Nepal; used by the natives to cure fresh wounds or bruises: yields on analysis—sulphate of alumina, 95; peroxyde of iron, 3; silex, 1; loss, 1. Sulphate of iron is procured in the Behar hills, and used by the Patna dyers; it yields sulphate of iron, 39; peroxyde of iron, 36; magnesia, 23: loss, 2=100.

Diamonds.—Sumbulpore has been celebrated for the finest diamonds in the world; they are found in the bed of the Mahanuddy. Mines were formerly worked at Wyraghur, Nagpore; Malaville, in Masulipatam (near Ellore); and at Panna, in Bundelcund. Mr. H. W. Vosse described, in 1824, the diamond mines of the *Nalla Mulla* mountains, north of the Kistnah,* which were formerly extensively worked.†

Rubies.—Sumbulpore; in the detritus of rocks.

Pearls.—Gulf of Manaar, near Cape Comorin, and on the coast of many of the islands in the Mergui Archipelago.

Muriate of soda (common salt) is found in rock and liquid form at various places. A salt lake, 20 m. long by 1½ broad, is situated in lat. 26° 53', long. 74° 57'; it supplies a great portion of the neighbouring country with salt after the drains are dried up. A salt lake in Berar contains in 100 parts,—muriate of soda, 20; muriate of lime, 10; muriate of magnesia, 6. Towards the sources of the Indus, salt lakes exist at 16,000 ft. above the sea. There are extensive salt mines in the *Salt range* of the Punjab. Natron and soda lakes are said to exist in the Himalaya.

Cornelian is found and worked in different places: the principal mines are situated at the foot of the western extremity of the Rajppeepla hills, close to the town of Ruttunpoor; the soil in which the cornelians are imbedded consists chiefly of quartz sand—reddened by iron, and a little clay. Agates abound in Western India: at one part of Cutch the sides of the hills (of amygdaloid) are covered with heaps of rock crystal, as if cart-loads had been purposely thrown there, and in many parts of the great trapezoid district the surface is strewn with a profusion of agatoid flints, onyx, hollow spheroids of quartz, crystals, and zoölitic minerals. There are evidences of several extinct volcanoes in Cutch.

This is but an imperfect sketch of the minerals of India: doubtless, there are many more places where metals exist; but during the anarchy and warfare which prevailed prior to British supremacy, the very knowledge of their locality has been lost. At no distant day this subterranean wealth will be developed; and probably, when the gold fields of Australia are exhausted, those of India may be profitably worked.

POPULATION.

From remote antiquity India has been densely peopled; but we know nothing certain of its indigenous inhabitants,—of accessions derived from immigration, or from successful invasions by sea and land,—of the progressive natural increase,—or of the circumstances which influence, through many generations, the ebb and flow of the tide of population.‡ There is direct testimony,

* These mountains are bounded on all sides by granite, that everywhere appears to pass under it, and to form its basis: some detached portions have only the upper third of their summits of sandstone and quartz, the basis or remaining two-thirds being of granite. Deep ravines are not infrequent. The diamond is procured only in the sandstone breccia, which is found under a compact rock, composed of a beautiful mixture of red and yellow jasper, quartz, chalcedony, and hornstone, of various colours, cemented together by a quartz paste; it passes into a pudding-stone of rounded pebbles of quartz, hornstone, &c., cemented by an argillo-calcareous earth of a loose friable texture, in which the diamonds are most frequently found. The breccia is seen at depths varying from 5 to 50 feet, and is about 2 feet in thickness; immediately above it lies a stratum of pudding-stone, composed of quartz and hornstone pebbles, cemented by calcareous clay and grains of sand. The miners are of opinion that the diamond is always growing, and that the chips and small pieces rejected, ultimately increase to large diamonds.—*Trans. A.S. Bengal*, vol. xiv., p. 120.

† The diamonds of Golconda have obtained great celebrity throughout the world, but they were merely cut and polished there, having been generally found at Partaill, in a detached portion of the Nizam's dominions, near the southern frontier, in lat. 16° 40', long. 80° 25'.

‡ It is not improbable that some of the early immigrants were offshoots of the colonists who are said to have passed from Greece into Egypt, thence travelled eastward, forming settlements on the banks of the Euphrates and Tigris; and ultimately reached the Indus and Ganges. In craniological and facial characteristics, many Hindoos present a striking similitude to the ancient Greek, modified by climate, food, and habits; and in several architectural structures, of which ruins are still extant, there is considerable resemblance to the ancient buildings of Egypt, and those erected on the Babylonian plains. Bryant is of opinion that Chaldaea was the parent country of the Hindoos; Vans Kennedy traces the Sanscrit language to Mesopotamia; H. H. Wilson deems that the Hindoos connected with the *Iig Veda* were from a northern site, as in that work the worshipper on more than one occasion, when soliciting long life, asks for a hundred winters, which the Professor thinks would not have been desired by the natives of a warm climate. This is not conclusive. In Britain man frequently dates his age from the number of summers he has seen. There can, however, be little doubt that many of the early invaders of

however, that before the Christian era the country was thickly inhabited by a civilized people, dwelling in a well-cultivated territory, divided into numerous flourishing states, with independent governments, united in federal alliance, and capable of bringing into the field armies of several hundred thousand men.

For more than a thousand years after the Greek invasion, we have no knowledge of what was taking place among the population of India, and but a scanty notice, in the eighth century, of the Arab incursions of the regions bordering on the Indus. Even the marauding forays of Mahmood the Ghaznevide, in the eleventh century, afford no internal evidence of the state of the people, save that derived from a record of their magnificent cities, stately edifices, immense temples, lucrative trade, and vast accumulations of wealth; the Hindoos were probably then in a more advanced state of social life, though less warlike, than during the Alexandrine period: they had gradually occupied the whole of India with a greatly augmented population, and possessed a general knowledge of the arts, conveniences, and luxuries of life.

During the desolating periods of Moslem forays, and of Mogul rule, there appears to have been a continued diminution of men and of wealth, which Akbar in vain essayed to check by some equitable laws. We have sufficient indirect and collateral evidence to show that whole districts were depopulated, that famines frequently occurred, and that exaction, oppression, and misgovernment produced their wonted results in the deterioration of the country. No census, or any trustworthy attempt at ascertaining the numbers of their subjects, was made by the more enlightened Mogul sovereigns, even when all their energies were directed to the acquisition of new dominions.

The English, until the last few years, have been as remiss in this respect as their predecessors in power. An idea prevailed that a census would be viewed suspiciously as the prelude to a capitation tax, or some other exaction or interference with domestic affairs. In Bengal, Behar, and Orissa, which we have had under control for nearly a century, no nearer approximation has yet been made to ascertain the number of our subjects, than the clumsy and inaccurate contrivance of roughly ascertaining the houses and huts in a village or district, and then supposing a fixed number of mouths in each house (say five or six). The fallacy of such estimates is now admitted, and rulers are beginning to see the value of a correct and full census, taken at stated intervals, in order to show the rates of increase or decrease, and to note the causes thereof. I believe that the Anglo-Indian Government have no reason to apprehend unpleasant disclosures if a decennial census be adopted for all the territories under their sway: the natural fecundity of the Hindoos would lead to an augmentation where peace and the elements of animal sustenance exist; and a satisfactory proof would be afforded of the beneficence of our administration, by the multiplication of human life. With these prefatory remarks, I proceed to show briefly all that is at present known on the subject.

In the returns collected by Mr. Edward Thornton, head of the statistical department of the East India House, there must be erroneous estimates somewhere, otherwise there would not be so great a disproportion of mouths to each square mile, as appears between the British territories (157) and the other states (74)—105,000,000 on 666,000 sq. m., and 53,000,000 on 717,000 sq. m. Estimating the entire area, as above, at 1,380,000 sq. m., and the population thereon at 158,000,000, would give 114 to each sq. m. Viewing India as including the entire region, from the Suliman on the west, to the Youmadoug mountains on the east, and from Cape Comorin to Peshawur, and estimating the area at 1,500,000 sq. m., and the number of inhabitants to each sq. m. at 130, would show a population of 195,000,000; which is probably not far from the truth.

The Chinese census shows 367,632,907 mouths on an area of 1,297,999 sq. m., or 283 to each sq. m. In England the density is 333; Wales, 134; Ireland, 200; Scotland, 100. India, with its fertile soil, a climate adapted to

India were of the tribe of Japhet,—some of them acquainted with maritime commerce, and all comparatively more civilized than the *indigenes* who were driven towards the southward and eastward, and to mountain and jungle fastnesses. When this occurred it is impossible to determine. General Briggs says that the *Vedas* were written in India at the period when Joshua led the Israelites over Jordan into Canaan. The date when Menu, the lawgiver, lived has not yet been ascertained. Whatever the period, the Hindoos had not then occupied the country farther south than the 23rd degree, as Menu describes the people beyond as "barbarians, living in forest, and speaking an unknown language." Remote annals are lost in legends and traditions; and the chronology of Hindooism is an absurdity, except on the principle of cutting off the ciphers attached to the apocryphal figures.

There have been several censuses of China, of which we have little reason to doubt the accuracy; that of 1753 showed 102,398,258; that of 1792, 307,467,200; that of 1812, 361,221,900. In some districts, along river banks, the density is very great, such as Kangsoo (Nankin)—774 to the square mile; in others the density varies from 515 down to 51. (See vol. i., p. 29, of my report on China to Her Majesty's Government, in 1847.)

See Preface (p. xv.) to my Australian volume, new issue, in 1855, for density of population in different European States.

inhabitants; and with an industrious and comparatively civilized people, might well sustain 250 mouths to each sq. m., or 375,000,000 on 1,500,000 sq. m. of area.*

The following table, framed from various public returns and estimates, is the nearest approximation to accuracy of

the population of each district under complete British rule; it shows (excluding Pegu) a total of about 120,000,000 (119,630,098) persons on an area of 829,084 sq. m., or 146 to each sq. m. :—

British Territories in Continental India—Area, Chief Towns, and Position.

Provinces, Districts, &c.	Area in Square Miles.	Population.	Principal Town.	Position of Town.		Date of Acquisition.
				Lat. N.	Long. E.	
BENGAL PROVINCE :—						
Calcutta and 24 Pergunnas	1,186	701,182	Calcutta	22 34	88 26	1700 & 1757
Hooghly	2,089	1,520,840	Hooghly	22 55	88 23	1757 & 1765
Nuddea	2,942	298,736	Kishnugur	23 24	88 28	1765
Jussore	3,512	381,744	Jessore	23 9	89 11	"
Backergunge and Shabazpore	3,794	733,800	Burrisol	22 33	90 22	"
Dacca	1,960	600,000	Dacca	23 43	90 25	"
Tipperah and Bulloah	4,850	1,406,950	Tipperah	23 28	91 10	"
Chittagong	2,560	1,000,000	Chittagong	22 20	91 55	"
Sylhet and Jyntea	8,424	380,000	Sylhet	24 54	91 50	1835
Mymensing	4,712	1,487,000	Sowara	24 44	90 23	1765
Rajeshaye	2,084	671,000	Rampoor	24 33	88 38	"
Moorshedabad	1,856	1,045,000	Berhampore	24 12	88 18	"
Beebhoom	4,730	1,040,876	Sooree	23 53	87 31	"
Dinapore	3,820	1,200,000	Dinapore	25 34	88 38	"
Rungpoor	4,130	2,559,000	Rungpoor	25 40	89 16	"
Burdwan	2,224	1,854,152	Burdwan	23 12	87 56	1760
Baraset	1,424	522,000	Baraset	22 43	88 33	"
Bancoorah	1,476	480,000	Bancoorah	23 14	87 6	1760
Bogulpore	5,806	2,000,000	Bogulpore	25 11	87 0	1765
Monghyr	2,558	800,000	Monghyr	25 19	86 30	"
Maldah	1,000	431,000	Maldah	25 2	88 11	"
Bagoorah	2,160	900,000	Bagoorah	24 50	89 25	"
Pubna	2,606	600,000	Pubna	24 0	89 12	"
Purneah	5,878	1,600,000	Purneah	25 46	87 34	"
Fureedpore, Deccan, and Jelalpore	2,052	855,000	Fureedpore	23 36	89 50	"
Darjeeling	834	30,882	Darjeeling	27 2	88 19	1835 & 1850
Singhbhoom	2,944	200,000	Chaibassa	22 36	85 44	1765
Maunbhoom	5,652	772,340	Pachete	23 36	86 50	"
SOUTH WEST FRONTIER :—						
Chota Nagpore	5,308	482,900	Lohadugga	23 6	84 46	1818
Palamow	3,468		Palamow	23 50	84 1	"
BAHAR PROVINCE :—						
Ramghur	8,524	372,216	Ramghur	24 0	85 24	1765
Behar	5,694	2,500,000	Gyah	24 43	85 2	"
Patna	1,828	1,200,000	Patna	25 53	85 16	"
Shahabad	3,721	1,600,000	Arrah	25 31	84 43	1775
Tirhoot	7,402	2,400,000	Mozufferpoor	26 6	85 28	1765
Sarun and Chumparun	2,560	1,700,000	Sarun or Chupra	25 45	85 48	"
Sumbulpore	4,693	800,000	Sumbulpore	21 29	84 0	1850
ORISSA PROVINCE :—						
Midnapore and Hidgelee	5,029	666,328	Midnapore	22 25	87 23	1760
Cuttack and Pooree	4,829	1,000,000	Cuttack	20 28	85 55	1803
Balasore	1,876	556,395	Balasore	21 30	87 0	"
Koordah	930	571,160	Koordah	20 10	85 43	"
MADRAS PRESIDENCY :—						
Ganjam	6,400	926,930	Ganjam	19 24	85 7	1765
Vizagapatam	7,650	1,254,272	Vizagapatam	17 41	83 21	"
Rajamundry	6,050	1,012,036	Rajamundry	17 0	81 50	"
Masulipatam	5,000	520,866	Musulipatam	16 10	81 12	1759
Guntoor	4,960	569,968	Guntoor	16 20	80 30	1788
Bellary	13,056	1,229,599	Bellary	15 9	76 59	1800
Cuddapah	12,970	1,451,921	Cuddapah	14 28	78 52	"
North Arcot	6,800	1,485,873	Chittoor	13 12	79 9	1751
South Arcot	7,610	1,006,005	Cuddalore	11 42	79 50	"
Chingleput and Madras	3,050	1,283,462	Madras	13 6	80 21	1765
Salem	8,200	1,195,367	Salem	11 39	78 14	1792
Coimbatore	8,280	1,153,862	Coimbatore	11 0	77 2	1799
Trichinopoly	3,000	709,196	Trichinopoly	10 48	78 46	1801
Tanjore	3,900	1,676,068	Tanjore	10 48	79 11	1799
Madura	10,700	1,756,791	Madura	9 55	78 10	1801
Tinnivelly	5,700	1,269,216	Tinnivelly	8 44	77 44	1801

* In illustration of this remark, the following statement, derived from the Commissioners' Report on the Punjab,—of the population of Jullundur Zillah, situated between the rivers Sutlej and Beas,—is subjoined, with the note appended by the census officer, Mr. R. Temple, 25th of October 1851.

Pergunnahs.	Hindoo.		Mussulmen.		Total.		Grand Total.	Total Area in Acres.	Area in Sq. Miles of 640 Acres each.	Number of Inhabitants per Sq. Mile.	Number of Acres to each Person.
	Agricultural.	Non-Agricultural.	Agricultural.	Non-Agricultural.	Agricultural.	Non-Agricultural.					
Philluor	41,997	38,591	20,442	19,211	62,439	57,802	190,241	187,001	299	412	1.52
Jullundur	48,967	49,652	46,049	50,568	95,016	100,220	195,236	250,397	391	499	1.25
Raloon	42,739	47,201	25,145	19,027	67,884	66,228	134,112	199,472	312	430	1.48
Nakdud	28,787	19,349	44,065	26,181	72,872	45,530	118,402	225,031	351	337	1.80
Total	162,490	154,793	135,721	114,987	298,211	269,780	567,991	861,901	1,346	422	1.55

Note.—This return certainly shows a considerable density of population. It may of course be expected that a small and fertile track like this, which contains a forest, waste, or hill, should be more thickly peopled than an extensive region like the north-western provinces, which embraces every variety of plain and mountain, of cultivation and jungle; we find therefore that in the provinces we have 322 inhabitants per square mile, while here we have one-fourth more, or 422; the population of this district proportionately exceeds that of 22 out of 31 districts of the north-western provinces, and is less than that of nine. It also exceeds the average population of any one out of the six divisions. It about equals that of the districts of Agra, Muttra, Furruckabad, and Cawnpore, but is inferior in density to the populous vicinities of Delhi or Benares, and to the fertile districts of Juanpoor, Azeengurh, and Ghazeepore. The comparative excess of Indian over European population has become so notorious, that it is superfluous to comment on the fact, that the population averages of this district exceed those of the most highly peopled countries of Europe.

British Territories in Continental India—Area, Chief Towns, and Position.

Provinces, Districts, &c.	Area in Square Miles.	Population.	Principal Town.	Position of Town.		Date of Acquisition.
				Lat. N.	Long. E.	
Madras Presidency—continued.						
Malabar - - - - -	6,060	1,514,909	Calicut - - -	11 15	75 50	1792
Canara - - - - -	7,720	1,056,333	Mangalore - - -	12 52	74 54	1799
Nellore - - - - -	7,930	935,690	Nellore - - -	14 27	80 2	1801
Kurnool - - - - -	3,243	273,190	Kurnool - - -	15 50	78 5	1838
Coorg - - - - -	1,420	{ 65,437 in 1836 }	Merkara - - -	12 27	75 48	1834
BOMBAY PRESIDENCY :—						
Concan, North - - -	5,477	815,849	Tanna - - -	18 57	72 53	1818
„ South - - - - -	3,964	665,238	Rutnagheriah - -	17 0	73 20	„
Bombay Island - - -	18	566,119	Bombay - - -	18 57	72 52	1661
Dharwar - - - - -	3,837	754,385	Dharwar - - -	15 28	75 4	1818
Poona - - - - -	5,298	666,006	Poona - - -	18 31	73 53	„
Kandeish - - - - -	9,311	778,112	Malligaum - - -	20 32	74 30	„
Surat - - - - -	1,629	492,684	Surat - - -	21 9	72 51	1759
Broach - - - - -	1,319	290,984	Broach - - -	21 42	73 2	1803
Ahmednuggur - - -	9,931	995,585	Ahmednuggur - -	19 6	74 46	1817
Sholapore - - - - -	4,991	675,115	Sholapore - - -	17 40	76 0	1818
Belgaum - - - - -	5,405	1,025,882	Belgaum - - -	15 50	74 36	1817
Kaira - - - - -	1,869	580,631	Kaira - - -	22 43	72 40	1803
Ahmedabad and Nassik -	9,931	995,585	Ahmedabad - - -	23 0	72 36	1818
Sattara - - - - -	10,222	1,005,771	Sattara - - -	17 40	74 3	1848
BERAR PROVINCE :—						
Deogur above the Ghauts - -	76,432	4,650,000	Chindwarrah - -	22 3	78 58	1854
„ below the Ghauts - -			Nagpore - - -	21 10	79 10	„
Wein-Gunga - - - -			Bundara - - -	21 11	79 41	„
Choteesgurh - - - -			Ryepore - - -	21 11	81 40	„
Chandarpoor - - - -			Chandah - - -	19 57	79 23	„
NERBUDDA DISTRICTS :—						
Saugor - - - - -	1,857	305,594	Saugor - - -	23 50	78 49	1818
Jubbulpore - - - -	6,237	442,771	Jubbulpore - - -	23 10	80 1	„
Hoosingabad - - - -	1,916	242,641	Hoosingabad - -	22 44	77 44	„
Seuni - - - - -	1,459	227,070	Seuni - - -	22 1	79 40	„
Dumoh - - - - -	2,428	363,584	Dumoh - - -	23 49	79 30	„
Nursingpore - - - -	501	254,486	Nursingpore - -	24 0	79 28	„
Baitool - - - - -	990	93,441	Baitool - - -	21 50	77 58	„
AGRA PRES., OR N.W. PROVINCE :—						
Benares - - - - -	995	851,757	Benares - - -	25 17	83 4	1775
Ghazeepore - - - -	2,181	1,596,324	Ghazeepore - - -	25 32	83 39	„
Azimghur - - - - -	2,516	1,653,251	Azimghur - - -	26 0	83 14	1801
Goruckpore - - - -	7,340	3,087,874	Goruckpore - - -	26 42	83 24	„
Jounpoor - - - - -	1,552	1,143,749	Jounpoor - - -	25 44	82 45	1775
Allahabad - - - - -	2,788	1,379,788	Allahabad - - -	25 26	81 45	1801
Banda - - - - -	3,009	743,872	Banda - - -	25 27	80 23	1803
Futtypore - - - - -	1,583	679,787	Futtypore - - -	25 57	80 54	1801
Cawnpore - - - - -	2,348	1,174,556	Cawnpore - - -	26 29	80 25	„
Etawah - - - - -	1,677	610,965	Etawah - - -	26 46	79 5	„
Furruckabad - - - -	2,122	1,064,607	Furruckabad - -	27 24	79 40	„
Shajehanpore - - - -	2,308	986,096	Shajehanpore - -	27 52	79 58	„
Allyghur - - - - -	2,153	1,134,565	Allyghur - - -	27 56	78 8	1817
Bareilly - - - - -	3,119	1,378,268	Bareilly - - -	28 23	79 29	1801
Moradabad - - - - -	2,698	1,138,461	Moradabad - - -	28 50	78 51	„
Agra - - - - -	1,864	1,001,961	Agra - - -	27 10	78 5	1803
Delhi - - - - -	789	435,744	Delhi - - -	28 38	77 19	„
Saharunpore - - - -	2,162	801,325	Saharunpore - -	29 58	77 36	1803
Paniput - - - - -	1,269	389,085	Paniput - - -	29 23	77 2	„
Hissar - - - - -	3,294	330,852	Hissar - - -	29 8	75 50	„
Rohtuk - - - - -	1,340	377,013	Rohtuk - - -	28 54	76 38	„
Goorgaon - - - - -	1,939	662,486	Goorgaon - - -	28 28	77 5	„
Mozuffernuggur - - -	1,646	672,861	Mozuffernuggur -	23 28	77 45	1836
Meerut - - - - -	2,200	1,135,072	Meerut - - -	28 59	77 46	„
Booldshuhur - - - -	1,823	778,342	Burrin - - -	28 24	77 56	1803
Bijnore - - - - -	1,900	695,521	Bijnore - - -	29 22	78 11	1802
Budaon - - - - -	2,401	1,019,161	Budaon - - -	28 2	78 11	„
Muttra - - - - -	1,613	862,909	Muttra - - -	27 30	77 45	1803
Mynpoory - - - - -	2,020	832,714	Mynpoory - - -	27 14	97 4	„
Humeerpore - - - - -	2,241	548,604	Humeerpore - - -	25 58	80 14	1802
Mirzapore - - - - -	5,152	1,104,315	Mirzapore - - -	25 6	82 38	1801
Jaloun - - - - -	1,873	176,297	Jaloun - - -	26 9	74 24	„
Ajmere - - - - -	2,029	224,891	Ajmere - - -	26 29	74 43	1817
Mairwarra - - - - -	282	37,715	Nyanugga - - -	26 6	74 25	„
CIS SUTLEJ :—						
Umballa - - - - -	293	67,134	Umballa - - -	30 24	76 49	1847
Loodiana - - - - -	725	120,898	Loodiana - - -	30 55	75 54	„
Kythul and Ladwa - -	1,538	164,805	Kythul - - -	29 49	76 28	1843
Ferozepore - - - - -	97	16,890	Ferozepore - - -	30 55	75 55	1835
Sikh States - - - - -	1,906	249,686	Patialah - - -	30 20	76 25	„
PUNJAB :—						
Jhelum - - - - -	13,959	1,116,035	Jhelum - - -	32 56	73 47	1849
Lahore - - - - -	13,428	2,470,817	Lahore - - -	31 36	74 21	„
Leia - - - - -	30,000	1,500,000	Leia - - -	30 57	71 4	„
Mooltan - - - - -	14,900	500,000	Mooltan - - -	30 12	71 30	„
Jullundur - - - - -	1,324	569,722	Jullundur - - -	31 21	75 31	1846
Peshawur - - - - -	4,836	{ about 850,000 }	Peshawur - - -	34 71	71 33	1849
Kangra - - - - -			Kangra - - -	32 5	76 18	„
SINDE PROVINCE :—						
Kurrachee - - - - -	16,000	185,550	Kurrachee - - -	24 56	67 3	1843
Shikarpore - - - - -	6,120	350,401	Shikarpore - - -	28 1	68 39	„
Hyderabad - - - - -	30,000	551,811	Hyderabad - - -	25 12	69 29	„

British Territories in Continental India—Area, Chief Towns, and Position.

Provinces, Districts, &c.	Area in Square Miles.	Population.	Principal Town.	Position of Town.		Date of Acquisition.
				Lat. N.	Long. E.	
ULTRA-GANGETIC DISTRICTS :—						
Arracan - - - -	15,104	321,522	Akyab - - - -	20 10	92 54	1826
Assam, Lower - - -	8,948	710,000	Gowhatty - - -	26 9	91 45	"
Assam, Upper - - -	12,857	260,000	Seebpore - - -	27 0	94 40	"
Goalpara - - - -	3,506	400,000	Goalpara - - -	26 8	90 40	1765
Cossya Hills - - -	729	10,935	Chirra Ponjee -	25 14	91 45	1826
Silchar - - - -	4,000	60,000	Silchar - - - -	24 49	92 50	1830
Tenasserim, Mergui, Ye, &c.	29,168	115,431	Mergui - - - -	12 27	98 42	1826
Pegu Province - - -	25,000	550,000	Prome - - - -	17 40	96 17	1853

A more recent return (28th July 1855) from the East India House, gives the population of India thus :—

British States.—Bengal, &c., 59,966,284; N. W. Provinces, 30,872,766; Madras, 22,301,697; Bombay, 11,109,067; Eastern settlements, 202,540: total, 124,452,354.

Native States.—Bengal, 58,259,862; Madras, 4,752,975; Bombay, 4,460,370: total, 47,473,207.

Foreign States.—French settlements, 171,217; Portuguese ditto, not known. Grand total, 172,096,778*.

The varying degree of density of population to area forbids reliance being placed on any mere "estimates," or "approximations to actual amount." Thus in Bengal, Behar, and Cuttack, the number of mouths to each square mile is stated to be—in Jessore, 359; Moorshedabad, 394; Bogulpore, 318; Patna, 506; Cuttack, 220; Dacca, 193; Chittagong, 324: average of all, 324†. These are high ratios; but the soil is fertile, and the inhabitants very numerous along the banks of rivers. In Assam, on the N.E. frontier of Bengal, and along the rich valley of the Brahmapootra, the density is placed at only 32 to the square mile; in Arracan, at 21; Tenasserim provinces, at 4; on the S.W. frontier (Chota Nagpore, &c.), at 85; in the Saugor and Nerbudda territories, at 109; in the non-regulation provinces, Kumaon, Ajmeer, &c., at 44.

The census of the Madras presidency shows, on an area of 138,279 sq. m., a population of 22,281,527, or 161 persons to each sq. m. In some districts the inhabitants are much more thinly scattered: for instance, at Kurnool, 84; at Bellary, 94; at Masulipatam, 104: the highest is the rich district of Tanjore, with 430 to each sq. m. Madras has a much less density than the British N.W. Provinces, which,

according to the return of 1852–3, shows the following results :—

Districts.	Square M.	Population.	Months to each sq. m.
Agra - - -	9,298	4,373,156	465
Allahabad - - -	11,971	4,526,607	378
Benares - - -	19,737	9,437,270	478
Delhi - - -	8,633	2,195,180	254
Meerut - - -	9,985	4,522,165	453
Rohileund - - -	12,428	5,217,507	419
Total - - -	72,052	30,271,885	420

By the two full censuses of Madras and the N.W. Provinces, we gain at last a fair estimate of the small number of Mohammedans, as compared with the Hindoos, in India: the Madras census of 1850–1 shows, on a total of 21,581,572, that the *adult* Hindoos numbered 13,246,509; Mohammedan adults and others, 1,185,654: the *children*—Hindoos, 6,655,216; Mohammedans and others, 594,193: total census (exclusive of Madras city and suburbs, containing 700,000)—

Class.	Males.	Females.	Total.
Hindoos - - -	10,194,098	9,707,627	19,901,725
Mohammedans and others - - -	852,978	826,869	1,679,847
Total - - -	11,047,076	10,534,496	21,581,572

The proportion of Moslems to Hindoos in Southern India, is as 1 to 10.

The N.W. Provinces return, in 1852–3, shows—

Class.	Males.	Females.	Total.
Hindoos - - -	13,803,645	11,920,464	25,724,109
Mohammedans and others - - -	2,376,891	2,170,880	4,547,771
Total - - -	16,180,536	14,091,344	30,271,880

London, 1861.

R. M. MARTIN.

* The of sum 124,452,354 is a higher figure than the Anglo-Indian subjects of the British crown have hitherto been rated, and is probably the result of a more accurate numbering of the people; thus, until a census now (July 1855) in progress was made of the Punjab, the population was, as usual, underestimated. According to the *Lahore Chronicle* of 30th of May 1855, the returns then received show for Lahore, 3,458,322; Jhelum, 1,762,488; Cis-Sutlej, 2,313,969; which are higher figures than those given from the Parliamentary Papers. The enumerations made up to May last for the Punjab gave 10,765,478; and it was supposed that the grand total, when completed, would be about eleven millions and a half, or nearly four millions more than the official document previously given for the Punjab and Cis-Sutlej states. In my first work on India, twenty years ago, I assumed the population under British jurisdiction to be about one hundred millions, which some considered an exaggeration; the above augmentation of twenty-four millions is accounted for by the addition of new states, such as the Punjab. I have little doubt that an accurate census will show a larger aggregate than 124,000,000.

† I obtained in India, in 1830, "a census," or rather estimate of these districts, showing an aggregate of area in square miles, 1,3792; villages, 154,268; houses, 7,781,240; mouths, 39,957,561; or about one village to each square mile of 640 acres, five houses to each village, five and a half persons to each house, and 259 mouths to each square mile. (See first *History of the British Colonies*, vol. I., Asia; 2nd edition, p. 166; published in 1835.)

‡ As regards the censuses of Madras and the N.W. Provinces, I have seen no details given of the means adopted to ensure an accurate enumeration in a single day; they must, I think, be considered as "near approximations" to truth; they appear to be the best yet obtained.

TABULATED VIEWS of the MOUNTAINS and PASSES, their Position, Elevation, and Extent; also the TABLE-LANDS, their Extent and Height, and the RIVERS.—To illustrate or explain the TOPOGRAPHICAL MODEL of INDIA constructed by R. MONTGOMERY MARTIN, Esq.

Name of Range.	Extent and Position of Extremities.	Elevation above the Sea.	General Remarks.
HIMALAYA, or "abode of Snow."	This stupendous mass extends in an irregular curve over 22° of lon., from the defile above Cashmere, where the Indus penetrates into the plains of the Punjab, lon. 73° 23', to the S. bend of the Sampoo, lon. 95° 23'. It is 1,500 m. long, with an avg. breadth of 150 m.	1. Dairmal, 26,629 ft.; 2. Bal Tal, 17,839; 3. Ser and Mer, 23,447; 4. Haul, 20,000; 5. Gya, 24,764; 6. Porgyal, 22,600; 7. Raldang, 20,103; 8. St. Patrick, 22,798; 9. St. George, 22,654; 10. The Pyramid, 21,579; 11. Gangotri, 22,906; 12. Jumnotri, 21,155; 13. Kedarnath, 23,062; 14. Badrinath, 22,954; 15. Kamet, 25,550; 16. Nanda Devi, 25,749; 17. Guria, 23,900; 18. Dhawalagiri, 27,600; 19. Gonsainthan, 24,740; 20. Junnoo, 25,311; 21. Kinchinjunga, 28,176; 22. Choniomo, 19,000; 23. Kanchan Jhow, 22,000; 24. Chumalari, 23,929; 25. Three peaks on lower bank of Deemree, 21,000; 26. Kailas, 22,000. Average elevation, 18,000 to 20,000 ft. M. Everest, 29,002.	Limit of perpetual snow, or congelation on S. slope, 15,000 to 18,000 ft. Deep narrow valleys, separated by ranges running either parallel or at right angles with the main ridge, contain the numerous sources of the rivers flowing into the Ganges, the Indus, and the Brahmaputra.* The steep face is towards the plain, and to the N. the chain supports the lofty table-land of Tibet. The greater part of the giant peaks, which rise to an elevation of 25,000 or 28,000 ft., are situated not on the central axis, but to the south of it. Viewed from Patna, at a distance of about 150 miles, these mountains present a long line of snow-white pinnacles, which, on a nearer approach, are seen towering above the dark line of lower but still lofty mountains.† With the exception of a strip of land at the foot of the mountains, the whole of Bootan presents a succession of the most lofty and rugged mountains on the surface of the globe. It is a series of ridges, separated only by the narrow beds of roaring torrents.
HINDOO KOOSH,‡ Kowentun, or Mooz Taugh.	About 850 m. long. From Kara-korum, lat. 35°, lon. 77°; to Bamian,|| lat. 34° 50', lon. 67° 48'.	1. Hindoo-Koosh, 35° 40', 68° 50', 21,000 ft., § 2. Summit N. of Jelalabad, 20,248; 3. Koushan Pass, 15,500; 4. Khawak Pass, 13,200; 5. Akrobat, 10,200 feet. Laram Mountains, 35° 20', 62° 54'; about 60 m. from N.E. to S.W., dividing the valley of Suwat from that of Panj-kora; and Laspissor Mountains, S. of, and subordinate to, Hindoo-Koosh, about 50 m. from E. to W., 36°, 70°—little known.	Limit of perpetual snow on S. slope (lat. 37°), 17,000 ft. The most remarkable feature of Hindoo-Koosh is, that to the S. it supports the plains of Kabool and Koh-Damaun, 6,000 to 7,000 ft.; while to the N. lies the low tract of Turkistan. Koondooz tow, distant in a direct line 80 m. N. of Hindoo-Koosh, only 900 ft. above the sea. The Hindoo-Koosh is a distinct mountain system, its parallelism being from S.W. to N.E., while that of the Himalaya is from S.E. to N.W.** It is a vast rounded mass, the culminating ridge ascending in lofty peaks, covered with perpetual snow, stretching as far as the eye can reach—further to the W. it sinks into the many mountains forming the Huzareh highlands. Supposed to be the Parapamissus of the Greeks.
KOH-I-BABA - - -	About 60 m.,—along lat. 34° 30', between lon. 67° 30', and 68° 30'. At the S.W. extremity of Hindoo-Koosh with which it is connected by the transverse ridges of Kalloo and Hajeguk.	Variously estimated. According to Burnes and Lady Sale, 18,000 ft.; Outram, 20,000 ft.; Humboldt, 2,800 toises, or 17,640 ft.; the most probable is 16,000 ft. Highest accessible point, 34° 40', 67° 30'; 13,200 ft. Hajeguk Pass, 11,700 ft.	

* The two sections of the Himalaya furnish points of resemblance in presenting almost insurmountable obstacles to communication between the countries which they divide, thereby separating the Botis or people of Tibet from the Hindoo family of India. Major Cunningham considers the distinction of climate not less positively marked, both ranges forming the lines of demarcation between the cold and dry climate of Tibet, with its dearth of trees, and those of the Ganges and its affluents; and the other intervening between the Indus, flowing at its northern base, and the subsequent tributaries of that river rising on its southern slope.

† Any view of the Himalaya, especially at a sufficient distance for the snowy peaks to be seen overtopping the outer ridges, is very rare, from the constant deposition of vapours over the forest-clad ranges during a greater part of the year, and the haziness of the dry atmosphere of the plains in the winter months. At the end of the rains, when the south-east monsoon has ceased to blow with constancy, views are obtained, sometimes from a distance of nearly 200 miles.

‡ It has often been observed, the Koh Kosh, or mountain of Kosh, offers a plausible etymology for the Caucasus of the classical writers. It is supposed by Ritter and Wilford to be the Mount mentioned by Pliny, under the name of *Gravadas*, but slightly deviating from the Sanscrit *Gravadasas* (shining rock).

§ Remarkable for its mass and elevation. Viewed from the Koushan Pass, distant ten miles south, its appearance is very sublime. The outline is serrated, being crowned by a succession of lofty peaks, with sides often perpendicular, and it is wrapped in a perpetual covering of snow, in all parts not too steep to admit its lying.

|| All the series appear to diverge from the apex of the plain, expanding "like the sticks of a fan."

¶ Humboldt regards it as the "most striking phenomenon amongst all the mountain-ranges of the old world." He considers that it may be traced from Taurus, in Asia Minor, across Persia, then, in the Huzareh mountains, to Hindoo-Koosh, and to the frontier of China; and that it is distinct from the Himalaya. The two ranges are physically discriminated by the depression down which the Indus flows, which, with its numerous irregularities, it is not easy to believe could have been hollowed out by the water's force even of that great river.

** "The elevated expanse of Pamir," to the north of Hindoo-Koosh, observes Humboldt, "is not only a radiating point in the hydrographical system of Central Asia, but is the focus from which originate its principal mountain chains, being common to India, China, and Turkestan; and from it, as from a central point, their several streams diverge."

Tabulated Views of the Mountains and Passes, Table-Lands, and Rivers, &c.—*continued*.

Name of Range.	Extent and Position of Extremities,	Elevation above the Sea.	General Remarks.
SUFIED-KOH, <i>Snowy or White Mountains.</i>	Near Attock, lon. $72^{\circ} 16' W.$ to lon. $69^{\circ} 36'$, proceeding nearly along the parallel of lat. $33^{\circ} 50'$; then sinking into a maze of hills stretching to the Kohistan of Kabool.	There are three ranges, running nearly parallel to the S. of the Kabool River; they rise in height as they recede from the river, the highest between $69^{\circ} 40'$ and $70^{\circ} 30'$, attaining an altitude of 14,000 ft.	Covered with perpetual snow. Generally of primary formation, consisting of granite, quartz, gneiss, mica slate, and primary limestone. The Soorkh Rood, the Kara Su, and many other shallow but impetuous streams rush down its northern face, and are discharged into the Kabool river, which conveys their water to the Indus. The two lowest ranges are covered with pine forests; the highest and most distant has a very irregular outline, is steep and rocky, yet furrowed by many beautiful vales. Always covered with snow. Its south-eastern brow overhangs the delightful region of Kohi-Damaun and also Cabul; its northern face forms the southern boundary of the Ghorbund valley.
PUGHMAN, <i>or Pamghan Range.</i>	Subordinate to Hindoo-Koosh, running along its S. base, generally from N.E. to S.W.	Estimated at 13,000 ft. Oona Pass, $34^{\circ} 23'$ and $68^{\circ} 15'$; 11,320 ft. Erak Summit, $34^{\circ} 40'$ and $68^{\circ} 48'$; 12,480 ft.	Four routes over this range practicable only for a man and horse; at Latta-bund Pass, 4,000 British troops were destroyed in their retreat, in 1842. Cold intense during winter, the frost splitting the rocks into huge fragments.
KURKUTCHA MOUNTAINS -	Separates the valley of Kabool from plain of Jelalabad; and connects the Hindoo-Koos with Sufiled-Koh.	From 1,000 to 2,000 ft. above Kabool, and the highest part, $34^{\circ} 25'$ and $69^{\circ} 30'$; 8,000 ft. above the sea.	Appear at first irregularly grouped, but the distinct arrangement of a chain is afterwards observable. Four passes through this range. The hills generally consist of slate and primary limestone, with overlying sandstone.
KHYBER MOUNTAINS -	Length, about 50 m.; breadth, about 20 m. Between $33^{\circ} 30'$ and $34^{\circ} 20'$, and $71^{\circ} 10'$ and $71^{\circ} 30'$. They connect Hindoo-Koosh with Sufiled-Koh. Lat. $33^{\circ} 22'$, lon. $67^{\circ} 50'$; 30 m. S.W. from Ghuznee.	Tartara summit, highest point, 4,800 ft. Summit of Khyber Pass, 3,373 ft.	
GOOLKOO MOUNTAINS -	Lat. $33^{\circ} 22'$, lon. $67^{\circ} 50'$; 30 m. S.W. from Ghuznee.	Estimated at 13,000 ft.	
AMRAN MOUNTAINS -	Lat. $30^{\circ} 50'$, lon. $66^{\circ} 30'$ -	General elevation, about 8,000 ft. Highest part, $30^{\circ} 50'$ and $66^{\circ} 30'$; about 9,000 ft. Kojuck Pass, 7,437 ft.	Bounds the table lands of Shawl and Pisheen on the W., as the Hala range does to the E.
TOBA MOUNTAINS -	Length, 150 m. Between $30^{\circ} 40'$ and $32^{\circ} 40'$, and $66^{\circ} 40'$ and $68^{\circ} 20'$; extending N.E. from the N. side of Pisheen valley.	General elevation, 9,000; above Pisheen, 3,500 ft. Tukattoo Hill, $30^{\circ} 20'$ and $66^{\circ} 55'$; 11,500 ft.	Country, though generally rugged, fertile.
PUBE MOUNTAINS -	Length, about 90 m. from C. Monze to lat. 26° .	Supposed to equal those of W. Sinde, viz., 2,000 ft. Highest part, about $25^{\circ} 30'$.	In $25^{\circ} 3'$ and $66^{\circ} 50'$, they are crossed by the Guncloba Pass, described as stony, and of easy ascent and descent.
Sinde Ranges, viz. - I. JUTTEEL.	60 to 70 m. S.W. from Sehwan to Dooaba. Between $25^{\circ} 32'$, $26^{\circ} 20'$, and $67^{\circ} 48'$, $68^{\circ} 8'$.	Steep—in few places less than 2,000 ft. - - -	The road from Sehwan to Kurrahee lies between them, and Keertar more to the W.
II. KEERTAR -	Parallel with the Jutteel, more to the W., between $25^{\circ} 50'$, $26^{\circ} 40'$, and about $67^{\circ} 40'$.	Average height, probably below 2,000 ft. - - -	Imperfectly explored.
III. LUKKEE -	Length, about 50 m. From Jutteel, S.E. towards Hyderabad. Centre of range, $26^{\circ} 67^{\circ} 50'$.	Highest part, 1,500 to 2,000 ft. Between Lukkee and Sehwan the mountains have a nearly perpendicular face, towards the Indus, above 600 ft. high.	They are of recent formation, and contain a profusion of marine exuvie. Huge fissures traverse this range, and hot springs and sulphurous exhalations are of frequent occurrence.
HALA, <i>Brachioick, or Bolan Range.</i>	Length, about 400 m. From Tukattoo to Arabian Gulf, forming the E. wall of Beloochistan table-land.	Average height, 5,000 to 6,000 ft. Kurklekee Mountains, that part which borders on the Bolan Pass, from $29^{\circ} 20'$ to $30^{\circ} 10'$, and 67° to $67^{\circ} 30'$, where the crest of Bolan Pass intersects them, 5,793 ft.	The range is crossed by the Bolan Pass, through which the route lies from Shikarpore to Kandahar and Ghuznee, and though important in a military point of view, inferior in commercial interest to the Goolairee, farther N.
SULIMAN RANGE -	Length, about 350 m. From $33^{\circ} 40'$, they run nearly S. in the 70th meridian of lon. to the mountains about Hurund and Kahun, in lat. 29° . Stretch from the E. base of Suliman Mountains to Jhelum River, N.E. to S.W., in lon. $32^{\circ} 30'$ to $33^{\circ} 30'$.	Highest elevation, Takht-i-Suliman, called also Khaissa-Ghar, lat. $31^{\circ} 35'$; 11,000 ft.	E. face dips rather steeply to the Indus, but the W. declivity much more gradual, to the table-land of Sowestan. Sides of mountains clothed nearly to the summits with dense forests; valleys overgrown with a variety of indigenous trees, shrubs, and flowers.
KALA, <i>or Salt Range</i>		Highest elevation, 2,500 ft. - - -	Vegetation scanty; the bold and bare precipices present a forbidding aspect. About $32^{\circ} 50'$, $71^{\circ} 40'$, the Indus makes its way down a narrow rocky channel, 350 yards broad; and the mountains have an abrupt descent to the river.

SEWALIK RANGE	Length, 155 m.; greatest breadth, 10 m. From Hurdwar to Roopur, S.E. to N.W.	From 3,000 to 3,500 ft.; highest part, 30° 17', and 77° 50', between the Timli and Lal Derwaza Passes.	In many places each hill might be represented by a right-angled triangle, the base resting on the pass, perpendicular facing towards the plains; hypothesis sloping towards the Dhoons, in the opposite direction.
NEPAL MOUNTAINS, AND TABLE-LAND.	500 m.; breadth from 90 to 150 m. From Kumaon to Sikkim.	Diversified by several inhabited valleys, elevated from 3,000 to 6,000 ft. above the plains of Bengal. The hills rise towards the culminating ridge of the Himalayas. Kamandoo, 4,628 ft. above sea, in a valley surrounded by stupendous mountains.† Bynturee, 29° 35', and 79° 20'; 5,615 ft. Average 3,000 ft. Highest elevation, Mt. Aboo, 5,000 ft. Crest of Koulmair Pass, 3,353 ft. Twelve m. from Beaur; country one mass of hills, intersected by small vales.	Hills consist of limestone, hornstone, and conglomerate. Nepal, owing to its elevation, enjoys a climate resembling that of S. Europe. Snow lies on the mountain-chain which surrounds the capital, in winter, and occasionally falls in the valley. The whole region is well watered. Forms the western buttress of a plateau of Central India. The mountains at Pokur are of a rose-coloured quartz, displaying bold pinnacles and abrupt rocky sides. The geological formation of Mt. Aboo is granitic.
ARRAVULLI RANGE	Length, 200 m.; average breadth, 10 to 15 m. Extent from 22° 40' to 26° 50', and from lon. 74° to 75°.	The Gir, a succession of ridges and hills, some 1,000 ft.; elevation diminishing towards N. Girnar, a granitic peak, 3,500 ft. Palithana Mt., 1,500 ft. Group near Poorbunder, 2,000 ft. Low ridge running from Choteyla to Gir, 400 ft. The centre of peninsula is the highest, and here all the rivers take their rise.	Caverns, deep ravines, and other fastnesses, very numerous in the Gir. The base of Girnar Mt. is clothed with jungle, diversified with black rocks, which appear through the vegetation. After this, the mount rises an immense bare and isolated granite rock, the face being quite black, with white streaks; and the N. and S. sides nearly perpendicular scarps.‡
KATTYWAR MOUNTAINS	The peninsula lies between 20° 42', 23° 10', 69° 5', 72° 14'; area, 19,850 sq. m.	Avg. height 1,500 to 2,000 ft. Chumpaneer, 22° 31', 73° 41'; 2,500 ft. Crest of Jam Ghaut, 2,300 ft. Mountain in Bhopal, 2,500 ft. Mahadeo Mountains, between 21° 30', 22° 40', and 78° 50'; Doulagherce, said to be the highest; Ambarmarph, estimated at 2,500 ft. Chindwarra, 2,100 ft.; and Patchmaree, vaguely stated to be 5,000 feet; but this is probably an exaggeration; Dokgur, stated to be 4,800 ft.; Putta Sunka, and Choura Doo, the highest, conjectured at 5,000 ft. Amar-kantak, a jungly table-land, computed to be 3,463 ft. Leela, a summit in Lanjee hills, 21° 55', 80° 25', 2,900 ft.; another of the same hills, in 21° 40', 80° 35', 2,400 feet.	The chain forms the southern buttress of the plateau of Malwah, Bhopal, &c. In the Saugor and Nerbudda territories, its crest is but the brow of this table-land; but in the western part it rises a few hundred feet above the high land on its northern side. The Passes that have been made over this range are, for the most part, bad. The geological formations are granitic and sandstone, overlaid by trap rock.
VINDHYA CHAIN	From Goozerat on the W. to the basin of the Ganges on the E.; and comprised between the 22nd and 25th parallels of latitude.	Commence near Seundah, lat. 26° 14', lon. 78° 50'; proceeds S.W. to Narwar, 25° 39', 77° 52'; S.E. to 24° 12'; N.E. to Ajeagarh, 24° 53', 80° 20'; and Kalleenjurr, in the same vicinity, and E. to Barghar, 25° 10', 81° 36'. Rises S. of the Bindyachal plateau	The lower parts are primary, overlaid by sandstone, in many places trap, or other formations of volcanic origin. The plateau, which surmounts the range, is from 10 to 12 m. wide.
Bundelcund Ranges, THREE, viz.:—			
I. BINDYACHAL			
II. PANNA			
III. BANDAIR	Separated from the Panna range by the valley of Lohargaon, rising from a platform from 10 to 20 m. wide.	Average elevation between Kuttra Pass and Lohargaon, 1,050 ft. Elevation between Lohargaon and the foot of the hills near Patteriya, about 1,200 ft. Average elevation, 1,700; on some of its undulations, amounting to 2,000 ft.	Summit an undulating platform, about ten miles wide. Where deep ravines allow examination, an enormously thick bed of sandstone is found with primary rock superincumbent, itself overlaid by volcanic rocks. Generally of sandstone, intermixed with ferruginous gravel. The basin of Lohargaon is of lias limestone. The outer limit of this hilly tract is marked by abrupt isolated hills.
RAMMAHAL HILLS	Rise about 20 m. S. of the Ganges; stretch S. and S.W. to the Vindhya range and the highlands of the Deccan. They terminate at the pass of Sikri-gali.	Of moderate elevation. Cluster on the W. of the Phalgu, one on the E. of that river, a third near Shukpoora; 700 ft. Hills towards the S. probably twice that elevation. Railway sweeps round the eastern extremity of the range.	In the E. the rock is of trap; in one place there is a conical hill, having at the top a cavity resembling the crater of an extinct volcano. A neighbouring hill sends forth smoke, luminous at night. In the W. and S.W. the rock is of quartz, or coarse jasper and flint, containing ore of iron and lead.

* The country between Sufiled-Koh and Hindoo-Koosh is hilly; breadth about 20 m. It is divided into a series of plains by cross ranges (Klyber, Kurkutch, &c.), which pass between Sufiled-Koh and the outer ranges of Hindoo-Koosh. These plains are generally barren and stony, and have a slope from E. to W. The Kabool river, which flows through them, has to make its way by narrow passages.

† Valley of Catmandoo, nearly of oval shape; length, N. to S., 12 m.; E. to W., about 10 m. Bounded on the N. and S. by stupendous mountains. To the E. and W. by others less lofty, the western end defined principally by a low steep ridge, called Naga-Arjoon, which passes close behind Sumbhoo Nath, and is backed by a more considerable one named Dhoahouk. To the eastward, the most remarkable hills are those of Ranichouk and Mahabut, but they do not reach the elevation of Phalelouk (the highest on the south), or of Sheepoori, which is by far the highest mountain. The bottom of the valley is uneven, intersected by deep ravines, and dotted throughout with little hills.

‡ The number of peaks which crown this mountain is variously stated. According to Tod, there are six, the most elevated of which is that of Gorucknath, having on its summit an area of only ten feet in diameter, and surrounded by a shrine dedicated to Gorucknath; each of the other peaks has its shrine. On a small table-land on the mountain, about 600 feet below its summit, is the ancient palace of Khengar, and numerous Jain temples.

§ Ascent from Indore (1,998 feet), gradual; descent, to the Nerbudda, steep and abrupt.

Tabulated Views of the Mountains and Passes, Table-Lands, and Rivers, &c.—continued.

Name of Range.	Extent and Position of Extremities.	Elevation above the Sea.	General Remarks.
SIRGOOLAH MOUNTAINS -	Length, 90 m.; breadth, 83 m. Lie between $22^{\circ} 34'$, $24^{\circ} 54'$, and $82^{\circ} 40'$, $84^{\circ} 6'$.	Rugged and mountainous, from 500 to 600 ft. above adjoining table-land of Chota Nagpore.	Drained by the rivers Kunher and Rhen, with its feeder the Mohan, flowing in a direction generally northerly. These rivers are mostly shallow, except during the rains, when they become rapid torrents.
PACHEKE HILLS -	Length, 103 m.; breadth, 95 m. Lie between $22^{\circ} 56'$, $23^{\circ} 54'$, $85^{\circ} 46'$, $87^{\circ} 10'$.	Imperfectly known. N. part described as marked by hills from 400 to 600 ft. About $23^{\circ} 35'$, $85^{\circ} 5'$, a mountain conjectured at from 2,500 to 3,000 ft. Near the centre of district some hills about 900 ft.	Formation generally primitive, of either granite, gneiss, or sienite. Coal has been found near Jaria, $23^{\circ} 44'$, $86^{\circ} 25'$; and iron-ore exists at a short distance. The chain unites the N. extremities of the W. and E. Ghauts, and forms the base of the triangle on which rests the table-land of S. India. By the Moguls the country to the N. was called Hindoostan, and that to the S. the Decan.
SAITTOORA MOUNTAINS -	Divides the Nerbulda from the Taptee valleys, extending from 21° and 22° , and $73^{\circ} 40'$, to 78° , when it becomes confounded with the Vindhya.	Avg. elevation, supposed, 2,500 ft. Asseerghur hill-fort, 1,200 ft. They form the northern base of the Deccanic table-land.	S. declivity towards Taptee abrupt; N. towards Nerbulda, gentle. The mountains rise into peaks, or swell into forms denoting a primitive origin. They are volcanic.
Western Ghauts, called by the natives Syadree in its N. part; and Subheri in its S. part.—MALABAR COAST.	Length, about 800 m. From about $21^{\circ} 15'$, to $73^{\circ} 45'$, and $74^{\circ} 40'$, where they terminate almost precipitously, forming the N. side of the Gap of Palgatcheri.	Avg. height, 4,000 ft. About 21° ; 2,000 ft. Mahableswhur, 18° , $73^{\circ} 43'$; 4,700 ft. Poorundher, 4,472 ft. Singhur, 4,162 ft. Hurreechundurghur, 3,894 ft. About 15° ; 1,000 ft. Towards Coorg: Bonasson Hill, 7,000 ft. Tandianmole, 5,781 ft. Papagiri, 5,682 ft.	Seaward face, though abrupt, not precipitous, but consists of a series of terraces or steps. Chasms or breaks in the range give access to the high-lands, and are denominated ghauts or passes, a name which has become generally applied to the range itself. The core is primary, inclosed by alternating strata of more recent origin. Scenery delightful and grand, displaying stupendous scarps, fearful chasms, numerous waterfalls, dense forests, and perennial verdure.
NEIGHURRY GROUP -	Length, about 50 m.; breadth, about 20 m.; area from 600 to 700 sq. m. Between $11^{\circ} 10'$ and $11^{\circ} 35'$, and $76^{\circ} 30'$ and $77^{\circ} 10'$.	Elevation from 5,000 to 8,000 ft. Dodabetta, 8,760 ft. Kudiakad, 8,502 ft. Kundah, 8,353 ft. Duvrsolabeta, 8,380 ft. Beroyabeta, 8,488 ft. Murkurti, 8,402 ft. Otacamund, lat. $10^{\circ} 50'$; 7,361 ft. General surface, an undulating table-land.	The foundation rocks are primary. Principal mineral,—iron ore. Neither calcareous nor stratified rocks, nor organic remains are found. So steep are the precipices, that in many parts a stone dropped from the edge will fall several thousand feet without striking anything. Neilgherries, from "neil," blue, and "gherries," hills; blue hills.
PALGHAT GHAUTS -	Length, about 200 m. From the Gap of Palgatcheri nearly to C. Comorin.	Elevation from 4,000 to 7,000 ft. A spacious table-land, 4,740 ft. A peaked summit, 6,000 ft. Another 7,000 ft. Varragherry mts., 5,000 to 6,000 ft. Near C. Comorin, in the extreme S., 2,000 ft. Several not measured.	The W. brow is, with little exception, abrupt; on the E. side the declivity is gradual. Such a conformation would seem to indicate a volcanic disturbance along the W. precipitous face.
EASTERN GHAUTS, along COROMANDEL COAST.	Length, about 1,000 m. From Balasore, S.W. to Ganjam; thence to Naggery, near Madras; where it joins the range which crosses the country in a northerly direction, from the W. Ghauts, N. of the Gap of Palgatcheri.	Average elevation, about 1,500 ft. Cauvery Chain, 4,000 ft. Condapilly, 1,700 ft. W. of Madras, estimated, 3,000 ft. Hill seen from the Moghalbundi, between Pt. Palmyras and Chilka Lake, appearing in irregular scattered groups, 300 to 1,200 ft.	Granite constitutes the basis of the range; and clay, hornblende, flinty and primitive slate, or crystalline limestone, forms the sides of the mountains; and the level country, as far N. as the Pennar, appears to consist of the debris, when the laterite formation covers a large surface. From the Kistnah, northward, the granite is often penetrated by trap and greenstone. To Vizagapatam and Ganjam sienite and gneiss predominate, occasionally covered by laterite.
As on Mountains, viz.— I. NAGA HILLS.	Length, about 250 m. On the S.E. border of Assam, stretches to the mountain-range forming the N.W. boundary of Burmah. Centre, about $26^{\circ} 30'$, lon. 95° .	In the Khaibund range, supposed 4,000 ft. Some peaks are almost inaccessible.	The country is a wild unexplored tract. The measures adopted by the British Government to restrain the outrages committed by the Nagas within British territory, have led to their submission.
II. DIPHALA and ABOR HILLS.	Mountains N. of Assam, inhabited by Bhootians, Duphala, and Abor tribes.	From 5,000 to 6,000 ft. above the surrounding level	The face of Assam presents an immense plain, studded with clumps of hills, rising abruptly from the general level. The mountains on the N. are composed generally of primitive rocks. Those to the S., of tertiary and metamorphic.
III. GARROW HILLS -	On the N.E. frontier of Bengal	-	Character of country, wild. The rock formation is supposed to be chiefly of gneiss, or stratified granite.
IV. COSHYA HILLS -	Estimated area, 7,290 sq. m. Between 25° and 26° , and 91° and 92° .	A confused assemblage, from 1,000 to 6,000 ft. Estimated area, 4,347 sq. m. Chirra Poonjee, 4,100 ft.	

YOMADONG, or <i>Irracan</i> Mountains.	80 m. in length from N. to S., and 40 in breadth. Extends from lat. 24° 55' to 26° 7', and from long. 91° 35' to 92° 48'. Length, about 600 m. From Munneepoot, lat. 22° 20' to C. Negrais, lat. 16°.	Coal is said to abound in the hills of Jynteah.
BURMAH MOUNTAINS -	Little known - - - - -	It is a continuation of the great mountain chain commencing at the S. of Assam, in 26° 30'; and extends S. running parallel with the river Irawaddy, and forms a natural barrier between Arracan and Ava.
TENASSERIM MOUNTAINS -	Length, about 500 m., breadth nowhere exceeds 80 m. Area, 30,000 sq. m.	Gold, silver, iron, tin, lead, antimony, and other metals, are met with. Quarries of marble are worked near Ummarapoora. Coal has been discovered on the Irawaddy.
		Coal of excellent quality has been discovered. Iron, tin, and gold are frequently met with. Country unexplored by Europeans.

MOUNTAIN PASSES on the INDIAN FRONTIERS, from the INDUS to the IRAWADDY—as far as known.—By R. MONTGOMERY MARTIN.

Name and Position.	Lat. and Lon. of Extremities; Length and Breadth.	Heights, in Feet.	General Remarks.
MOOLA or GUNDAYA—CUTCH GUNDAYA.	Lat. 28° 10', lon. 66° 12'; lat. 28° 24', lon. 67° 27'.—About 100 m.	Bapow, 5,250 ft.; Peesee Bhent, 4,600; Nurd, 2,850; Benti-Jah, 1,850; Kullar, 750 ft.	Descent, 4,650 ft., average 46 ft. per m. Water abundant. Practicable for artillery.*
BOLAN—BELOOCHISTAN -	Open spaces, connected by defiles. Lat. 29° 30', lon. 67° 40'; lat. 29° 52', lon. 67° 4'.—55 m.; ½ m. wide at entrance.	Entrance, 800 ft.; Ab-i-goorn, 2,540; crest, 5,793 ft.	Average ascent, 90 ft. per m.† Ditto.
GOMUL or GOOLAIRREE—DEH RAJAT.	Lat. 32°, lon. 70° 30'.—About 100 m.	20 m. from entrance road N.W., then 80 m. S.W., then N.W. to Ghuznee.	Winding course.‡
KHYBER—PESHAWUR -	Lat. 33° 58', lon. 71° 30'.—About 33 m.	Crest, 3,973 ft. Ali-Musjid, 2,433 ft.	Rises gradually from the E., but has a steep declivity westward.§
BAMIAN—AFGHANISTAN -	Lat. 34° 50', lon. 67° 48'.—About 1 m. wide, bounded by nearly perpendicular steep.	Bamian, 8,496 ft., over a succession of ridges from 8,000 to 15,000 ft.	Only known route over Hindoo-Koosh for artillery or wheeled carriages.¶
KOUSIAN—HINDOO-KOOSH -	Lat. 35° 37', lon. 68° 55': over principal shoulder of Hindoo-Koosh peak.—About 40 m.; narrow.	Crest, 15,000 ft.	Road rocky and uneven descent, 200 ft. per m. Three entrances¶
KHAWAK—HINDOO-KOOSH -	Lat. 35° 38', lon. 70°.—About 15 m.	Crest, 13,200 ft.	Ascent on N. side, an uniformly inclined plane.**
BUL TUL or SIUR-JI-LA—CASHMERE.	Lat. 34° 10', lon. 70° 15'	Crest, 10,500 ft.	Only pass into Cashmere practicable for an army.
BARAMULA—CASHMERE -	Lat. 34° 10', lon. 74° 30'	-	
BARA LACHA—TIBET -	Lat. 32° 44', lon. 77° 31'	-	
ROTANG—HIMALAYA -	Lat. 32° 25', lon. 77° 12'	-	
MANERUNG—HIMALAYA -	Lat. 31° 56', lon. 78° 24'	-	
CHARUNG—HIMALAYA -	Lat. 31° 24', lon. 78° 35'	-	

* In 1839, the Anglo-Indian detachment marched through it. It is preferable to the Bolan Pass in a military point of view.
† A continuous succession of ravines and gorges. The air in the lower part of the pass is in summer oppressively hot and unhealthy.
‡ Of great commercial importance. Every spring, large caravans traverse it from Hindoostan to Afghanistan.
§ Called the Key of Afghanistan. At Ali-Musjid, merely the bed of a rivulet, with precipices rising on each side at an angle of 70°. Near Lamdee Khana, a gallery 12 ft. wide; on one side a perpendicular wall, and on the other a deep precipice. It was twice forced by the British.
¶ The great commercial route from Kabul to Turkestan; the several Passes to the eastward are less frequented on account of their difficulty and their elevation.
¶ Most frequented east of Bamian; impassable for wheeled carriages.
** Scarcely frequented, yet may be considered the most practicable. Tamerlane crossed it on his march into Hindoostan.

Tabulated Views of the Mountains and Passes, Table-Lands, and Rivers, &c.—continued.

Name and Position.	Lat. and Lon. of Extremities; Length and Breadth.	Heights, in Feet.	General Remarks.
BURENDA—HIMALAYA	Lat. 31° 23', lon. 78° 12'—Length of crest, 50 paces	Crest, 15,095 ft.	Most elevated part a narrow glen, very steep.*
BULCHA—KUMAON	Lat. 30° 28', lon. 80° 14'	-	Over a high ridge extending E. and W.
NITI—KUMAON	Lat. 30° 57', lon. 79° 54'	-	Open from the end of June to October.†
KAMBACHEN—NEPAL	Lat. 27° 38', lon. 88°	Crest, 16,814; village of Niti, 11,464 ft.	Broad shelf of snow between rocky eminences.‡
CHOONJERMA—NEPAL	Lat. 27° 33', lon. 88° 1'	Crest, 15,770 ft.	Temperature, 24° at 5 p.m.
WALLANGHOON—NEPAL	Lat. 27° 52', lon. 87° 14'	Crest, 16,000 ft.	Path leading up the pass for eight miles, a narrow, stony, and steep gorge. Top, a low saddle, between two ridges of rock.
TUNKERA—SIKKIM	Lat. 27° 38', lon. 88° 56'	Crest, 16,755 ft.	Ascent, on N.W. side, gradual, over a snow-bed and glacier; descent, on S.E., steep, but grassy.
DONKIA—SIKKIM	Lat. 27° 56', lon. 88° 48'	Crest, 16,100 ft.	View of Tibet from summit.
AENG—ARRACAN	Lat. 19° 49', lon. 94° 9'—34 miles	Crest, 18,600 ft.	Average rise, 250 ft., average descent, 472 ft. per m.‡
MYTHEE—ARRACAN	Lat. 19° 14', lon. 94° 30'	Crest, 4,517; Khen-Kyomig, 3,777; Aeng, 147 ft.	Myhee village, a police station.

* Passes over the Outer Himalaya range:—Sugla, 31° 13' lat., 78° 29' lon.—elevation, 16,000 ft.; Kimlia, 31° 15', 78° 25', 17,000; Siaga, 31° 16', 78° 21', 16,000; Lumbia, 31° 16', 78° 20', 16,000; Barga, 31° 16', 78° 19', 15,000; Nulgun, 31° 19', 78° 15', 14,891; Rupin, 31° 2', 78° 10', 15,851; Nibrunig, 31° 22', 78° 10', 16,035; Gunas, 31° 21', 78° 8', 16,026; Yusu, 31° 24', 78° 4', 15,877; Sundru, 31° 24', 78° 2', 16,000; Shatul, 31° 25' lat., 77° 58' lon., 15,555 ft. In Kunawur there are fifteen passes, at elevations varying from 15,000 to 17,000 ft.

† Considered the best pass between Kumaon and Tibet, and is one of the principal channels of trade between Chinese Tartary and Hindoostan.

‡ Ascertained by Dr. Hooker, December 1848. The distance to which the voice was carried was very remarkable: he could hear distinctly every word spoken at from 300 to 400 yards off.

§ Considerable trade carried on over this pass between Ava and Arracan.

RIVERS OF BRITISH INDIA, their Source, Course, Discharge, and Length; TRIBUTARIES OR CONFLUENTS; and ESTIMATED AREA, in Square Miles, drained; Forty-nine Main Streams, having their Outlet in the Sea;

and large Tributaries having their Outlet in other Rivers.—By R. MONTGOMERY MARTIN.

Name.	Source, Course, Discharge, and Length.	Tributaries, and their Length in British Miles; and Area drained.	General Remarks.
1. GANGES.—BHAGERUTTEE at its source, and Ponda near the sea.	Gangotri, Himalaya, 1,400 ft. above the level of the sea. N.W. to Johnioi; W. and S.W., 13 m.; S.W., 36 m.; S., 15 m.; S.E., 39 m.; S., 8 m.; W., 24 m.; S.W., 15 m.; S., 130 m.; S.E. to Allahabad, E., 270 m.; E. to Sikrigalee; S.E. remainder of course into Bay of Bengal, by numerous mouths. The Ganges gives off some of its waters to form the Hoogly, and also anastomoses with the Megna.—Length, 1,514 m.	Junna, 860; Ghogra, 606; Gunduck, 450; Goomtee, 482; Sone, 465; Coosy, 325; Rangruna, 373; Mahananda, 240; Kaimnassa, 140; Koniae or Jumuna, 130; Aluknunda, 80; Bhillung, 50 m.—398,000 sq. m. drained, exclusive of Hoogly.	Navigable for river craft as far as Hurdwar, 1,100 m.; steamers ply as far as Gurnuktesur, 393 miles above Allahabad, distant from Calcutta via Delhi, 930 miles; at Cawnpore, 140 m. above Allahabad, the navigation is piced with great activity. The breadth of the Ganges at Benares varies from 1,500 to 3,000 ft. Mean discharge of water there, throughout the year, 250,000 cub. ft. per second.
2. HOOGLY	Formed by junction of Bhageruttee and Tellinghee, two branches of Ganges. S. to Calcutta; S.W. to Diamond Harbour; E. and S.W. into the sea at Saugor road-head, by an estuary 15 m. wide.—Length, 160 m., by winding of stream.	Dammoodah, 350; Dalkissore, 170; Coosy, 240; Mor. 130.—About 49,000 sq. m. drained.	Formerly navigable for a line-of-battle ship to Chandernagore; now, vessels drawing more than 17 ft., not safe in passing from Calcutta to the sea, by reason of shoals.
3. INDUS, or NILAB ("Blue River.")	Tibet, behind Kailas range, to the N. of Kailas peak, 22,000 ft. above the sea. N.W. to Dras R.; more northerly to Shy-yok; W.N.W., 115 m. to Makpon-i-Shagaron; S.S.W. and S. to Attock; a little W. of S. to confluence with Punjind; S.W. to Khyrpoor; S. to Sehwan; S.E. to Hyderabad; W. of S. to Arabian Sea, Indian Ocean.—Length, 1,800 m.	Eckung-Choo, 110; Hanle, 70; Zanskar, 150; Dras, 75; Shy-yok, 800; Shy-ghur, 70; Ghilgit; Cabool, 320; Sutlej, 850; Chenab, 765; Jhelum, 490; Ravee, 450; Punjind, 60 m.—About 390,000 sq. m. drained.	Navigable to Attock, 942 m. from sea, there from 500 to 800 ft. wide; depth, 60 ft. Breadth and depth varies much after junction with Punjind; breadth, 1 to 30 m.; depth, 12 to 186 feet.

The branches of the Brahmapootra, together with those of the Ganges, intersect Lower Bengal in such a variety of directions as to form a complete system of inland navigation.

The Bassein branch affords a passage for the largest ships for 60 miles from its mouth. No river of similar magnitude, it is stated, presents so few obstructions to navigation.

In 1846, the sanction of the Court of Directors of E. I. C. was given to the construction, at an expense of 47,500*l.*, of a dam of sufficient height to command the delta, and to supply the rich alluvial soil of which that tract is composed, with the means of constant irrigation. The experiment of navigating the Godavary by steam has been entertained by the Madras government, and means for carrying it into effect are under consideration.

The Kistnah, in consequence of the rapid declivity of its water-way and rockiness of its channel, cannot be navigated by small craft, even for short distances. An extensive system of irrigation in connection with this river is now in progress, and has been estimated to cost £150,000.

The river, notwithstanding the great width of its bed in some parts of its upper course, appears to be scarcely anywhere continuously navigable for any considerable distance, in consequence of the innumerable basaltic rocks scattered over its channel.

Bed full of micaceous quartzose rock; banks low, and little above the surrounding level.

The surface of Kattywar peninsula is generally undulating, with low ridges of hills, running in irregular directions. The land in the middlemost part is the highest, and here all the rivers take their rise, disembodying themselves respectively into the Ruun, the Gulf of Cutch, and the Gulf of Cambay.

It can scarcely be deemed a navigable stream, as at Surat, 17 m. from its mouth, it is fordable when the tide is out. It is said to be navigable in the dry season for boats of light draught, through Candeish. The mouth is obstructed by numerous sands and a bar.

Navigable for 15 m. from its mouth. At 50 m. up 100 yds. wide; bed, 400 yds.; depth, 1ft.

Sanpoo, 1,000; Dihong, 140; Noh-Dihong, 100; Boree Dehing, 150; Scobu-Sheeree, 180; Monas, 189; Bagnee, 150; Guddala, 160; Durlah, 148; Teesta, 313; Barak, 200; Goomtee, 140 m. In lat. 25° 10', lon. 85° 43', it gives off the Koniae.—305,000 sq. m. drained.

Khyendwen, 470; Shwely, 180; Moo, 125 m.—164,000 sq. m. drained.

Wein-Gunga, 439; Manjera, 330; Poorna, 160; Paira, 105; Inderaotee, 140 m.—130,000 sq. m. drained.

N.B.—Where no tributaries or area drained are mentioned, it is because, as regards the former, there are none of note; and the other is small, and imperfectly defined.

Beemah, 510; Toongabudra, 325; Gutpurba, 160; Mulpurba, 160; Warna, 80; Dindee, 110; Peedda Wag, 70 m.—110,000 sq. m. drained.

Herrun; Samarsee, 60; Suktha, 70 m.—About 60,000 sq. m. drained.

Rairee, 88; Sokree, 130 m.—About 19,000 sq. m. drained.

About 17,000 sq. m. drained.

Area of peninsula, 18,950 m.

Poorna, 160; Girna, 160; Boree, 90; Panjar, 92 m.—About 25,000 sq. m. drained.

Amass, 90; Manchun, 55 m. - - -

N.E. extremity of Himalaya range; lat. 28° 30', lon. 97° 20'. S.W., 63 m.; W., S.W., S.E., S.W., and E. to Bay of Bengal, through three mouths, Hattia, Ganges, and Shebazzpoor.—Length, 933 m.

E. extremity of Himalaya, lat. 28° 5' lon. 97° 58'. Nearly N. to S. through Burnah, and the recently acquired British territory of Pegu; into the Bay of Bengal, by numerous mouths.—Length, 1,060 m.

E. declivity of W. Ghauts, near Nassik, 3,000 ft. above the sea. S.E., 200 m.; E. 100 m.; S.E., 85 m.; E., 170 m.; S.E., 200 m.; into Bay of Bengal, by three mouths.—Length, 998 m.

N.B.—Where no tributaries or area drained are mentioned, it is because, as regards the former, there are none of note; and the other is small, and imperfectly defined.

Mahableshwur table-land, Deccan, lat. 18° 1', lon. 73° 41'; 4,500 ft. above the sea. S.E., 145 m.; N.E., 60 m.; S.E., 105 m.; N.E., 180 m.; S.E. to Chentapilly; S.E. 70 m. further; then, parting into two arms, one flowing S.E. 30 m., the other S. 25 m. into Bay of Bengal. Length, 800 m.

Amrantaak, a jungly table-land, lat. 22° 39', lon. 81° 49'; from 3,500 to 5,000 ft. above the sea. Nearly due W., with occasional bends, to Gulf of Cambay, by a wide estuary.—Length, 801 m.

Arravulli Mts., near Pokur, lat. 26° 37', lon. 74° 46'. S.W., nearly parallel with Arravulli range, into Ruun of Cutch, by two mouths, principal in lat. 24° 42', lon. 71° 11'.—Length, 320 m.

In a cluster of summits in the Arravulli range, lat. 24° 47', lon. 73° 28'. S.W. into Ruun of Cutch, by several small channels.—Length, 180 m.

Kattywar, lat. 22° 10', lon. 71° 18'. S.W., into Indian Ocean, near Poorbunder, lat. 21° 38', lon. 69° 46'.—Length, 135 m.

Kattywar, lat. 21° 31', lon. 70° 50'. Circuitous, but generally W., into backwater, behind Poorbunder.—Length, 75 m.

Kattywar, lat. 22° 10', lon. 76° 31'. N.W., into Gulf of Cutch.—Length, 60 m.

Kattywar, lat. 21° 15', lon. 70° 25'. E. into Gulf of Cambay.—Length 60 m.

Kattywar, lat. 22°, lon. 71° 20'. E. into Gulf of Cambay.—Length, 60 m.

Kattywar, lat. 22° 18', lon. 71° 30'. E., into Gulf of Cambay.—Length 88 m.

Sauroopora Mts., near Mooltae, lat. 21° 46', lon. 78° 21'. Generally W., to Gulf of Cambay.—Length, 441 m.

Vindhya Mts., lat. 22° 32', lon. 75° 5'; 1,850 ft. above the sea. N.W., 145 m.; W. 25 m.; S.W., 180 m., into Gulf of Cambay.—Length, 350 m.

4. BRAHMAPOOTRA — MEGNA, near the sea.

5. IRAWADEY - - -

6. GODAVERY - - -

7. KISTNAH, or KRISHNA - - -

8. NERBUDDA - - -

9. LOONEE - - -

10. BUNNAS - - -

11. BHADER - - -

12. OOGAL - - -

13. AJEE - - -

14. SETROONTEE - - -

15. GEYLA - - -

16. GOOMA - - -

17. TAPTEE - - -

18. MYTHE, or MAKE - - -

Western side of India.

Tabulated View of the Mountains and Passes, Table-Lands, and Rivers, &c.—*continued*.

Name.	Source, Course, Discharge, and Length.	Tributaries, and their Length in British Miles ; and Area drained.	General Remarks.
19. WASHISTEE	W. Ghauts, lat. 17° 50', lon. 73° 36'. S.—W.—S.E.—W., into Indian Ocean.—Length, 55 m.	No tributaries of note; area drained small, and imperfectly defined.	Though rugged, the Concan have many fertile valleys, each of which, for the most part, affords a passage for a small river or torrent, holding a westerly course from the Ghauts to Indian Ocean. The most fertile spots are on the banks of streams. The rivers abound with fish, but are also frequented by alligators. The Savitree is navigable as far as Mhat, 30 m. from its mouth.
20. SAVITREE	W. Ghauts, lat. 18° 17', lon. 73° 27'. S.E.—W., into Indian Ocean.—Length, 70 m.		
21. TAUNSA	W. Ghauts, lat. 19° 41', lon. 73° 29'. S.W.—W.—W.S.W.—W., into Indian Ocean.—Length, 58 m.		
22. SOORLA	W. Ghauts, lat. 19° 54', lon. 73° 24'. W.—S., into Indian Ocean.—Length, 68 m.		
23. DANGUNGA	W. Ghauts, lat. 20° 11', lon. 73° 42'. W.—N.—W.N.W., into Indian Ocean.—Length, 58 m.		
24. PAR	W. Ghauts, lat. 20° 30', lon. 73° 43'. W., into Indian Ocean.—Length, 50 m.	No tributaries of any extent; and area drained imperfectly. Known.	Nothing worthy note.
25. EEB	W. Ghauts, lat. 20° 50', lon. 73° 42'. W., into Indian Ocean.—Length, 70 m.		
26. POORNA	W. Ghauts, lat. 20° 59', lon. 73° 44'. W., into the Indian Ocean.—Length, 60 m.		
27. GUNGAVALY	Plain of Dharwar, lat. 15° 45', lon. 75° 10'. S.—S.W., into Indian Ocean.—Length, 100 m.		
28. CAULY NUDDEE	Plain of Dharwar, lat. 15° 33', lon. 74° 47'. S., 61 m.; W., 30 m., into Indian Ocean.—Length, 91 m.		
29. PONANY	Coimbatore, lat. 10° 19', lon. 77° 6'. N.W.—W., into Indian Ocean.—Length, 128 m.	-	Navigated by the largest pátimars for 20 m. From Mullipoor to Sheda-begur, rendered easy by uniformity of channel. Navigable for canoes as far as Palghat, 63 m. from the sea.
30. VYCAH	Madura, lat. 10° 17', lon. 77° 37'. S.E., into Bay of Bengal.—Length, 130 m.		
31. VELLAUR	Base of E. Ghauts, lat. 10° 28', lon. 78° 21'. E., into Gulf of Manaar.—Length, 80 m.		
32. GOONDAH	Vellanuddhee hills, Madura. S.E., into Gulf of Manaar.—Length, 95 m.		
33. CAUVERY	Coorg, lat. 12° 25', lon. 75° 34'. E., 33 m.; N.E., 28 m.; S.E., 95 m.; N.E.—S.E., 47 m.; S., 47 m.; S.E.—E.—N.E., into Bay of Bengal. Length, 472 m.		
34. VELLAUR	Base of E. Ghauts. E., into Bay of Bengal, near Porto Novo Mysore table-land, lat. 13° 20', lon. 78° 2'. S.E., 55 m.; E., 87 m.; S.E., 48 m., into Bay of Bengal.—Length, about 220 m.	Magnummurchy, 40; Bhovani, 120; Noyel, 95 m.; Hennavutti; Leechman-Tceet; Cubbany; Shimska; Arkavati; Ambrawutti. — About 36,000 sq. m. drained.	Navigable for craft through the low country during the inundation. Gungan Zooka fall, 370 ft. Burr Zooka, 460 ft.
35. PALAR	Mysore table-land, lat. 13° 26', lon. 73° 11'. N.E., to Bay of Bengal.—Length, 99 m.		
36. SOORNAHOOKY	Nundidroog table-land, lat. 13° 23', lon. 77° 43'. N.W. 30 m.; N., 95 m.; E., 230 m., into Bay of Bengal.—Length, 355 m.		
37. PENNAR.—(N.)	N. Nundidroog table-land, lat. 13° 39', lon. 77° 45'. S. to Mootankalli, 55 m.; S.E., 190 m., into Bay of Bengal, a mile N. of Ft. David.—Length, 245 m.		
38. PENNAR.—(S.)	Lat. 15° 40', lon. 78° 49'. Very circuitous; E.—N.E.—S.S.E.—S.E., into Bay of Nizamputnam.—Length, 155 m.		
39. GUNDLACAMA	Table-land of Orissa, lat. 19° 39', lon. 83° 27'. S., into Bay of Bengal.—Length, 130 m.	Pony, 40; Sheyaroo, 90 m.	The river is small at its mouth, and admits only coasting craft. The entrance of the Palar, near Sadras, is contracted by a bar or narrow ridge of sand, inside of which the river becomes of considerable width.
40. BONDSORA	Table-land of Orissa, near source of Bondsora. S., into Bay of Bengal.—Length, 133 m.	Chitravutti, 107; Paupugnee, 130; Chittair, 75 m.	
41. LALGLAH		-	

42. MAHANUDDY	-	-	Native state of Nowagudda, lat. 20° 20', lon. 82° W., 30 m.; N.E., 110 m.; S.E., 300 m., to Bay of Bengal by numerous mouths. —Length 520 m.	Hutsoo, 130; Aurag, 117; Tell, 130; Bang Nuddee, 60 m.—About 46,000 sq. m. drained.	From July to February, navigable for boats for 460 m.
43. BRAHMINY	-	-	Palamow table-land, lat. 23° 25', lon. 84° 13'. S.—E.—S.E., into Bay of Bengal, near Pt. Palmyras.—Length, 410 m.	Sunk, 95 m.—About 26,000 sq. m. are drained by Brahminy and Byturnee.	Sacred in the Hindoo mythology, more especially at its source.
44. BYTURNEE	-	-	Near Lohardugga, lat. 23° 29', lon. 84° 55'. N.—E.—S.—S.W.—S.E.—E., into Bay of Bengal, by Dhumrah river.—Length, 345 m.		
45. SOORUNREKA (En. India)	-	-	Chota Nagpore table-land. N.E.—E.—S.E.—S.—S.E.—E.—S.E.—S., into Bay of Bengal.—Length, 280 m.	Karow, 80 m.—About 12,000 sq. m. drained.	Navigable within a few miles of Arracan town, for ships of 250 tons burden. 90 m. above Akyab, the stream is narrow, and navigable only for canoes. 10 m. broad at its mouth. It is a navigable river. For about 190 m. forms the boundary between the Tenasserim provinces and Pegu. It enters the British dominions about lat. 18° 40'.
46. ARRACAN, or COLADYNE	-	-	Near Blue Mountain, Youmadoung range, lat. 22° 27', lon. 92° 51'. S., into Combermere Bay.—Length, 160 m.	Myoo; Lemyo - - - - -	
47. SITANG	-	-	Burmah, lat. 21° 40', lon. 96° 50'. S., into Gulf of Martaban.—Length, 420 m.	Yennan, 115; Saar, 120 m. - - - - -	
48. SALUEN, or SALWEEN	-	-	N. of Yunnan province, China; about lat. 27° 10', lon. 98° 57'. S., into Gulf of Martaban, by two mouths, formed by Pelewgewen Island.—Length, 430 m.	Attaran or Weings, 110; Thoung-yin Myit, 225; Meloun, 90 m.	
49. TENASSERIM	-	-	Supposed to lie in the mountains to the N.E. of Tavoy, between the 14th and 15th parallel of latitude. S. to Metamio, lat. 14° 13'; S.E. and S. to Tenasserim town; N.W. into Bay of Bengal, by two mouths.—Length, 270 m.	Baing-Khiaung; Little Tenasserim; Kamaun Khiaung.	Upper part of course through a wild and uncultivated tract, sometimes between high and perpendicular banks. It afterwards opens on extensive plains. On many parts of its banks exist forests of fine teak, and the valuable sappan wood. In consequence of its bed being obstructed by shoals and rocks, navigation is not practicable for craft above Delhi, except by means of the canal. Its banks are lofty and precipitous, and ridges of rock in many places advance into the stream, combining with its general shallowness and strong current to render navigation extremely difficult and dangerous. Butter describes it as navigable for the largest class of boats in all seasons.
JUMNA, tributary to GANGES	-	-	Jumnoutri, Himalaya, lat. 31° lon. 78° 32'; 10,849 ft. above the sea. S.W.—S.E., to Ganges, at Allahabad.—Length, 860 m.	Tonse or Supin, about 100; Hindan, about 160; Hansoutee, 99; Bangunga, 220; Chumbul, 570; Sindie, 260; Betwa, 360; Cane, 230; Baghin Nuddee, 90; Seyngur, 210; Urrund Nuddee, 245 m.—About 105,000 sq. m. drained.	In the rainy season, boats of 1,000 or 1,200 maunds (40 tons) burthen, are sometimes seen proceeding to Lucknow.
Ghogra, tributary to GANGES	-	-	N. of Kumaon, lat. 30° 28', lon. 80° 40', probably between 17,000 and 18,000 ft. S.E., 33 m.; S.W., 70 m.; S.E., 12 m.; S., 30 m.; S., 23 m. further; S.E., to Ganges, near Chupra.—Length, 606 m.	Raptee, 134; Kurnalli, 222; Bhyrvee, 70; Dhauli, 45; Goringunga, 60 m.—About 49,000 sq. m. drained.	The navigation of the river is not considered available for purposes of important utility higher than Daudnagar, 60 m. from the confluence with the Ganges.
GOOMTEE, tributary to GANGES	-	-	In a small lake or morass, 19 m. E. of the town of Pillebhet. Lat. 28° 35', lon. 80° 10'; 520 ft. above the sea. S.—S.E., into Ganges, 30 m. below Benares.—Length, 482 m.		Though navigable continuously through its whole course downwards from Bhelaunji, there are in the part of its channel nearer that place many rapids and passes, where, the course being obstructed by rocks, navigation becomes difficult and dangerous.
SONE, tributary to GANGES	-	-	Amarkantak table land, lat. 22° 41', lon. 82° 7'; from 3,500 to 5,000 ft. above the sea. N., 30 m.; N.W., 80 m., N., 40 m.; N.E., 125 m.; E., 47 m.; N.E., into the Ganges, 10 m. above Dinapoor.—Length, 465 m.	Koel, 140; Kunher, 130; Johila, 100 m.—Including the Phalgu and other rivers falling into the Ganges above Rajmahal, about 42,000 sq. m. drained.	It does not appear to be used for navigation, which is probably incompatible with the average declivity of its bed (2 ft. 5 in. per m.), and still more so with the general rugged and rocky character of its channel. Its average volume of water is so considerable, that on its junction it has been known to raise the united stream 7 or 8 feet in 12 hours.
GUNDUCK, tributary to GANGES	-	-	Near Dhawalagiri peak, Himalaya. S.—S.E.—S.W.—S.E., into Ganges, near Patna.—Length, 407 m.	Trisula-gunga, 100; Marachangdi, 100; Naling, 110 m.—About 40,000 sq. m. drained.	Fordable at Moradabad, at 15 m. below confluence with Kosee; but not usually fordable below Jellalabad.
CHUMBUL, tributary to JUNNA	-	-	Malwah, lat. 22° 26', lon. 75° 45', 8 or 9 m. S.W. from Mhow, which is 2,019 ft. above the sea. It rises in the cluster called Janapava. N., 105 m.; N.W., 6 m.; S.E., 10 m.; N.E., 23 m.; N.W., 25 m.; N. to junction with Kallee Sind; N.E., 145 m.; S.E., 78 m., to Jumna.—Length, 570 m., described in a form nearly semicircular, the diameter being only 330 m.	Chumbela, 70; Seepira, 120; Parbutty, 220; Kallee Sindie, 225; Banas, 320; Chota Kallee Sindie, 104 m.—About 56,000 sq. m. drained.	
RANGUNGA, tributary to GANGES	-	-	Kumaon, lat. 30° 6', lon. 79° 20'; about 7,144 ft. above the sea. S.E., 20 m.; S.W., 70 m.; S. to Moradabad—S.E.—S., into Ganges.—Length, 373 m.	Kosee, 150; Gurra, 240 m. - - - - -	
Coosy, tributary to GANGES	-	-	Himalaya Mountains, lat. 28° 25', lon. 86° 11'. S.W.—S.E.—S.—E.—S.E.—S., into Ganges.—Length, 325 m.	Arun, 310; Tambur, 95; Gogaree, 235; Dud Coosy, 50; Tiljuga, 40 m.—46,000 sq. m. dr.	Where narrowest, and when lowest, stream, 1,200 ft. wide and 15 ft. deep. It is larger than the Jumna or the Ghogra.

Tabulated Views of the Mountains and Passes, Table-Lands, and Rivers, &c.—continued.

Name.	Source, Course, Discharge, and Length.	Tributaries, and their Length in British Miles, and Area drained.	General Remarks.
MAHANANDA, tributary to GANGES.	Near Darjeeling, in the Sikkim hills, lat. 26° 57', lon. 88° 20'. S., 40 m.; S.W., 60 m.; S.E., 50 m.; S., 20 m.; S.E., 40 m.; S., 30 m.—Length, 240 m.	- - - - -	Navigable during the dry season for craft of 8 tons as far as Kishengunge, for those of much larger burthen during the rains.
KARUNASSA, tributary to GANGES.	In the Kymore range, lat. 24° 38', lon. 83° 11'. N.—N.W., into the Ganges, near Ghazee-pore.—Length, 140 m.	- - - - -	
TONS, tributary to GANGES.	Lat. 24°, lon. 80° 30'. N.W.—E.N.E.—N., into the Ganges, a few miles below Allahabad.—Length, 165 m.	Satni, Behar, Mahana, Belun, and Scoti.—Including small streams, 13,000 sq. m. drained.	
ALUKNUNDA, tributary to GANGES.	Lat. 30° 33', lon. 79° 38'. N.W.—S.W.—W.—S.W., into the Bhageeruttee, at Deoprayag.—Length, 80 m.	Doulee, 32; Vishnuganga, 25; Mundakni, 32; Pindur, 60 m.	At confluence with Bhageeruttee, 142 ft. broad; rises 46 ft. during the melting of the snow.
BHILLUNG, tributary to GANGES.	Lat. 30° 46', lon. 78° 55'. S.W., into the Bhageeruttee.—Length, 50 m.	- - - - -	Between 60 and 70 ft. wide in the beginning of May, 5 m. from its mouth.
DAMMOODAH, tributary to HOOGLY.	Ranghur district, lat. 23° 55', lon. 84° 53'. E. and S.E., to Burdwan; S., to Diamond Harbour.—Length, 350 m.	Barrachur, 155 m. - - - - -	Crossed by a ferry 50 m. above its mouth. At Ranee-gune, 135 m. from mouth, 500 yds. wide, fordable, with a rapid current about 1 ft. deep in December.
COOSRY, tributary to HOOGLY.	Ranghur district, lat. 23° 35', lon. 85° 58'. Circuitous, but generally S.E., into Hoogly.—Length, 240 m.	Comaree - - - - -	It is crossed at Amedungghur, 80 m. from source, and at Kollaghat, 41 m. from mouth, by fords during the dry season, and ferries during the rains.
DAKISSORE, tributary to HOOGLY.	Pachete district, lat. 23° 30', lon. 86° 34'. S.E.—S.—S.E., into Hoogly at Diamond Harbour.—Length, 170 m.	- - - - -	Crossed at Bancoora, 50 m. from source, and at Jahanabad, by means of fords.
SHY-YOK, tributary to INDUS.	Near Kara-korum Pass. S.E.—N.W., into Indus, near Iskardo.—Length, 300 m.	Chang-Chemo, 58; Nubra, 66 m.	
CABUL, tributary to INDUS.	Lat. 34° 15', lon. 68° 10', near Sir-i-Chusma, in Afghanistan; elevation, 8,400 ft. Generally E., through the valley of Cabul, and plains of Jellalabad and Peshawur, into the Indus.—Length, about 320 m.	Punchshir, 120; Tagao, 80; Alishang, 120; Soorkh-Rood, 70; Kooner, 230; Suwat, 150 m.—About 42,000 sq. m. drained.	Not navigable along the N. base of Khyber Mts. except on rafts and hides. Navigable for boats of 40 or 50 tons to Dobundee.
ZANSKAR, tributary to INDUS.	N. declivity of Bara-Lacha Pass, lat. 32° 47', lon. 77° 33'. N.W.—W.—N.W.—N.E.—N.W.—N.E., into the Indus, a few miles below Le.—Length, 150 m.	Trarap, 42; Zingchan-Tokpo, 22 m.	
SUTLEJ, tributary to INDUS.	Remote sources, Lakes Manasarwar and Rahwan Hrad, lat. 30° 8', lon. 81° 53'; 15,200 ft. above the sea. N.W., 180 m.; S.W. through Bussahir; W. to junction with Beas; S.W. to Punjind.—Length, 550 m., to junction with Beas; 300 m. farther to Punjind; total, 850 m.	Spiti, 120; Buspa, 52; Beas, 290 m.—About 29,000 sq. m., or, including Ghara and Beas, about 65,000 sq. m. drained.	At Roopur, 30 ft. deep, and more than 500 yds. wide. Navigable as far as Filoor in all seasons, for vessels of 10 or 12 tons burthen.
BEAS, tributary to SUTLEJ.	On S. verge of Rotang Pass, lat. 32° 24', lon. 77° 11'; 13,200 ft. above the sea. S., 80 m.; W., 50 m.; then a wide sweep to N.W. for 80 m.; S., 80 m., to Sutlej, at Endressa.—Length, 290 m.	Parbati; Sainj, 88; Gomati, 55 m.; Ul; Gaj.—About 10,000 sq. m. drained.	
CHENAB, tributary to INDUS.	Near Bara-Lacha Pass, lat. 32° 48', lon. 77° 27'. N.W. to Murum-urduwan; S.W. to confluence with Jhelum, thence S.W. to Ghara, or continuation of Sutlej.—Length, 605 m. to Jhelum, 765 m. to Ghara.	Suru-Bhagar, 44; Murumurdwan, 86; Dharh, 56 m.—About 21,000; including Jhelum, 50,000; and with Ravce, 72,000 sq. m. drained.	Becomes navigable for timber rafts at Aknur. Descends at the average rate of 40 ft. per m. for the first 200 m. Estimated elevation at Kishtwar, 5,000 ft.
JHELUM, tributary to CHENAB.	The Lidur, in N.E. mountains of Cashmere, near Shesha Nag. Through valley of Cashmere, and into Punjab by Baramulla gorge; S. to Chenab confluence, in lat. 30° 10', lon. 79° 9'.—Length, 409 m.	Lidur, 50; Vishnau, 44; Sindie, 72; Lolab, 44; Kishengunga, 140; Kunhar, 100; Pirpanjal, 115 m.—About 280,000 sq. m. drained.	Navigable for 70 m. through Cashmere. Navigable from the Indus to the town of Ohind.
RAVEE, tributary to CHENAB.	Lat. 32° 26', lon. 77°, in the Pirpanjal, or Mid-Himalaya range, to the W. of Rotang Pass. S.W., about 40 m.; W. to Lahore; S.W. to junction with Chenab.—Length, 450 m.	Nye, 20; Sana, 36; Chakki, 50 m.—About 22,000 sq. m. drained.	Tortuous course; fordable in most places for eight months of the year.

SANKI-SANPOO, tributary to BRAHMAPOOTRA.	N. face of Himalayas, lat. $30^{\circ} 25'$, lon. $82^{\circ} 5'$. E., winding its way through Tibet, and washing the borders of the territory of Lassa. It then turns suddenly S., and falls into the Brahmapootra, under the name of Dihong.—Length, about 1,000 m.	Sanki-Sanpoo, Niamtsion, Zangtsiou, Lalee Nuddee.	
TYESTA, tributary to BRAHMAPOOTRA.	About lat. $27^{\circ} 59'$, lon. $88^{\circ} 50'$. S.—S.E., into Brahmapootra.—Length, 333 m.	Lachong, 23; Rungbo, 22; Rungeet, 23 m.	Navigable for craft of 6 or 7 tons as far up as Puharpoo, 15 m. beyond the divergence of the Attree.
BABAKI, tributary to BRAHMAPOOTRA.	It is an offset from the Jeree, which leaves in lat. $24^{\circ} 43'$, lon. $93^{\circ} 13'$. W. through Cachar and Silhet; S.W., into Megna.—Length, 200 m.	- - - - -	Banks low and marshy along the valley of the Cachar.
MONAS, tributary to BRAHMAPOOTRA.	Himalaya range, lat. $28^{\circ} 20'$, lon. $91^{\circ} 18'$. S., 40 m.; S.W., 110 m.; S.W., into Brahmapootra.—Length, 189 m.	Deemree, of greater length than itself.	
KHYENDVEN, tributary to IRRAWADDY.	Burmah, lat. $26^{\circ} 28'$, lon. $96^{\circ} 54'$. Generally S., into Iraraddy, near the town of Anyemmyo.—Length, 470 m.	Myitia Khyoung, 170 m.	
WEIN-GUNGA, OF PRENHETA, tributary to GODAVERY.	Mahadeo Mountains, lat. $23^{\circ} 25'$, lon. $79^{\circ} 8'$. E., 80 m.; S., 34 m.; S., 25 m.; S.W., 80 m.; S., 100 m.; into Godavery.—Length, 439 m.	Pench Nuddee, 150; Kanhan Nuddee, 130 m.— —About 21,000 sq. m. drained, exclusive of Payne-Gunga and Wurda.	Elevation at Bundara, lat. $21^{\circ} 12'$; 872 ft. above the sea.
WURDA, tributary to WEIN-GUNGA.	Saunpoora Mountains, lat. $21^{\circ} 44'$, lon. $78^{\circ} 23'$. Generally N.W. to S.E.—Length, about 250 m.	Payne-Gunga, 320 m.—About 8,000 sq. m. drained.	Forable, except at the height of the rains; then navigable for 100 m. above its mouth.
PAYNE-GUNGA, tributary to WEIN-GUNGA.	Lat. $20^{\circ} 32'$, lon. $76^{\circ} 4'$, in Candeish. Very circuitous, but generally E., into Wurda.—Length, 320 m.	Araun, 105; Koon, 65 m.—About 8,000 sq. m. drained.	
MANJERA, tributary to GODAVERY.	Lat. $18^{\circ} 44'$, lon. $75^{\circ} 30'$. S.E., S.W., into Godavery.—Length, 330 m.	Thairnya, 95; Narinja, 75; Munnada, 100 m.— About 11,000 sq. m. drained.	
BEEMAH, tributary to KISTNAH.	Lat. $19^{\circ} 5'$, lon. $73^{\circ} 33'$, in the table-land of the district of Poona; 3,090 ft. above the sea. S.E. into Kistnah.—Length, 510 m.	Goor, 100; Neera, 120; Seena, 170; Tandoor, 85 m.	
TOONGABUDRA, tributary to KISTNAH.	Lat. 14° , lon. $75^{\circ} 43'$, junction of Toonga and Budra rivers. N.—N.E., into Kistnah.—Length, 325 m.	Chinna Hugry; Humdry, 225 m.; Wurda.—About 28,000 sq. m. drained.	Rocky obstacles to navigation in upper part of course. Fine teak forests on banks.
POORNAH, tributary to TAPTEE.	Lat. $21^{\circ} 35'$, lon. $77^{\circ} 41'$. S., 65 m.; W., 25 m.; into the Taptee.—Length, 160 m.		
GIRNA, tributary to TAPTEE.	E. slope of W. Ghauts, lat. $20^{\circ} 37'$, lon. $73^{\circ} 25'$. E., 120 m.; N., 50 m.; into the Taptee.—Length, 160 m.		
BHOVANI, tributary to CAUVERY.	Among the Kundah group, lat. $11^{\circ} 15'$, lon. $76^{\circ} 4'$. E. into Cauvery.—Length, 120 m.		
NOVEL, tributary to CAUVERY.	E. slope of W. Ghauts, lat. $10^{\circ} 59'$, lon. $76^{\circ} 44'$. E., into Cauvery.—Length, 93 m.		
HUTSOO, tributary to MAHANUDDY.	Lat. $23^{\circ} 18'$, lon. $82^{\circ} 32'$. S., into Mahanuddy.—Length, 130 m.		
T'ELL, tributary to MAHANUDDY.	Lat. $19^{\circ} 54'$, lon. $82^{\circ} 41'$. N.W., into Mahanuddy.—Length, 130 m.		

NOTE.—Of the above-named rivers, 49 main streams flow to the sea; the chief tributaries to these number 210; of which 30 flow for 200 m. and upwards; 63 have a course of 100 to 200 m.; and the remainder under 100 m.

Tabulated View of Rivers in Afghanistan, and in the Countries adjacent to India on the North-west, so far as known.—By R. MONTGOMERY MARTIN.

Name and Length.	Source, Course, and Discharge.	Tributaries or Confluents, and their Length in English Miles.	General Remarks.
HELMUND.—650 miles	Pughman range, lat. $34^{\circ} 40'$, lon. $68^{\circ} 2'$; at an elevation of 10,076 ft. above the sea. Westerly; south-westerly to Pullaluk; north-westerly; in the Hamoon marshy lake, and that of Duk-i-Teer, by numerous channels.	At 25 m. below Girishk receives the Urgundab, 250 m.; Turnak.	At Girishk, 350 m. from source; banks about 1,000 yards apart; in spring spreads beyond these limits; depth 10 or 12 ft., with a rapid current. At Pullaluk it was crossed by Christie, who found it, at the end of March, 400 yards wide, and very deep. In April the water (which is briny) is 7 or 8 yards wide, and 2 ft. deep. It is crossed on the route from Shawl to Kandahar.
LORAH.—About 80 miles	Shawl table-land, lat. $39^{\circ} 49'$, lon. $67^{\circ} 20'$. South-westerly, until lost in the sands of the desert of Khorasan.	- - - - -	

Tabulated Views of the Mountains and Passes, Table-Lands, and Rivers, & c.—*continued*.

Name and Length.	Source, Course, and Discharge.	Tributaries or Confluents, and their Length in English Miles.	General Remarks.
Koonpooz.—About 800 miles	Valley of Bamian, about lat. $31^{\circ} 52'$, lon. $67^{\circ} 40'$. Easterly; northerly; north-easterly; northerly; and north-westerly; into the Amoo or Jinoon River.	Inderaub, 65; and Khanah-i-bad, 90 m.	
Herr Rood, or Hurr.—About 600 miles.	Huzareh Mountains, lat. $34^{\circ} 50'$, lon. $66^{\circ} 20'$; 9,500 ft. above the sea. Generally westerly to Herat, where it turns north-westerly, forming a junction with the Moorghaub; the united stream is ultimately lost in the desert of Khorasan.	Sir-i-Jungle, 90 m.	At Herat, it was formerly crossed by a brick bridge, but three out of thirty-three arches being swept away, communication is intercepted in time of inundation. It is remarkable for the purity of its water.
Poorallee.—100 miles -	Jhalawan province, about lat. $27^{\circ} 23'$, lon. $66^{\circ} 21'$. Southerly, through Lus province into the Indian Ocean, in lat. $25^{\circ} 23'$, lon. $66^{\circ} 20'$; near Sonmeanee.		From the bund N. of Lyaree, the river has no bed; as it fills, during the rains, the bund is swept away, and the water inundates the plain, which is here about 5 m. broad.
Ghuznee.—About 60 miles -	Huzareh Mountains, about lat. $33^{\circ} 50'$, lon. $68^{\circ} 20'$. Generally southerly, as far as lat. 33° ; afterwards south-westerly; into Lake Abistada, in lat. $32^{\circ} 42'$, lon. $68^{\circ} 3'$.	N.B.—The tributaries of these rivers, in the countries adjacent to India, are as yet very imperfectly known,—as indeed are also the origin and courses of the rivers themselves, or the countries through which they flow.	
Bolan.—About 70 miles -	Sir-i-Bolan, Bolan Pass, lat. $29^{\circ} 51'$, lon. $67^{\circ} 8'$; 4,494 ft. above sea. Remarkably sinuous, but generally south-easterly; from a junction with the Nari River.		Liable to inundations; and as its bed, in some parts, occupies the whole breadth of the ravine, travellers are frequently overtaken by the torrent. Falls 3,751 ft. in 50 m., from source to Dadur.
Moola.—About 150 miles -	A few miles S. of Kelat, in Beloochistan. South easterly, about 80 miles; north-easterly; and easterly; ultimately absorbed in the desert of Shikarpore.		The Moola or Gundava Pass winds along its course.
Urgundae.—250 miles -	Huzareh Mountains, about lat. 33° , lon. 67° . South-westerly to 25 m. past Kandahar; westerly remainder of course,—falls into the Helmund River.	Turnak - - - - -	Where crossed 12 m. from Kandahar, it is, ordinarily, about 40 yards wide, from 2 to 3 ft. deep, and fordable; but in inundations, becomes much increased. Greater part of its water drawn off to fertilize the country.
Gomul.—About 160 miles -	Afghanistan, about lat. 35° , lon. $69^{\circ} 6'$, at the foot of an offshoot from Sufiled-Koh. S.; W.; and a little E. of S. to Goolkuts; thence E., N.E., and S.E., until absorbed by the sands of the Daman.	Zhobe, about 170 m	Its bed for a great distance forms the Goolaire Pass, or great middle route from Hindoostan to Khorasan, by Dera Ismael Khan and Ghuznee: crosses the Sulliman range, lat. 32° .

TABLE-LANDS OF BRITISH INDIA—their Extent, Height, &c.—By R. MONTGOMERY MARTIN.

Name.	Locality.	Elevation, in Feet.	General Remarks.
CENTRAL INDIA, including OODEYPORE, MALWAH, BHOPAL, BUNDELCUND, and SHAHABAD.	Extends by the Aravulli, Dongurpoor, Vindhya, Bindyachal, Panna, and Bandair ranges,— 73° to 84° ; about 700 m. long; breadth very various,—greatest from Amjhera to Ajmeer, 250 m.; from Mhow to Mokundurra, 150 m.; at Saugor and Dumoh, 75 m.; afterwards very narrow.	Highest towards S. and W.; average of Oodeypore, 2,000 ft. Malwah, 1,500 to 2,000 ft. Bhopal, 2,000 ft. Bundelcund, about 1,000 ft. Shahabad, 700 ft. Plain of Ajmere, 2,000 ft. Oodeypore town, $24^{\circ} 37'$, $73^{\circ} 49'$; 2,064 ft.—slope to N.E., Banas River flowing in that direction; gradual fall also to valley of Chumbul River, where it rises to Malwah; Mhow, 2,019 ft. Dectum, 1,881 ft. Dhar, 1,908 ft. Indore, 1,998 ft. Crest of Jaum Ghaut, 2,328 ft. Oojein, 1,698 ft. Ajiyghurh, 1,340 ft. Amjhera, 1,890 ft. Saugor, 1,940 ft. Rhotasgurh, 700 ft. Sonar River, source, 1,903 ft. From the Vindhya range the surface has a generally gradual, but in some places abrupt, descent; as at Mokundurra, and the Bindyachal hills, where rivers occasionally fall over the brow in cascades. Shahabad district very rocky and uneven.	Tin and copper are found in Oodeypore. In Bhopal the prevailing geological formation appears to be trap overlying sandstone. Minerals are few and unimportant. Water is very plentiful. The mineral resources of Bundelcund appear to be considerable.
SOUTHERN INDIA, including DECCAN, Mysore, &c.	Supported as it were by a triangle formed by the Sautpoora or sub-Vindhya on the N., W. Ghauts on the W., and E. Ghauts on the E.;	Highest parts, those nearest W. Ghauts, and in centre of Mysore. Mahabulishwar 18° , $73^{\circ} 45'$; 4,700 ft. Source of Godavery, 3,000 ft. Poona, 2,823 ft. Source o Manjera, 3,019 ft. Rivers rising in ravines between spurs of W.	Hypogene schists, penetrated and broken up by prodigious outbursts of plutonic and trappean rocks, occupy by far the greater portion of the

SOUTH-WEST FRONTIER OF BENGAL, including CHOTA-NAGPORE, SIR-GOONJAH, PALAMOW, RAMGURH, HAZAREEBAGH, MYNPAT and AMARKANTAK.	the Sautpoora range constituting the base. Length, from Sautpoora River to Salem, about 700 m.; breadth from Mahabeshwur to Sir-goonjah, about 700 m. If Choota-Nagpore be considered as part of this great table-land, it may be said to extend nearly 250 m. farther in a north-easterly direction.	<p>Ghaunts, wind their way through E. Ghaunts across the Deccan, the slope being in that direction. Plains of Nagpore, 1,000 ft.—slope to S.E.; drained by Wein-Gunga, which falls into Godavery. Hyderabad, 1,800 ft. Secunderabad, 17° 26', 78° 33'; 1,837 ft. Beder, 17° 53', 77° 36'; 2,359 ft. From the Wein-Gunga the surface rises towards N.E., where Rypoor, 21° 12', 81° 40', is 1,747 ft. Source of Mahanuddy, 2,111 ft.; and Kon-keir, 20° 16', 81° 33', 1,953 ft. Nundy-droog, highest in Mysore, 4,856 ft.; slope from hence on all sides,—S. to Bangalore, 3,000 ft.; E. to plains of Carnatic—Chittoor, 1,100 ft.; N. to plains of Gooty, 1,182 ft.; and those of Bellary, 1,600 ft. Colar, 13° 8', 78° 10'; 2,800 ft. Mysore town, 12° 18', 76° 42'; 2,450 ft. Srirangapatam, 12° 25', 76° 45', 2,412 ft.—from hence, there is a gradual rise to Coorg, where Verajenderpetta is 3,399 ft., and Merkara, 4,506 ft. From Bangalore, descent to S. by rather abrupt steps to plains of Salem, 1,400 ft., and Coimbatore, 1,483 ft. From Belgaum, 15° 50', 74° 36', 2,550 ft. there is a gradual fall to the E. Bellary plains, 1,600 ft. Gooty plains 1,182 ft.; Cuddapah town, 507 ft.; and E. part of Cuddapah district 450 ft.</p> <p>Chota-Nagpore, 3,000 ft.; hills running E. and W., but of little elevation; Sirgoonjah, mountainous, rising 600 to 700 ft. above level of Chota-Nagpore. Mynpat table-land, about 30 m. S.E. from Sirgoonjah town; area not ascertained—about 3,000 or 3,500 ft. Palamow dist., very mountainous—little known. Hazareebagh town, 24°, 85° 54'; 1,750 ft. Slope of country to S., towards Sumbulpore—N. and E. parts of dist. very mountainous, but level, and even depressed towards Mahanuddy. Sumbulpore town, only 400 ft. Orissa table-land then rises on the other side of Mahanuddy, in some places to 1,700 ft. backed by the chain of E. Ghaunts. Amarkantak, jaggedly table-land, 22° 40', 81° 50'; 3,500 ft. The surface generally consists of valleys varying from 4,000 to 6,000 ft. above Bengal plains. Khatmandoo (in an oval-shaped valley 12 m. long), 27° 42', 85° 18'; 4,628. Blynturee, 29° 84', 80° 30'; 5,615 ft. Slope to S. drained by Ghogra, Gunduck, and Cooy.</p>

TABULATED VIEW OF TABLE-LANDS OF AFGHANISTAN and the COUNTRIES adjacent to INDIA, on the NORTH-WEST.—By R. MONTGOMERY MARTIN.			
Name.	Locality.	Elevation, in Feet.	General Remarks.
WESTERN AFGHANISTAN	From about Ghuznee or Sufiad Koh, to Amran Mountains, N. to S.; and from near Kandahar to the Suliman range.	Crest of highland of Ghuznee, lat. 30° 45', long. 68° 20'; 9,000 ft. Ghuznee, 33° 34', 68° 18'; 7,296. Yerghuttoo, 33° 20', 68° 10'; 7,502. Mookur, principal source of Turnak River, 32° 50', 67° 37'; 7,091. Abistada Lake, 32° 35', 68°; 7,000. Punguk, 32° 30', 67° 21'; 6,810. Shuftul, 32° 28', 67° 12'; 6,514. Sir-i-Asp, 33° 15', 66° 54'; 5,973. Kelat-i-Ghijie, 32° 8', 66° 45'; 5,773. Julduk, 32° 60' 28'; 5,396. Hydurzie, 30° 23', 66° 51'; 5,259. Hykulzie, 30° 32', 63° 50'; 5,063. Teer-Andaz, 31° 55', 66° 17'; 4,829. Kandahar, 32° 37', 65° 28'; 3,484 ft.	Afghanistan, for four-fifths of its extent, is a region of rocks and mountains, interspersed with valleys of great fertility, and in many places containing table-lands, cold, bleak, and barren. It has a surface as rugged as that of Switzerland, with mountain summits of much greater height. General slope of the country, from N.E. to S.W. Slope from W. to E.; Cabul River flowing in that direction; lofty mountains enclosing valley of Jellalabad on N. and S. sides. Course of river obstructed, and bed contracted by ridges of rock connecting them. City of Cabul surrounded by hills on three sides. Jellalabad, on a small plain.
NORTHERN AFGHANISTAN	Between Hindoo-Koosh on the N., and Sufiad-Koh on S.; and Huzareh country on the W., and Khyber hills on the E.	Kurzar, near source of Helmund, 34° 30', 67° 54'; 10,959 ft. Kalloo, 34° 30', 67° 56'; 10,883 ft. Youant or Oord, 34° 24', 68° 11'; 10,618. Gooljatooe, 34° 31', 68° 5'; 10,500 ft. Shibbertoo, 34° 50', 67° 20'; 10,530 ft. Shah Sung, 34° 34', 69° 8'; 10,438 ft. Gurdan Dewar, 34° 25', 68° 8'; 10,076 ft. Suktah, 34° 40', 67° 50'; 9,839 ft. Khawak Fort, 35° 38', 70° 5'; 9,300 ft. Topchee, 34° 45', 67° 44'; 9,085 ft. Chasgo, 33° 43', 68° 22'; 8,697 ft. Bamian, 34° 50', 67° 45'; 8,496 ft. Huftasaya, 33° 49', 68° 15'; 8,420 ft. Sir-i-Chusma, 34° 21', 68° 20'; 8,400 ft. Zohak's Fort, 34° 50', 67° 55'; 8,186 ft. Killa Sher Mahomed, 34° 16', 68° 45'; 8,051 ft. Kot-i-Asruf, 34° 28', 68° 35'; 7,749 ft. Midan, 34° 22', 68° 43'; 7,747 ft. Urghundee, 34° 30', 68° 50'; 7,628 ft. Khoord Kabool, 34° 21', 69° 18'; 7,466 ft. Kabool, 34° 28', 69°; 6,396. Boothauk, 34° 30', 69° 15'; 6,247 ft. Jugdulluk, 34° 25', 69° 46'; 5,373. Gundamuk, 34° 17', 70° 5'; 4,616 ft. Crest of Khyber Pass, 34° 8', 71° 15'; 3,373. Ali-Musjid, 34° 3', 71° 22'; 2,433 ft. Jellalabad, 34° 25', 70° 28'; 1,964 ft.	

Tabulated Views of the Mountains and Passes, Table-Lands, and Rivers, &c.—continued.

Name.	Locality.	Elevation, in Feet.	General Remarks.
SHAWL AND PISHEEN -	Between Hala and Amran ranges, on the N. frontier of Beloochistan.	Khojuck Pass, Amran Mts., 30° 45', 66° 30'; 7,443 ft. Pisheen, from 5,000 to 6,000 ft. Shawl exceeds 5,000 ft. Town of Shawl, 5,563 ft. Dashi-i-Bedowlat, 30° 57'; about 5,000 ft. Siriah, 30° 3', 66° 53'; 5,793 ft.	Wildest parts of enclosing mountains,—haunts of wild sheep and goats; more accessible tracts yield pasture for herds and flocks. Orchards numerous. Dashi-i-Bedowlat (<i>wretched plain</i>), destitute of water.
BELOOCHISTAN -	S. of Afghanistan - - - - -	Kelat, 28° 53', 66° 27'; 6,000 ft. Sohrab, 28° 22', 66° 9'; 5,800 ft. Munzilgah, 29° 53'; 67°; 5,793 ft. Angeera, 28° 10', 66° 12'; 5,250 ft. Bapow, 28° 16', 66° 20'; 5,000. Peesee-Bhent, 28° 10', 66° 35'; 4,600 ft.; Sir-i-Bolan, 29° 50', 67° 14'; 4,494. Putkee, 28° 5', 66° 40'; 4,250 ft. Paeshti-Khaua, 27° 59', 66° 47'; 3,500 ft. Nurd, 27° 52', 66° 54'; 2,850. Ab-i-goom, 29° 46', 67° 23'; 2,540. Jungikooht, 27° 55', 67° 2'; 2,150 ft. Bent-i-Jah, 28° 4', 67° 10'; 1,850 ft. Beebee Nauee, 29° 39', 67° 28'; 1,695 ft. Kohow, 28° 20', 67° 12'; 1,250 ft. Gurmab, 29° 36', 67° 32'; 1,081 ft. Kullar, 28° 18', 67° 15'; 750 ft.	Coast craggy, but not elevated; in some places a sandy shore; inland surface becomes higher. Most remarkable features of Beloochistan, rugged and elevated surface, barrenness, and deficiency of water. It may be described as a maze of mountains, except on the N.W., in which direction the surface descends to the Great Desert on the S., where a low tract stretches along the sea-shore.
CASHMERE and BUL-TISTAN, or LITTLE TIJET.	Western Himalaya - - - - -	Average elevation of Cashmere valley, between 5,000 and 6,000 ft. above the sea. Huramuk Mt. 13,000. Fir-panjal, 15,000. Small elevations in valley, 250 to 500 ft. Average of valley of Indus (N. of Cashmere vale), 6,000 to 7,000 ft. Slope from S.E. to N.W. Mountains on each side rising from 6,000 to 8,000 ft. higher.	Mountains enclosing Cashmere vale, basaltic. Ranges on each side of Bulistan valley rugged, bare, and nearly inaccessible; formation generally of gneiss; that of the valley, shingle and sand.

R. M. MARTIN.
149, Piccadilly, London, 1861.

SANITARY STATISTICS

OF

THE BRITISH TROOPS OF THE EAST INDIA COMPANY'S ARMY,
AND OF HER MAJESTY'S REGIMENTS SERVING IN INDIA.

SANITARY STATISTICS OF BRITISH TROOPS OF THE EAST INDIA COMPANY'S ARMY.

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SANITARY STATISTICS, BRITISH ARMY IN INDIA.

THE facts and calculations embodied in the following series of tables have been derived from the annual rolls of strength and casualties in the various regiments; these documents are transmitted periodically from the military officers in India to the Home Government, and are deposited at the India Office. The annual alphabetical long rolls of strength for each regiment contain the name, age, personal description, date and place of attestation, and date of arrival in India of each man borne on the strength in each year. The annual casualty rolls contain the same particulars as the rolls of strength, with the addition of a column showing the nature of each casualty, whether by death, discharge, invaliding, or any other cause. The period of service, and age of every man who has DIED in the different corps during the 10 years 1847-56, have been abstracted from the above-mentioned casualty rolls; but in getting the age and period of service of the STRENGTH it has been deemed sufficient to take three enumerations only, in order to save time; and therefore the mortality has been deduced by dividing three-tenths of the total deaths by the total of the three enumerations of strength.

INDIA.—SUMMARY TABLES.—1770-1856.

THE Tables 1 to 10 show the mortality, &c. in each year, extending over a period of 87 years, from the year 1770 to 1856. The facts for the earlier years up to 1800 are no doubt imperfect, but they have been abstracted from the books at the India Office, by Messrs. Bremner and Bacon, with very great care, and they present the only results which can be obtained from the Annual Long and Casualty Rolls at the India Office. The calculations have been carefully made by Mr. Lewis, and although they to a great extent check themselves, yet, as a matter of precaution, Mr. Williams has checked the column of proportion of Total Casualties to Strength, and thus the accuracy of the whole is ensured.* General Register Office, April 18, 1860.

* MEMORANDUM by Colonel Baker, explaining the Nature of the Casualty Rolls of the East India Company's European Troops. Casualty Rolls are transmitted from India, monthly and annually, under orders which will be found at pages 362 and 366 of Pay and Audit Regulations of 1845, a copy of which, it is understood, has been furnished for the use of the Commission. The annual rolls are compiled on the principle of accounting for every man become non-effective in the year. They are verified by the signatures of the commanding officers and adjutants of corps, and they are transmitted to the local Governments through the respective Town Majors for eventual transmission home. India Office, December 7, 1859.

If the years in the period 1770 to 1799, for which there are no Returns at the India Office, are supplied by taking for each of the missing years the average of the Strength, Deaths, &c., during the period, and thus completing the series of observations, it is estimated that during the 87 years, 1770 to 1856, out of a Total Strength of 857,895 European non-commissioned officers and men of the late East India Company's forces in India, 55,140 deaths have occurred, making the average annual mortality for the period 6·4 per cent.

Mean Strength of European Non-commissioned Officers and Men
in India during the 87 years

1770-1856	=	9,861
1770-1799	=	8,969
1800-1829	=	7,985
1830-1856	=	12,936

No. 1.
TABLE showing the PROPORTION per Cent. of DEATHS and other CASUALTIES to STRENGTH of the EUROPEAN FORCES of the late EAST INDIA COMPANY during the Period 1800-56.

INDIA.							
Years.	Aggregate Strength.	Casualties.			Proportion per cent. to Strength.		
		Deaths.	Other Casualties.	Total Casualties.	Deaths.	Other Casualties.	Total Casualties.
1800-56	588,820*	40,420	48,262	88,682	6·86	8·20	15·06
1800-29	239,557	20,272	20,734	41,006	8·46	8·66	17·12
1830-56	349,263	20,148	27,528	47,676	5·77	7·88	13·65

BENGAL.							
1800-56	257,768	19,104	23,625	42,729	7·41	9·17	16·58
1800-29	105,695	8,523	10,323	18,846	8·06	9·77	17·83
1830-56	152,073	10,581	13,302	23,883	6·96	8·75	15·71

MADRAS.							
1800-56	211,164	13,404	12,774	26,178	6·35	6·05	12·40
1800-29	92,291	7,783	5,911	13,694	8·43	6·40	14·83
1830-56	118,873	5,621	6,863	12,484	4·73	5·77	10·50

BOMBAY.							
1800-56	119,888	7,912	11,863	19,775	6·60	9·90	16·50
1800-29	41,571	3,966	4,500	8,466	9·54	10·83	20·37
1830-56	78,317	3,946	7,363	11,309	5·04	9·40	14·44

* The aggregate strength is the sum of the mean annual strengths = mean strength multiplied by the years under observation.

No. 2.—BENGAL.

TABLE showing the PROPORTION per Cent. of DEATHS and other CASUALTIES to STRENGTH in each of the Years 1770-1799, amongst the EUROPEAN FORCES of the late EAST-INDIA COMPANY.

Years.	Mean Strength in each Year.	Casualties during each Year.			Proportion per cent. to Strength.		
		Deaths.	Other Casualties.	Total Casualties.	Deaths.	Other Casualties.	Total Casualties.
1770	2,858	305	76	381	10·67	2·66	13·33
1771	2,858	245	249	494	8·57	8·71	17·28
1772	3,837	242	414	656	6·31	10·79	17·10
1773	4,147	312	394	706	7·52	9·50	17·02
1774	4,335	253	273	526	5·84	6·30	12·14
1775	4,322	243	454	697	5·62	10·50	16·12
1776	4,141	304	384	688	7·34	9·27	16·61
1777	4,102	266	502	768	6·48	12·24	18·72
1778	4,019	279	636	915	6·94	15·82	22·76
1779	3,483	174	290	464	5·00	8·33	13·33
1780	2,667	121	252	373	4·54	9·45	13·99
1781	—	—	—	—	—	—	—
1782	2,535	231	330	561	9·11	13·02	22·13
1783	2,985	215	560	775	7·20	18·76	25·96
1784	—	—	—	—	—	—	—
1785	—	—	—	—	—	—	—
1786	—	—	—	—	—	—	—
1787	—	—	—	—	—	—	—
1788	—	—	—	—	—	—	—
1789	—	—	—	—	—	—	—
1790	—	—	—	—	—	—	—
1791	—	—	—	—	—	—	—
1792	3,900	374	254	628	9·59	6·51	16·10
1793	4,505	436	204	640	9·68	4·53	14·21
1794	4,203	332	228	560	7·90	5·42	13·32
1795	3,746	234	183	417	6·25	4·89	11·14
1796	3,472	208	291	499	5·99	8·38	14·37
1797	3,555	225	347	572	6·33	9·76	16·09
1798	3,699	175	531	706	4·73	14·36	19·09
1799	—	—	—	—	—	—	—
Average of the years	3,669	259	343	602	7·06	9·35	16·41

NOTE.—In consequence of the facts for the years in the above Table being imperfect, the results must be regarded as an approximation to the true mortality, &c. No returns could be found for the years 1781, 1784-91, and 1799.

No. 3.—MADRAS.

TABLE showing the PROPORTION per Cent. of DEATHS and other CASUALTIES to STRENGTH in each of the Years 1770-99 amongst the EUROPEAN FORCES of the late EAST INDIA COMPANY.

Years.	Mean Strength in each Year.	Casualties during each Year.			Proportion per cent. to Strength.		
		Deaths.	Other Casualties.	Total Casualties.	Deaths.	Other Casualties.	Total Casualties.
1770	—	—	—	—	—	—	—
1771	—	—	—	—	—	—	—
1772	5,142	223	43	266	4·34	·84	5·18
1773	5,190	239	6	245	4·61	·12	4·73
1774	4,491	226	12	238	5·03	·27	5·30
1775	3,823	155	16	171	4·05	·42	4·47
1776	3,828	173	23	196	4·52	·60	5·12
1777	3,870	158	135	293	4·08	3·49	7·57
1778	3,936	247	109	356	6·28	2·77	9·05
1779	—	—	—	—	—	—	—
1780	4,983	99	74	173	1·99	1·49	3·48
1781	6,043	103	55	158	1·70	·91	2·61
1782	5,223	150	153	303	2·87	2·93	5·80
1783	—	—	—	—	—	—	—
1784	—	—	—	—	—	—	—
1785	2,678	61	32	93	2·28	1·19	3·47
1786	2,220	65	47	112	2·93	2·12	5·05
1787	2,943	186	28	214	6·32	·95	7·27
1788	4,175	166	76	242	3·98	1·82	5·80
1789	4,026	151	71	222	3·75	1·76	5·51
1790	4,463	109	298	407	2·44	6·68	9·12
1791	5,465	299	550	849	5·47	10·06	15·53
1792	5,923	299	579	878	5·05	9·78	14·83
1793	6,126	199	355	554	3·25	5·79	9·04
1794	6,140	154	309	463	2·51	5·03	7·54
1795	6,060	85	276	361	1·40	4·55	5·95
1796	6,124	341	380	721	5·57	6·21	11·78
1797	6,106	179	99	278	2·93	1·62	4·55
1798	1,558	51	69	120	3·27	4·43	7·70
1799	1,534	84	69	153	5·48	4·50	9·98
Average of the years	4,483	168	155	323	3·75	3·46	7·21

NOTE.—In consequence of the facts for the years in the above Table being imperfect, the results must be regarded as an approximation to true mortality, &c. No returns could be found for the years 1770, 1771, 1779, 1783, and 1784.

No. 4.—BOMBAY.

TABLE showing the PROPORTION per Cent. of DEATHS and other CASUALTIES to STRENGTH in each of the Years 1770-99 amongst the EUROPEAN FORCES of the late EAST INDIA COMPANY.

Years.	Mean Strength in each Year.	Casualties during each Year.			Proportion per cent. to Strength.		
		Deaths.	Other Casualties.	Total Casualties.	Deaths.	Other Casualties.	Total Casualties.
1770	313	12	5	17	3·83	1·60	5·43
1771	312	12	12	24	3·85	3·85	7·70
1772	319	18	31	49	5·64	9·72	15·36
1773	370	10	52	62	2·70	14·06	16·76
1774	389	23	48	71	5·91	12·34	18·25
1775	339	5	7	12	1·47	2·06	3·53
1776	305	45	14	59	14·75	4·59	19·34
1777	315	37	14	51	11·75	4·44	16·19
1778	289	13	3	16	4·50	1·04	5·54
1779	306	33	9	42	10·78	2·94	13·72
1780	270	4	15	19	1·48	5·56	7·04
1781	292	28	14	42	9·59	4·79	14·38
1782	403	47	25	72	11·66	6·20	17·86
1783	431	40	49	89	9·28	11·37	20·65
1784	444	63	63	126	14·19	14·19	28·38
1785	652	42	100	142	6·44	15·34	21·78
1786	1,039	61	48	109	5·87	4·62	10·49
1787	1,243	83	24	107	6·68	1·93	8·61
1788	—	—	—	—	—	—	—
1789	1,129	63	162	225	5·58	14·35	19·93
1790	—	—	—	—	—	—	—
1791	1,030	164	70	234	15·92	6·80	22·72
1792	1,516	221	282	503	14·58	18·60	33·18
1793	1,841	148	109	257	8·04	5·92	13·96
1794	1,714	160	328	488	9·33	19·14	28·47
1795	1,627	110	147	257	6·76	9·04	15·80
1796	1,582	96	162	258	6·07	10·24	16·31
1797	1,592	82	173	255	5·15	10·87	16·02
1798	1,491	104	173	277	6·97	11·60	18·57
1799	1,342	61	124	185	4·55	9·25	13·80
Average of the years }	818	64	81	145	7·82	9·90	17·72

NOTE.—In consequence of the facts for the years in the above Table being imperfect, the results must be regarded as an approximation to the true mortality, &c. No returns could be found for the years 1778 and 1790.

No. 5.—BENGAL.

TABLE showing the AVERAGE ANNUAL PROPORTION per Cent. of DEATHS and other CASUALTIES to the STRENGTH of the EUROPEAN FORCES of the late EAST INDIA COMPANY, during the 57 Years 1800-56.

Years.	Average Annual Strength.	Average Annual Casualties.			Proportion per cent. to Strength.		
		Deaths.	Other Casualties.	Total Casualties.	Deaths.	Other Casualties.	Total Casualties.
1800-9	2,293·5	209·8	307·6	517·4	9·15	13·42	22·57
1810-9	3,587·1	246·3	236·7	483·0	6·87	6·60	13·47
1820-9	4,688·9	396·2	488·0	884·2	8·45	10·41	18·86
1830-9	5,016·1	301·5	356·4	657·9	6·01	7·11	13·12
1840-9	5,619·9	446·6	510·3	956·9	7·95	9·08	17·03
1850-6	6,530·4	442·9	662·1	1,105·0	6·78	10·14	16·92
1800-56	4,522·2	335·1	414·5	749·6	7·41	9·17	16·58

No. 6.—MADRAS.

TABLE showing the AVERAGE ANNUAL PROPORTION per Cent. of DEATHS and other CASUALTIES, to the STRENGTH of the EUROPEAN FORCES of the late EAST INDIA COMPANY, during the 57 Years 1800-56.

Years.	Average Annual Strength.	Average Annual Casualties.			Proportion per cent. to Strength.		
		Deaths.	Other Casualties.	Total Casualties.	Deaths.	Other Casualties.	Total Casualties.
1800-9	2,623·4	143·8	68·7	212·5	5·48	2·62	8·10
1810-9	3,108·0	301·6	187·0	488·6	9·70	6·02	15·72
1820-9	3,497·7	332·9	335·4	668·3	9·52	9·59	19·11
1830-9	3,507·6	194·5	227·0	421·5	5·55	6·47	12·02
1840-9	4,598·4	200·1	262·5	462·6	4·35	5·71	10·06
1850-6	5,401·9	239·3	281·1	520·4	4·43	5·20	9·63
1800-56	3,704·6	235·2	224·1	459·3	6·35	6·05	12·40

No. 7.—BOMBAY.

TABLE showing the AVERAGE ANNUAL PROPORTION per Cent. of DEATHS and other CASUALTIES, to the STRENGTH of the EUROPEAN FORCES of the late EAST INDIA COMPANY during the 57 Years 1800-56.

Years.	Average Annual Strength.	Average Annual Casualties.			Proportion per cent. to Strength.		
		Deaths.	Other Casualties.	Total Casualties.	Deaths.	Other Casualties.	Total Casualties.
1800-9	952·3	80·5	79·0	159·5	8·45	8·30	16·75
1810-9	1,354·5	134·9	120·8	255·7	9·96	8·92	18·88
1820-9*	2,055·9	201·3	278·0	479·3	9·79	13·52	23·31
1830-9	2,289·6	106·1	193·0	299·1	4·63	8·43	13·06
1840-9	3,125·0	213·4	332·7	546·1	6·83	10·65	17·48
1850-6*	4,028·5	125·2	351·0	476·2	3·11	8·71	11·82
1800-56	2,179·8	143·7	215·7	359·4	6·60	9·90	16·50

* The returns for the years 1827 and 1850 could not be found at the India Office when this Table was made.

No. 8.—BENGAL.

TABLE showing the PROPORTION per Cent. of DEATHS and other CASUALTIES, to STRENGTH, in each of the Years 1800–56, amongst the EUROPEAN FORCES of the late EAST INDIA COMPANY.

Years.	Mean* Strength in each Year.	Casualties during each Year.			Proportion per cent. to Strength.		
		Deaths.	Other † Casualties.	Total Casualties.	Deaths.	Other Casualties.	Total Casualties.
1800	2,702	211	181	392	7·81	6·70	14·51
1801	2,634	142	230	372	5·39	8·74	14·13
1802	2,519	224	288	512	8·89	11·43	20·32
1803	2,423	211	321	532	8·71	13·25	21·96
1804	2,177	492	126	618	22·60	5·79	28·39
1805	1,953	299	296	595	15·31	15·16	30·47
1806	1,968	175	306	481	8·89	15·55	24·45
1807	2,038	102	270	372	5·00	13·25	18·25
1808	2,103	108	273	381	5·14	12·98	18·12
1809	2,418	134	785	919	5·54	32·46	38·00
1810	3,189	118	299	417	3·70	9·38	13·08
1811	3,345	150	113	263	4·48	3·38	7·86
1812	3,032	224	62	286	7·39	2·04	9·43
1813	3,412	363	65	428	10·64	1·91	12·55
1814	3,697	241	61	302	6·52	1·65	8·17
1815	3,784	217	112	329	5·73	2·96	8·69
1816	3,949	246	334	580	6·23	8·46	14·69
1817	3,917	315	617	932	8·04	15·75	23·79
1818	3,817	379	449	828	9·93	11·76	21·69
1819	3,729	210	255	465	5·63	6·84	12·47
1820	3,829	334	251	585	8·72	6·56	15·28
1821	4,086	351	246	597	8·59	6·02	14·61
1822	4,215	262	368	630	6·22	8·73	14·95
1823	4,695	411	454	865	8·75	9·68	18·43
1824	5,046	412	529	941	8·17	10·48	18·65
1825	4,965	472	721	1,193	9·51	14·52	24·03
1826	4,812	748	609	1,357	15·54	12·66	28·20
1827	4,855	484	666	1,150	9·97	13·72	23·69
1828	5,132	260	539	799	5·07	10·50	15·57
1829	5,254	228	497	725	4·34	9·46	13·80
1830	5,275	274	561	835	5·19	10·64	15·83
1831	5,314	340	526	866	6·40	9·90	16·30
1832	5,198	272	380	652	5·23	7·31	12·54
1833	5,041	370	298	668	7·34	5·91	13·25
1834	4,998	352	288	640	7·04	5·76	12·80
1835	4,898	299	236	535	6·10	4·82	10·92
1836	4,861	151	215	366	3·10	4·42	7·52
1837	4,924	222	297	519	4·51	6·03	10·54
1838	4,895	338	348	686	6·91	7·11	14·02
1839	4,757	397	415	812	8·35	8·72	17·07
1840	5,117	287	507	794	5·61	9·91	15·52
1841	5,516	377	555	932	6·83	10·06	16·89
1842	5,593	600	577	1,177	10·73	10·32	21·05
1843	6,004	481	401	882	8·01	6·68	14·69
1844	6,025	466	419	885	7·73	6·95	14·68
1845	5,641	481	398	879	8·53	7·06	15·59
1846	5,355	561	509	1,070	10·48	9·51	19·99
1847	5,279	290	504	794	5·49	9·55	15·04
1848	5,669	369	554	923	6·51	9·77	16·28
1849	6,000	554	679	1,233	9·23	11·32	20·55
1850	6,208	364	683	1,047	5·86	11·00	16·86
1851	6,353	432	509	941	6·80	8·01	14·81
1852	6,329	260	480	740	4·11	7·58	11·69
1853	6,431	477	617	1,094	7·42	9·59	17·01
1854	6,623	477	786	1,263	7·20	11·87	19·07
1855	6,835	493	709	1,202	7·21	10·37	17·58
1856	6,934	597	851	1,448	8·61	12·27	20·88
1800–56	257,768	19,104	23,625	42,729	7·41	9·17	16·58

* The mean strength for each year has been obtained by taking the *mean* of the two enumerations of strength at the beginning and end of each period during which the deaths and casualties occurred.

† In the returns of casualties it has been observed that in the case of a man leaving his regiment in any year, from ill-health or otherwise, and rejoining it in the same year, *two* (or more) casualties are recorded on his account. This makes the casualties appear more numerous than they would be if only the cases of men leaving the regiment *entirely* were returned. The returns are also not made for one uniform period of 12 months ending always on the same day, but the dates are frequently changed, and therefore it must be understood that the facts in the above Table opposite each year are the nearest approximation to the deaths, &c., in *that year*, which can be ascertained from the books at the India Office.

No. 9.—MADRAS.

TABLE showing the PROPORTION per Cent. of DEATHS and other CASUALTIES to STRENGTH, in each of the Years 1800-56, amongst the EUROPEAN FORCES of the late EAST INDIA COMPANY.

Years.	Mean Strength* in each Year.	Casualties during each year.			Proportion per cent. to Strength.		
		Deaths.	Other Casualties.	Total Casualties.	Deaths.	Other Casualties.	Total Casualties.
1800	2,414	79	16	95	3·27	·66	3·93
1801	3,234	171	45	216	5·29	1·39	6·68
1802	2,238	81	120	201	3·62	5·36	8·98
1803	1,901	178	28	206	9·37	1·47	10·84
1804	2,379	159	126	285	6·68	5·30	11·98
1805	2,323	130	52	182	5·60	2·24	7·84
1806	2,723	132	40	172	4·85	1·47	6·32
1807	3,057	211	132	343	6·90	4·32	11·22
1808	2,917	130	68	198	4·46	2·33	6·79
1809	3,048	167	60	227	5·48	1·97	7·45
1810	3,192	252	86	338	7·90	2·69	10·59
1811	2,984	274	117	391	9·18	3·92	13·10
1812	2,824	257	125	382	9·10	4·43	13·53
1813	2,926	154	52	206	5·26	1·78	7·04
1814	3,170	364	167	531	11·48	5·27	16·75
1815	3,138	208	98	306	6·63	3·12	9·75
1816	3,214	231	188	419	7·19	5·85	13·04
1817	3,383	329	323	652	9·73	9·55	19·28
1818	3,181	504	164	668	15·85	5·16	21·01
1819	3,068	443	550	993	14·44	17·93	32·37
1820	3,149	295	333	628	9·37	10·57	19·94
1821	3,267	309	225	534	9·46	6·89	16·35
1822	3,485	265	349	614	7·60	10·01	17·61
1823	3,657	220	359	579	6·02	9·82	15·84
1824	3,507	635	614	1,249	18·11	17·51	35·62
1825	3,303	464	363	827	14·05	10·99	25·04
1826	3,324	286	330	616	8·60	9·93	18·53
1827	3,618	344	246	590	9·51	6·80	16·31
1828	3,835	300	234	534	7·82	6·10	13·92
1829	3,832	211	301	512	5·51	7·85	13·36
1830	3,946	214	248	462	5·42	6·28	11·70
1831	3,845	284	218	502	7·39	5·67	13·06
1832	3,593	234	233	467	6·51	6·49	13·00
1833	3,348	250	207	457	7·47	6·18	13·65
1834	3,310	188	145	333	5·68	4·38	10·06
1835	3,419	132	208	340	3·86	6·08	9·94
1836	3,436	133	205	338	3·87	5·97	9·84
1837	3,413	203	241	444	5·95	7·06	13·01
1838	3,392	146	170	316	4·30	5·01	9·31
1839	3,374	161	395	556	4·77	11·71	16·48
1840	3,716	202	296	498	5·44	7·97	13·41
1841	4,434	230	263	493	5·19	5·93	11·12
1842	4,717	285	312	627	6·04	7·25	13·29
1843	4,634	197	268	465	4·25	5·78	10·03
1844	4,562	190	228	418	4·16	5·00	9·16
1845	4,507	191	268	459	4·24	5·95	10·19
1846	4,444	194	214	408	4·37	4·81	9·18
1847	4,706	165	208	373	3·51	4·42	7·93
1848	5,150	142	228	370	2·76	4·43	7·19
1849	5,114	205	310	515	4·01	6·06	10·07
1850	4,988	167	235	402	3·35	4·71	8·06
1851	5,205	214	190	404	4·11	3·65	7·76
1852	5,315	259	187	446	4·87	3·52	8·39
1853	5,326	321	418	739	6·03	7·85	13·88
1854	5,610	333	310	643	5·94	5·53	11·47
1855	5,747	207	297	504	3·66	5·17	8·77
1856	5,622	174	331	505	3·09	5·89	8·98
1800-56	211,164	13,404	12,774	26,178	6·35	6·05	12·40

* NOTE.—In this table the mean annual strength for each year has been obtained thus :—

Strength on 1st January 1800 - - - - 1,510
Do. on 1st January 1801 - - - - 3,317

2) 4,827

2,413·5 = mean annual strength for 1800.

The deaths and casualties for the year 1800 occurred in the interval between the two enumerations.

No. 10.—BOMBAY.

TABLE showing the PROPORTION per Cent. of DEATHS and other CASUALTIES to STRENGTH, in each of the Years 1800-56, amongst the EUROPEAN FORCES of the late EAST INDIA COMPANY.

Years.	Mean Strength* in each Year.	Casualties during each Year.			Proportion per cent. to Strength.		
		Deaths.	Other Casualties.	Total Casualties.	Deaths.	Other Casualties.	Total Casualties.
1800	1,244	149	50	199	11.98	4.02	16.00
1801	1,202	109	45	154	9.07	3.74	12.81
1802	1,178	84	212	296	7.13	18.00	25.13
1803	1,082	69	125	194	6.38	11.56	17.94
1804	939	85	57	142	9.05	6.07	15.12
1805	811	84	89	173	10.36	10.98	21.34
1806	746	85	60	145	11.40	8.05	19.45
1807	768	47	34	81	6.12	4.43	10.55
1808	784	54	64	118	6.89	8.17	15.06
1809	769	39	54	93	5.07	7.03	12.10
1810	771	59	72	131	7.65	9.34	16.99
1811	886	65	48	113	7.34	5.42	12.76
1812	969	89	210	299	9.19	21.68	30.87
1813	1,039	183	40	223	17.61	3.85	21.46
1814	1,252	183	96	279	14.62	7.67	22.29
1815	1,548	124	63	187	8.01	4.07	12.08
1816	1,635	134	272	406	8.20	16.64	24.84
1817	1,699	150	182	332	8.83	10.71	19.54
1818	1,887	155	119	274	8.22	6.31	14.53
1819	1,859	207	106	313	11.14	5.70	16.84
1820	1,832	201	608	809	10.97	33.20	44.17
1821	1,781	217	162	379	12.18	9.10	21.28
1822	1,783	229	138	367	12.84	7.74	20.58
1823	2,010	208	236	444	10.35	11.74	22.09
1824	2,160	160	239	399	7.41	11.07	18.48
1825	2,146	163	227	390	7.60	10.58	18.18
1826	2,155	301	399	700	13.97	18.52	32.49
1827	—	—	—	—	—	—	—
1828	2,251	209	317	526	9.29	14.09	23.38
1829	2,385	124	176	300	5.20	7.38	12.58
1830	2,500	123	406	529	4.92	16.24	21.16
1831	2,556	78	135	213	3.05	5.28	8.33
1832	2,546	77	136	213	3.02	5.34	8.36
1833	2,383	86	195	281	3.61	8.18	11.79
1834	2,176	68	103	171	3.12	4.73	7.85
1835	2,134	127	203	330	5.95	9.51	15.46
1836	2,148	84	132	216	3.91	6.15	10.06
1837	2,127	106	163	269	4.98	7.67	12.65
1838	2,123	125	158	283	5.89	7.44	13.33
1839	2,203	187	299	486	8.49	13.58	22.07
1840	2,406	239	345	584	9.94	14.34	24.28
1841	2,990	132	393	525	4.42	13.15	17.57
1842	3,372	258	297	555	7.65	8.81	16.46
1843	3,297	265	297	562	8.04	9.01	17.05
1844	3,088	391	239	630	12.66	7.74	20.40
1845	2,915	147	204	351	5.04	7.00	12.04
1846	2,953	274	243	517	9.28	8.23	17.51
1847	3,146	132	470	602	4.20	14.94	19.14
1848	3,472	93	249	342	2.68	7.17	9.85
1849	3,611	203	590	793	5.62	16.34	21.96
1850	—	—	—	—	—	—	—
1851	3,767	124	253	377	3.29	6.72	10.0
1852	3,908	119	232	351	3.05	5.94	8.99
1853	3,841	96	226	322	2.50	5.88	8.38
1854	3,892	166	465	631	4.27	11.95	16.22
1855	4,240	133	437	570	3.14	10.31	13.45
1856	4,523	113	493	606	2.50	10.90	13.40
1800-56	119,888	7,912	11,863	19,775	6.60	9.90	16.50

* The mean strength for each year has been obtained by taking the *mean* of the two enumerations of strength at the beginning and end of each period during which the deaths, &c. occurred.

In consequence of the returns not being made for one uniform period of 12 months ending always on the same day, the dates being frequently changed, it must be understood that the facts in the above Table, opposite each year, are the nearest approximation to the correct numbers for that year, which can be ascertained from the returns at the India Office.

The returns for the years 1827 and 1850 could not be found at the time this Table was made.

SUMMARY TABLES.

No. 11.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent., in the Ten Years 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN FORCES of the late EAST INDIA COMPANY in INDIA.

Years.	Mean Strength.			Deaths in each Year.			Annual Rate of Mortality per cent.		
	Total.	Effectives.	Non-Effectives.	Total.	Effectives.	Non-Effectives.	Total.	Effectives.	Non-Effectives.
1847	13,130	11,592	1,538	587	512	75	4.47	4.42	4.88
1848	14,291	12,761	1,530	604	519	85	4.23	4.07	5.56
1849	14,724	13,193	1,531	962	869	93	6.53	6.59	6.07
1850	14,931	13,397	1,534	676	607	69	4.53	4.53	4.50
1851	15,324	13,802	1,522	770	688	82	5.02	4.98	5.39
1852	15,552	14,067	1,485	638	545	93	4.10	3.87	6.26
1853	15,597	14,143	1,454	894	785	109	5.73	5.55	7.50
1854	16,124	14,690	1,434	976	882	94	6.05	6.00	6.56
1855	16,822	15,381	1,441	833	758	75	4.95	4.93	5.20
1856	17,079	15,583	1,496	884	787	97	4.94	5.05	6.48
Aggregate of 10 years	153,574	138,609	14,965	7,824	6,952	872	5.09	5.02	5.83

No. 12.—STRENGTH OF EFFECTIVES.*

TABLE showing the AGE and PERIOD of SERVICE of the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY, for Three Years out of the Ten Years 1847-56.†

Age.	Total.	Period of Service, Years.									
		Under 1 Year.	1	2	3	4	Under 5 Years.	5	10	15	20 and upwards.
Total - -	39,375	4,318	3,489	2,765	2,860	3,036	16,468	12,556	6,432	2,992	927
10-15	119	79	27	8	5	—	119	—	—	—	—
15	78	30	31	7	8	—	76	2	—	—	—
16	64	20	16	5	13	7	61	3	—	—	—
17	60	12	11	7	9	6	45	15	—	—	—
18	88	23	17	10	14	15	79	9	—	—	—
19	503	393	61	9	9	13	485	17	1	—	—
10-20	912	557	163	46	58	41	865	46	1	—	—
20	10,046	3,045	2,437	1,749	1,300	663	9,194	814	38	—	—
25	13,694	655	819	919	1,421	2,081	5,895	7,398	378	21	2
30	8,749	55	65	50	69	238	477	3,883	4,038	339	12
35	4,225	6	4	1	11	12	34	401	1,774	1,940	76
40	1,358	—	1	—	1	1	3	14	192	621	528
45	227	—	—	—	—	—	—	—	11	58	158
50	80	—	—	—	—	—	—	—	—	8	72
55 and upwards	84	—	—	—	—	—	—	—	—	5	79

* Excluding in each Presidency the 3rd European Regiments, which were not formed until 1854.
† The period of 10 years 1847-56 applies to Bengal and Madras only; at the time these Tables were made the Annual Long Roll for the year 1850 for Bombay could not be found, and consequently the year 1846 was taken for that Presidency in lieu of the year 1850, making the period for Bombay 10 years 1846-49 and 1851-56.

No. 13.—DEATHS OF EFFECTIVES.*

TABLE showing the AGE and PERIOD of SERVICE of the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY, in the Ten Years 1847-56.†

Age.	Total.	Period of Service, Years.									
		Under 1 Year.	1	2	3	4	Under 5 Years.	5	10	15	20 and upwards.
Total - -	6,716	938	623	518	470	446	2,995	1,968	1,131	429	193
10-15	6	3	2	1	—	—	6	—	—	—	—
15	2	—	2	—	—	—	2	—	—	—	—
16	2	—	1	—	1	—	2	—	—	—	—
17	5	—	1	—	1	2	4	1	—	—	—
18	21	13	—	2	1	—	16	5	—	—	—
19	47	38	5	1	1	—	45	2	—	—	—
10-20	83	54	11	4	4	2	75	8	—	—	—
20	1,892	722	436	307	228	81	1,774	112	6	—	—
25	2,237	149	157	195	221	322	1,044	1,130	60	3	—
30	1,458	13	18	12	15	37	95	631	692	38	2
35	712	—	1	—	1	4	6	84	327	272	23
40	264	—	—	—	1	—	1	2	43	106	112
45	41	—	—	—	—	—	—	1	1	8	31
50	16	—	—	—	—	—	—	—	1	2	13
55 and upwards	13	—	—	—	—	—	—	—	1	—	12

* Excluding in each Presidency, the 3rd European regiments, they not having been formed until 1854.
† See note to preceding table.

No. 14.—EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent. at different AGES amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY, during the Ten Years 1847-56. (Deduced from Three Enumerations of the Strength and the Deaths in Ten Years).

Ages.	Mean Annual Strength in 3 Years.	Deaths in 10 Years.	Average Annual Rate of Mortality per cent.
Total - -	13,125	6,716	5·12
10-15	40	6	1·51
15	26	2	·77
16	21	2	·94
17	20	5	2·50
18	29	21	7·16
19	168	47	2·80
10-20	304	83	2·73
20-25	3,349	1,892	5·65
25-30	4,564	2,237	4·90
30-35	2,916	1,458	5·00
35-40	1,408	712	5·06
40-45	453	264	5·83
45-50	76	41	5·42
50-55	27	16	6·00
55 and upwards	28	13	4·64

No. 15.—EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent., at different PERIODS of SERVICE, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY, during the Ten Years 1847-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in 10 Years.	Average Annual Rate of Mortality per cent.
Total - -	13,125	6,716	5·12
0-1 year	1,439	938	6·52
1-2 "	1,163	623	5·36
2-3 "	922	518	5·62
3-4 "	953	470	4·93
4-5 "	1,012	446	4·41
0-5 years	5,489	2,995	5·46
5-10 "	4,186	1,968	4·70
10-15 "	2,144	1,131	5·28
15-20 "	997	429	4·30
20 and upwards	309	193	6·25

No. 16.—EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent., at different AGES and at different PERIODS of SERVICE, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY, during the Ten Years 1847-56.

Ages.	Years of Service.									
	Under 1 Year.	1	2	3	4	Under 5 Years.	5	10	15	20 and upwards
10-20	2·91	2·02	2·61	2·07	1·46	2·60	5·22	—	—	—
20-25	7·11	5·37	5·27	5·26	3·67	5·79	4·13	4·74	—	—
25-30	6·82	5·75	6·37	4·67	4·64	5·31	4·58	4·76	4·29	—
30-35	7·09	8·31	7·20	6·52	4·66	5·97	4·88	5·14	3·36	5·00
35-40	—	7·50	—	2·73	10·00	5·29	6·28	5·53	4·21	9·08
40-45	—	—	—	30·00	—	10·00	4·29	6·72	5·12	6·36
45-50	—	—	—	—	—	—	—	2·73	4·14	5·89
50-55	—	—	—	—	—	—	—	—	7·50	5·42
55 and upwards }	—	—	—	—	—	—	—	—	—	4·56

No. 17.—EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent., at different PERIODS of SERVICE, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY, during the Ten Years 1847-56, showing the AGE on entering INDIA.

Period of Service.	Age on entering India.						
	10-20	15-25	20-30	25-35	30-40	35-45	40-50
0-5	2·60	5·79	5·31	5·97	5·29	10·00	—
5-10	4·19	4·58	4·88	6·28	4·29	—	—
10-15	4·76	5·14	5·53	6·72	2·73	—	—
15-20	3·42	4·21	5·12	4·14	7·50	—	—
20 and upwards	8·52	6·36	5·89	5·42	4·56	—	—

BENGAL

No. 1.

TABLE showing the STRENGTH and DEATHS in each of the Years 1846 to 1856 of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN FORCES of the late EAST INDIA COMPANY in the PRESIDENCY of BENGAL.

Years.	Bengal Artillery.*		1st Bengal Fusiliers.		2nd Bengal Fusiliers.		3rd Bengal Europeans.		Town Major's List.		European Pensioners.		European Invalids.		European Veterans.		Total.	
	Strength on 31st August.	Deaths in the Year ending 31st August.	Strength on 31st August.	Deaths in the Year ending 31st August.	Strength on 31st August.	Deaths in the Year ending 31st August.	Strength on 31st August.	Deaths in the Year ending 31st August.	Strength on 31st August.	Deaths in the Year ending 31st August.	Strength on 31st August.	Deaths in the Year ending 31st August.	Strength on 31st August.	Deaths in the Year ending 31st August.	Strength on 31st August.	Deaths in the Year ending 31st August.	Strength on 31st August.	Deaths in the Year ending 31st August.
1846	2,710	270	638	155	746	38	—	—	602	49	144	14	258	26	110	9	5,208	561
1847	2,740	139	836	38	682	41	—	—	611	43	136	10	246	12	98	7	5,349	290
1848	3,248	143	855	114	779	32	—	—	627	42	130	12	259	20	91	6	5,989	369
1849	3,192	249	839	80	862	145	—	—	649	57	150	8	234	11	84	4	6,010	554
1850	3,260	167	995	65	1,032	62	—	—	635	45	172	8	233	11	79	6	6,406	364
1851	3,220	157	877	173	1,033	32	—	—	722	45	160	6	214	16	73	3	6,299	432
1852	3,291	136	930	44	975	15	—	—	709	41	168	11	217	9	69	4	6,359	260
1853	3,395	183	908	134	1,013	55	—	—	739	60	165	14	217	24	66	7	6,503	477
1854	3,358	155	701	89	768	115	757	45	711	49	176	11	213	10	58	3	6,742	477
1855	3,306	130	814	57	741	206	904	35	726	38	169	8	229	16	39	3	6,928	493
1856	3,113	315	877	29	819	45	941	128	737	35	180	10	237	32	36	3	6,940	597
Total	34,833	2,044	9,270	978	9,450	786	2,602	208	7,468	504	1,750	112	2,557	187	803	55	68,733	4,874

* The first company of Bengal artillery was raised in 1749, and consisted of about six officers and 110 non-commissioned officers and men. In 1778 the artillery had become sufficiently strong to be formed into an independent brigade of one European regiment about 60 officers and 700 men), and three native battalions. The head-quarters were at Fort William and the practice ground at Dum-Dum. In 1813 the head-quarters were removed to Dum-Dum, where barracks had been built, and the men were much gratified with the change from the narrow limits of a fortress to an airy, roomy cantonment.

The strength of the European non-commissioned officers and men of the Bengal artillery on the 1st December 1827 appears to have been about 3,000, which is nearly the average strength in the 10 years 1847-56.

In July 1845, the corps was re-organized preparatory to taking part in the Sikh war, and it was prominently engaged at the battles of Moodkee, Ferozeshuhur, Aliwal, Sobraon, Mooltan (January 1849), and Goojerat.

In 1854 the head-quarters of the artillery were removed from Dum-Dum to Meerut.

No. 2.

TABLE showing the MORTALITY per Cent., in each of the Years 1847 to 1856, amongst the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN FORCES of the late EAST INDIA COMPANY, in the PRESIDENCY of BENGAL.

Years ending 31st August.	Bengal Artillery.		First Bengal Fusiliers.		Second Bengal Fusiliers.		Third Bengal Europeans.		Town Ma- jor's List.		European Pensioners.		European Invalids.		European Veterans.		Total.
	Mortality per cent.	Station of Head-Quarters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quarters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quarters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quarters at the beginning and end of each Year.	Mortality per cent.	Head Quarters.	Mortality per cent.	Head Quarters.	Mortality per cent.	Head Quarters.	Mortality per cent.	Head Quarters.	Mortality per cent.
1847	5·101	Dum-Dum.	5·156	Subathoo.	5·742	Subathoo.	—	—	7·084	Fort William.	7·143	4·762	6·731	5·49			
1848	4·776		13·483	Subathoo.	4·381	Subathoo.	—	—	6·785		9·023						
1849	7·733		9·445	Cawnpore.	17·672	Subathoo.	—	—	8·934		5·714						
1850	5·177		7·088	Cawnpore.	6·547	Lahore.	—	—	7·009		4·969						
1851	4·846		18·483	Lahore.	3·099	Agra.	—	—	6·627		3·614						
1852	4·177		4·870	Meerut.	1·494	Agra.	—	—	5·726		6·707						
1853	5·474	Meerut.	14·581	On the Ganges.	5·533	Agra.	—	—	8·287	Chunar.	8·383	11·060	10·294	7·42			
1854	4·590		11·063	On the Ganges.	12·914	Fort Wil- liam.	5·945	Chinsurah. Chinsurah.	6·759		6·433						
1855	3·902		7·525	Rangoon.	27·303	Prome.	3·872	Chinsurah. Chinsurah.	5·285		4·624						
1856	9·813		3·430	Thayetmyo.	5·769	Moulmein. Subathoo.	13·603	Chinsurah. Agra.	4·781		5·714						
Average Annual Mortality in the 10 Years	5·557	—	9·668	—	8·630	—	7·994	—	6·690	—	6·164	—	6·964	—	6·276	—	6·88

No. 3.—STRENGTH OF EFFECTIVES.*

TABLE showing the STRENGTH of NON-COMMISSIONED OFFICERS and MEN in the BENGAL ARTILLERY, for the Three Years 1848, 1851, and 1856; 1ST EUROPEAN FUSILIERS for the Three Years 1847, 1851, and 1856; 2ND EUROPEAN FUSILIERS, for the Three Years 1849, 1851, and 1856; and on the TOWN MAJOR'S LIST for the Three Years 1848, 1851, and 1856.

Age.	Period of Service.														
	Total.	Months.					Years.								
		0—	3—	6—	9—	Under 1 Year.	1	2	3	4	Under 5 Years.	5—	10—	15—	20 and upwards.
Total -	16,971	23	215	519	1,618	2,375	1,582	1,477	1,627	1,129	8,190	5,043	2,256	1,041	441
10-15	42	6	16	5	1	28	8	4	2	—	42	—	—	—	—
15	43	2	9	4	3	18	13	6	5	—	42	1	—	—	—
16	26	2	1	—	2	5	6	4	7	3	25	1	—	—	—
17	26	—	1	1	3	5	5	6	4	2	22	4	—	—	—
18	51	2	3	4	7	16	8	5	9	5	43	8	—	—	—
19	203	5	53	52	57	167	11	6	3	4	191	11	1	—	—
10-20	391	17	83	66	73	239	51	31	30	14	365	25	1	—	—
20-25	5,096	3	109	364	1,268	1,744	1,116	920	830	216	4,826	249	21	—	—
25-30	5,672	2	15	79	252	348	384	504	725	799	2,760	2,815	82	15	—
30-35	3,423	1	6	9	23	39	27	21	36	96	219	1,747	1,397	53	7
35-40	1,685	—	2	1	2	5	4	1	5	3	18	199	680	747	41
40-45	534	—	—	—	—	—	—	—	1	1	2	8	73	202	249
45-50	80	—	—	—	—	—	—	—	—	—	—	—	2	24	54
50-55	35	—	—	—	—	—	—	—	—	—	—	—	—	—	35
55 & upwards	55	—	—	—	—	—	—	—	—	—	—	—	—	—	55

* The 3rd Bengal European regiment is excluded throughout these Tables unless otherwise stated, as it was not formed until the year 1854.

No. 4.—DEATHS OF EFFECTIVES.

TABLE showing the NUMBER of DEATHS of NON-COMMISSIONED OFFICERS and MEN in the BENGAL ARTILLERY, 1ST and 2ND EUROPEAN FUSILIERS, and on the TOWN MAJOR'S LIST during the Ten Years 1847-56.

Age.	Period of Service.														
	Total.	Months.				Years.									
		0—	3—	6—	9—	Under 1 Year.	1	2	3	4	Under 5 Years.	5—	10—	15—	20 and upwards.
Total - -	3,800	162	105	169	182	618	390	304	294	269	1,875	1,076	520	216	113
10-15	3	—	1	1	—	2	1	—	—	—	3	—	—	—	—
15	1	—	—	—	—	—	1	—	—	—	1	—	—	—	—
16	2	—	—	—	—	—	1	—	1	—	2	—	—	—	—
17	3	—	—	—	—	—	1	—	1	1	3	—	—	—	—
18	14	7	1	3	—	11	—	1	—	—	12	2	—	—	—
19	32	6	4	8	7	25	5	1	—	—	31	1	—	—	—
10-20	55	13	6	12	7	38	9	2	2	1	52	3	—	—	—
20-25	1,174	137	79	125	137	478	280	179	147	43	1,127	41	6	—	—
25-30	1,329	12	19	28	35	94	86	116	134	200	630	673	23	3	—
30-35	716	—	1	4	3	8	15	7	10	23	63	322	311	18	2
35-40	357	—	—	—	—	—	—	—	1	2	3	35	163	145	11
40-45	135	—	—	—	—	—	—	—	—	—	—	1	17	46	71
45-50	16	—	—	—	—	—	—	—	—	—	—	1	—	2	13
50-55	10	—	—	—	—	—	—	—	—	—	—	—	—	2	8
55 and upwards	8	—	—	—	—	—	—	—	—	—	—	—	—	—	8

No. 5.—STRENGTH OF NON-EFFECTIVES.

TABLE showing the STRENGTH of NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN PENSIONERS for the Three Years 1848, 1851, and 1856; INVALIDS for the Three Years 1848, 1851, and 1856; and VETERAN COMPANY for the Three Years 1848, 1851, and 1853.

Age.	Period of Service, Years.											
	Total.	Under 5 Years.	5—	10—	15—	20—	25—	30—	35—	40—	45—	50 and upwards.
Total -	1,413	—	41	44	191	355	249	195	140	105	28	65
20-25	4	—	4	—	—	—	—	—	—	—	—	—
25-30	19	—	17	1	1	—	—	—	—	—	—	—
30-35	55	—	17	19	12	6	1	—	—	—	—	—
35-40	138	—	—	16	93	22	7	—	—	—	—	—
40-45	312	—	1	6	56	209	26	13	1	—	—	—
45-50	300	—	1	2	18	94	140	31	8	6	—	—
50-55	235	—	1	—	10	17	58	99	30	17	3	—
55-60	162	—	—	—	1	7	11	39	71	25	3	5
60-65	82	—	—	—	—	—	3	7	16	38	11	7
65-70	52	—	—	—	—	—	3	3	9	13	7	17
70-75	29	—	—	—	—	—	—	3	5	4	4	13
75 and upwards	25	—	—	—	—	—	—	—	—	2	—	23

No. 6.—DEATHS OF NON-EFFECTIVES.

TABLE showing the NUMBER of DEATHS of NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN PENSIONERS, INVALIDS, and VETERANS in the Ten Years 1847-1856.

Age.	Period of Service, Years.											
	Total.	Under 5 Years.	5—	10—	15—	20—	25—	30—	35—	40—	45—	50 and upwards.
Total -	305	—	5	16	57	73	51	35	23	18	12	15
20-25	1	—	1	—	—	—	—	—	—	—	—	—
25-30	1	—	1	—	—	—	—	—	—	—	—	—
30-35	11	—	3	7	1	—	—	—	—	—	—	—
35-40	33	—	—	5	22	5	—	1	—	—	—	—
40-45	85	—	—	3	29	44	7	1	1	—	—	—
45-50	55	—	—	—	5	22	22	3	2	1	—	—
50-55	42	—	—	—	—	2	17	15	4	3	—	1*
55-60	30	—	—	1	—	—	4	8	8	7	2	—
60-65	16	—	—	—	—	—	1	4	4	1	3	3
65-70	17	—	—	—	—	—	—	2	3	4	5	3
70-75	8	—	—	—	—	—	—	1	1	—	2	4
75 and upwards	6	—	—	—	—	—	—	—	—	2	—	4

* Age, 53 years and 6 months; period of service, 50 years (an Indian); received from Lower Orphan School in 1798, and died in 1848.

No. 7.—CASUALTIES OF EFFECTIVES.

NUMBER of DEATHS, DISCHARGES, and other CASUALTIES amongst the NON-COMMISSIONED OFFICERS and MEN of the BENGAL ARTILLERY, and 1ST and 2ND EUROPEAN FUSILIERS, during the Ten Years 1847-56 at different PERIODS of SERVICE.

	Period of Service.														
	Total.	Months.				Under 1 year.	1	2	3	4	Under 5 years.	5—	10—	15—	20 and upwards.
		0—	3—	6—	9—										
DEATHS - - - - -	3,345	124	96	159	175	554	378	286	282	254	1,754	980	429	143	39
LEAVING THE CORPS - - - - -	3,144	24	31	27	52	134	158	137	185	199	813	963	744	340	284
Pensioned - - - - -	154	—	—	—	—	—	—	1	—	1	2	2	2	13	135
Invalided to Europe - - - - -	835	1	2	6	22	31	59	50	61	70	271	259	180	81	44
„ Chunar, or other parts of India	381	—	—	—	—	—	1	—	4	9	14	40	82	168	77
Sent to lunatic asylum - - - - -	44	2	1	—	4	7	2	7	6	—	22	14	7	1	—
Discharged by purchase - - - - -	251	1	—	3	7	11	25	21	29	26	112	98	41	—	—
„ (time expired or otherwise) - - - - -	296	6	13	5	2	26	11	8	7	12	64	85	127	16	4
Promoted - - - - -	75	—	—	—	—	—	1	1	4	5	11	32	20	4	8
Transferred to Town Major's List - - - - -	719	1	1	3	5	10	23	21	39	50	143	322	184	54	16
„ to other corps - - - - -	274	4	6	2	—	12	17	18	23	19	89	97	87	1	—
Deserted - - - - -	107	8	8	8	12	36	19	8	12	6	81	13	12	1	—
Missing - - - - -	2	—	—	—	—	—	—	2	—	—	2	—	—	—	—
Other causes - - - - -	6	1	—	—	—	1	—	—	—	1	2	1	2	1	—
JOINING THE CORPS - - - - -	1,864	1,364	63	20	3	1,450	20	30	20	23	1,543	137	110	59	15
Remanded from Town Major's list - - - - -	201	—	1	—	1	2	3	4	5	4	18	66	63	46	8
From other corps - - - - -	192	7	4	9	1	21	11	23	14	14	83	59	33	12	5
Enlisted in India - - - - -	128	118	1	—	1	120	1	—	—	3	124	3	1	—	—
„ in Europe - - - - -	2	1	—	—	—	1	—	—	—	—	1	—	1	—	—
Rejoined from desertion - - - - -	17	—	1	3	—	4	1	2	1	1	9	4	3	1	—
Entertained - - - - -	1,324	1,238	56	8	—	1,302	4	1	—	1	1,308	5	9	—	2
Casualty not specified - - - - -	8	7	—	—	—	7	—	—	—	—	7	—	1	—	—

No. 8.—CASUALTIES.—TOWN MAJOR'S LIST.

NUMBER of DEATHS, DISCHARGES, and other CASUALTIES amongst the NON-COMMISSIONED OFFICERS and MEN of the TOWN MAJOR'S LIST during the Ten Years 1847-56 at different PERIODS of SERVICE.

	Period of Service.														
	Total.	Months.				Total under 1 year.	1	2	3	4	Total under 5 years.	5—	10—	15—	20 and upwards.
		0—	3—	6—	9—										
DEATHS - - - - -	455	38	9	10	7	64	12	18	12	15	121	96	91	73	74
LEAVING THE CORPS - - - - -	664	2	1	2	—	5	14	18	20	22	79	140	146	92	207
Pensioned - - - - -	92	—	—	—	—	—	—	—	—	—	—	1	2	3	86
Invalided to Europe - - - - -	31	—	1	1	—	2	2	2	2	1	9	11	7	3	1
„ to Chunar, or other parts of India	2	—	—	—	—	—	—	—	—	—	—	—	—	2	—
Sent to lunatic asylum - - - - -	2	—	—	—	—	—	—	—	—	—	—	—	2	—	—
Discharged by purchase - - - - -	46	—	—	—	—	—	—	4	2	4	10	26	9	1	—
„ (time expired or otherwise) - - - - -	33	—	—	—	—	—	—	1	2	2	5	8	15	2	3
Promoted - - - - -	131	—	—	—	—	—	—	—	—	—	—	2	15	24	90
Transferred to Town Major's list - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ to other corps - - - - -	288	1	—	—	—	1	7	8	12	10	38	84	87	56	23
Deserted - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Missing - - - - -	2	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Other causes - - - - -	37	1	—	1	—	2	5	3	2	5	17	8	9	1	2
JOINING THE CORPS - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Remanded from Town Major's list - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
From other corps - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Enlisted in India - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ in Europe - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rejoined from desertion - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Entertained - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Casualty not specified - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

No. 11.

TABLE showing the STRENGTH, DEATHS, and AVERAGE ANNUAL RATE of MORTALITY per Cent. in the Ten Years 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN FORCES of the Late EAST INDIA COMPANY in BENGAL at different AGES.

Ages.	Strength.			Deaths.			Annual Rate of Mortality per cent.		
	Total.	Effectives.	Non-Effectives.	Total.	Effectives.	Non-Effectives.	Total.	Effectives.	Non-Effectives.
Total -	18,384	16,971	1,413	4,105	3,800	305	6.70	6.72	6.48
10-15	42	42	—	3	3	—	2.14	2.14	—
15	43	43	—	1	1	—	.70	.70	—
16	26	26	—	2	2	—	2.31	2.31	—
17	26	26	—	3	3	—	3.46	3.46	—
18	51	51	—	14	14	—	8.24	8.24	—
19	203	203	—	32	32	—	4.73	4.73	—
10-20	391	391	—	55	55	—	4.22	4.22	—
20-25	5,100	5,096	4	1,175	1,174	1	6.91	6.91	7.50
25-30	5,691	5,672	19	1,330	1,329	1	7.01	7.03	1.58
30-35	3,478	3,423	55	727	716	11	6.27	6.28	6.00
35-40	1,823	1,685	138	390	357	33	6.42	6.36	7.17
40-45	846	534	312	220	135	85	7.80	7.58	8.17
45-50	380	80	300	71	16	55	5.61	6.00	5.50
50-55	270	35	235	52	10	42	5.78	8.57	5.36
55 and upwards	405	55	350	85	8	77	6.30	4.36	6.60

No. 12.—EFFECTIVES.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BENGAL, in the Ten Years 1847-56, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	5,657	3,800	6.72
0- 1 years		618	7.81
1- 2 "	527	390	7.40
2- 3 "	492	304	6.17
3- 4 "	543	294	5.42
4- 5 "	376	269	7.15
0- 5 "	2,730	1,875	6.87
5-10 "	1,681	1,076	6.40
10-15 "	752	520	6.91
15-20 "	347	216	6.22
20 and upwar ^{ds}	147	113	7.69

No. 13.—NON-EFFECTIVES.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the NON-EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BENGAL, in the Ten Years 1847-56, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	471	305	6.48
5-10 Years	14	5	3.66
10-15 "	15	16	10.91
15-20 "	63	57	8.95
20-25 "	118	73	6.17
25-30 "	83	51	6.14
30-35 "	65	35	5.38
35-40 "	47	23	4.93
40-45 "	35	18	5.14
45-50 "	9	12	12.86
50 & upwards	22	15	6.92

No. 14.—EFFECTIVES.

AVERAGE ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BENGAL, in the Ten Years 1847-56, at different AGES.

Ages.	Mean Strength.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	5,657	3,800	6.72
10-15	14	3	2.14
15	14	1	.70
16	9	2	2.31
17	9	3	3.46
18	17	14	8.24
19	67	32	4.73
10-20	130	55	4.22
20-25	1,699	1,174	6.91
25-30	1,890	1,329	7.03
30-35	1,141	716	6.28
35-40	562	357	6.36
40-45	178	135	7.58
45-50	27	16	6.00
50-55	12	10	8.57
55 and upwards	18	8	4.36

No. 15.—NON-EFFECTIVES.

AVERAGE ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN PENSIONERS, INVALIDS, and VETERANS in the Ten Years 1847-56, at different AGES.

Ages.	Mean Strength.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	471	305	6.48
20—	1.3	1	7.50
25—	6.3	1	1.58
30—	18.3	11	6.00
35—	46.0	33	7.17
40—	104.0	85	8.17
45—	100.0	55	5.50
50—	78.3	42	5.36
55—	54.0	30	5.56
60—	27.3	16	5.85
65—	17.3	17	9.81
70—	9.7	8	8.28
75 and upwards	8.3	6	7.20

No. 16.—EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent. at different AGES and at different PERIODS of SERVICE amongst the NON-COMMISSIONED OFFICERS and MEN of the BENGAL ARTILLERY, 1ST and 2ND BENGAL EUROPEAN REGIMENTS, and TOWN MAJOR'S LIST, during the Ten Years, 1847-56.

Ages.	Years of Service.									
	Under 1 Year.	1—	2—	3—	4—	Under 5 Years.	5—	10—	15—	20 and upwards.
10-20	4·77	5·29	1·94	2·00	2·14	4·27	3·60	—	—	—
20-25	8·22	7·53	5·84	5·31	5·97	7·01	4·94	8·57	—	—
25-30	8·10	6·72	6·90	5·54	7·51	6·85	7·17	8·41	6·00	—
30-35	6·15	16·67	10·00	8·33	7·19	8·63	5·53	6·68	10·19	8·57
35-40	—	—	—	6·00	20·00	5·00	5·28	7·19	5·82	8·05
40-45	—	—	—	—	—	—	3·75	6·99	6·83	8·55
45-50	—	—	—	—	—	—	—	—	2·50	7·22
50-55	—	—	—	—	—	—	—	—	—	6·86
55 and upwards	—	—	—	—	—	—	—	—	—	4·36

No. 17.—NON-EFFECTIVES.

MORTALITY at different AGES and at different PERIODS of SERVICE amongst the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN PENSIONERS, INVALIDS, and VETERANS, in the Ten Years, 1847-56.

Ages.	Years of Service.									
	5—	10—	15—	20—	25—	30—	35—	40—	45—	50 and upwards.
20-25	7·50	—	—	—	—	—	—	—	—	—
25-30	1·76	—	—	—	—	—	—	—	—	—
30-35	5·29	11·05	2·50	—	—	—	—	—	—	—
35-40	—	9·38	7·10	6·82	—	—	—	—	—	—
40-45	—	15·00	15·54	6·32	8·08	2·31	30·00	—	—	—
45-50	—	—	8·33	7·02	4·71	2·90	7·50	5·00	—	—
50-55	—	—	—	3·53	8·79	4·55	4·00	5·29	—	—
55-60	—	—	—	—	10·91	6·15	3·38	8·40	20·00	—
60-65	—	—	—	—	10·00	17·14	7·50	·79	8·18	12·86
65-70	—	—	—	—	—	20·00	10·00	9·23	21·43	5·29
70-75	—	—	—	—	—	10·00	6·00	—	15·00	9·23
75 and upwards	—	—	—	—	—	—	—	30·00	—	5·22

No. 17 a.—EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent. at Different PERIODS of SERVICE, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY, during the Ten Years 1847-56, in the PRESIDENCY of BENGAL, showing the AGE on entering INDIA.

Period of Service.	Age on entering India.						
	10-20	15-25	20-30	25-35	30-40	35-45	40-50
0-5	4·27	7·01	6·85	8·63	5·00	—	—
5-10	4·82	7·17	5·53	5·28	3·75	—	—
10-15	8·45	6·68	7·19	6·99	—	—	—
15-20	9·26	5·82	6·83	2·50	—	—	—
20 and upwards	8·13	8·55	7·22	6·86	4·36	—	—

No. 18.—EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY in the Ten Years 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the BENGAL ARTILLERY, and the 1ST and 2ND BENGAL EUROPEAN REGIMENTS.

Period of Service.	Proportion per cent. leaving the Corps annually.		
	From all Causes.	By Death.	Pensioned, Invalided, Discharged, transferred to Town Major's List, &c.
Years.			
0-5	9·85	6·87	2·98
5-10	12·13	6·40	5·73
10-15	16·81	6·91	9·90
15-20	16·02	6·22	9·80
20 and upwards	27·01	7·69	19·32

No. 19.—TOWN MAJOR'S LIST.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY in the Ten Years 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the TOWN MAJOR'S LIST.

Period of Service.	Proportion per cent. leaving the Corps annually.		
	From all Causes.	By Death.	Pensioned, Invalided, Discharged, transferred to Town Major's List, &c.
0-5	17·43	10·55	6·88
5-10	13·54	5·51	8·03
10-15	12·91	4·96	7·95
15-20	12·90	5·70	7·20
20 and upwards	29·74	7·79	21·95

No. 20.—NON-EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY in the Ten Years 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN PENSIONERS, INVALIDS, and VETERANS.

Period of Service.	Proportion per cent. leaving the Corps annually.		
	From all Causes.	By Death.	Pensioned, Invalided, Discharged, transferred to Town Major's List, &c.
Years.			
0-5	30·00	—	30·00
5-10	16·10	3·66	12·44
10-15	20·45	10·91	9·54
15-20	16·81	8·95	7·86
20-25	19·09	6·17	12·92
25-30	7·34	6·14	1·20
30-35	6·30	5·38	·92
35-40	5·14	4·93	·21
40-45	8·00	5·14	2·86
45-50	13·93	12·86	1·07
50 and upwards	7·84	6·92	·92

No. 23.—CASUALTIES OF NON-EFFECTIVES.

(EUROPEAN PENSIONERS, INVALIDS, and VETERANS.)

TABLE showing the PROPORTION per Cent. of NON-COMMISSIONED OFFICERS and MEN LEAVING the CORPS ANNUALLY, from various Causes, in the Ten Years 1847-56.

Casualties.	Period of Service, Years.										
	Under 5 Years.	5—	10—	15—	20—	25—	30—	35—	40—	45—	50 and upwards.
Leaving the corps from various causes -	30·00	12·44	9·54	7·86	12·92	1·20	·92	·21	2·86	1·07	·92
Pensioned -	—	—	—	·16	1·86	·24	·31	·21	·29	—	—
Invalided to Europe -	—	—	—	·16	·17	—	—	—	—	—	—
Invalided to Chunar -	—	—	—	—	—	—	—	—	—	—	—
Sent to Lunatic Asylum -	—	—	·68	—	—	—	—	—	—	—	—
Discharged by purchase -	—	—	—	—	—	—	—	—	—	—	—
Discharged (time expired or otherwise) -	30·00	7·32	8·18	6·75	10·39	·84	·46	—	2·57	1·07	·92
Promoted -	—	·73	—	·16	·25	—	—	—	—	—	—
Transferred to Town Major's list -	—	—	—	—	—	—	—	—	—	—	—
Transferred to other corps -	—	4·39	·68	·63	·25	—	·15	—	—	—	—
Deserted -	—	—	—	—	—	—	—	—	—	—	—
Missing -	—	—	—	—	—	·12	—	—	—	—	—
Other causes -	—	—	—	—	—	—	—	—	—	—	—

No. 21.—CASUALTIES OF EFFECTIVES.

(BENGAL ARTILLERY, 1ST and 2ND BENGAL EUROPEANS, in the Ten Years 1847-56.)

TABLE showing the PROPORTION per Cent. of NON-COMMISSIONED OFFICERS and MEN LEAVING the CORPS ANNUALLY from various Causes.

Casualties.	Period of Service, Years.				
	0—	5—	10—	15—	20 and upwards.
Leaving the corps from various causes.	2·98	5·73	9·90	9·80	19·32
Pensioned -	·01	·01	·03	·37	9·19
Invalided to Europe -	·99	1·54	2·39	2·33	2·99
Invalided to Chunar -	·05	·24	1·09	4·84	5·24
Sent to Lunatic Asylum -	·08	·08	·09	·03	—
Discharged by purchase -	·41	·58	·55	—	—
Discharged (time expired or otherwise).	·23	·51	1·69	·46	·27
Promoted -	·04	·19	·27	·12	·54
Transferred to Town Major's list.	·52	1·91	2·44	1·56	1·09
Transferred to other corps -	·33	·58	1·16	·03	—
Deserted -	·30	·08	·16	·03	—
Missing -	·01	—	—	—	—
Other causes -	·01	·01	·03	·03	—

No. 22.—CASUALTIES, TOWN MAJOR'S LIST.

TABLE showing the PROPORTION per Cent. of NON-COMMISSIONED OFFICERS and MEN LEAVING the TOWN MAJOR'S LIST ANNUALLY, from various Causes, in the Ten Years 1847-56.

Casualties.	Period of Service, Years.				
	0—	5—	10—	15—	20 and upwards.
Leaving the corps from various causes.	6·88	8·03	7·95	7·20	21·95
Pensioned -	—	·06	·11	·23	9·12
Invalided to Europe -	·78	·63	·38	·23	·11
Invalided to Chunar -	—	—	—	·16	—
Sent to Lunatic Asylum -	—	—	·11	—	—
Discharged by purchase -	·87	1·49	·49	·08	—
Discharged (time expired or otherwise).	·44	·46	·82	·16	·32
Promoted -	—	·11	·82	1·88	9·54
Transferred to Town Major's list.	—	—	—	—	—
Transferred to other corps -	3·31	4·82	4·73	4·38	2·44
Deserted -	—	—	—	—	—
Missing -	—	—	—	—	·21
Other causes -	1·48	·46	·49	·08	·21

No. 24.—BENGAL ARTILLERY.

ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the BENGAL ARTILLERY in each of the Ten Years 1847-56.

Years ending August 31.	Mean Annual Strength.	Deaths in the Year.	Annual Rate of Mortality per cent.
1846-7	2,725	139	5.101
1847-8	2,994	143	4.776
1848-9	3,220	249	7.733
1849-50	3,226	167	5.177
1850-1	3,240	157	4.846
1851-2	3,256	136	4.177
1852-3	3,343	183	5.474
1853-4	3,377	155	4.590
1854-5	3,332	130	3.902
1855-6	3,210	315	9.813
Average of the 10 years	3,192.3	177.4	5.557

No. 25.—BENGAL ARTILLERY.

AVERAGE ANNUAL RATE of MORTALITY amongst the NON-COMMISSIONED OFFICERS and MEN of the BENGAL ARTILLERY, in the Ten Years 1847-56, at different AGES.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	3,193.6	1,774	5.555
10-15	9.0	2	2.222
15	7.6	1	1.304
16	3.7	1	2.727
17	2.7	1	3.750
18	6.7	1	1.500
19	16.0	5	3.125
10-20	45.7	11	2.409
20-25	913.7	492	5.385
25-30	1,176.7	650	5.524
30-35	630.3	342	5.426
35-40	319.0	204	6.395
40-45	98.7	70	7.095
45-50	8.3	5	6.000
50-55	1.0	—	—
55 and upwards	.2	—	—

No. 26.—BENGAL ARTILLERY.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the BENGAL ARTILLERY, in the Ten Years 1847-56, at different PERIODS of SERVICE.

Period of Service.	Mean Strength in 3 Years.	Deaths in the 10 Years, 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	3,193.6	1,774	5.555
0-1 years -	436.7	277	6.344
1-2 „ -	214.3	177	8.258
2-3 „ -	357.0	154	4.314
3-4 „ -	390.3	148	3.792
4-5 „ -	231.0	137	5.931
0-5 years -	1,629.3	893	5.475
5-10 „ -	945.0	498	5.270
10-15 „ -	400.3	236	5.895
15-20 „ -	171.0	114	6.667
20 and upwards	48.0	33	6.875

No. 27.—BENGAL ARTILLERY.—STRENGTH.

ABSTRACT of AGE and PERIOD of SERVICE in INDIA of NON-COMMISSIONED OFFICERS and MEN of the BENGAL ARTILLERY, for the Three Years 1848, 1851, and 1856.

Age.	Period of Service.				
	Years.				
	Under 5 Years.	5—	10—	15—	20 and upwards.
10—	27	—	—	—	—
15—	103	7	—	—	—
20—	2,660	76	5	—	—
25—	1,961	1,544	20	5	—
30—	129	1,082	666	13	1
35—	8	120	459	359	11
40—	—	6	51	123	116
45—	—	—	—	13	12
50 and upwards	—	—	—	—	4

It will be seen from this Table that 2,660 men, of the age of 20 and under 25, had served under 5 years in India. Now, take one of those men of the age 20 precisely, then he would represent the youngest man of the number, and it is impossible that he could have entered India earlier than the age 15, otherwise he must have served more than 5 years in India. By the nature of the case, no one of the 2,660 can be above 25 years of age; and it is here shown that the youngest life must have been at least 15 years of age on entering, consequently all the 2,660 must have entered India between the ages of 15 and 25. (See other Form, Table No. 30.)

No. 28.—BENGAL ARTILLERY.—DEATHS.

ABSTRACT of AGE and PERIOD of SERVICE in INDIA of NON-COMMISSIONED OFFICERS and MEN of the BENGAL ARTILLERY, for the Ten Years 1847–56.

Age.	Period of Service.				
	Years.				
	Under 5 Years.	5—	10—	15—	20 and upwards.
Years.					
10—	2	—	—	—	—
15—	8	1	—	—	—
20—	485	6	1	—	—
25—	366	280	3	1	—
30—	31	191	117	2	1
35—	1	18	103	79	3
40—	—	1	12	31	26
45—	—	1	—	1	3

No. 29.—BENGAL ARTILLERY.

AVERAGE ANNUAL MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the BENGAL ARTILLERY, in the Ten Years 1847–56, at different AGES and at different PERIODS of SERVICE.

Age.	Period of Service.				
	Years.				
	Under 5 Years.	5—	10—	15—	20 and upwards.
Years.					
10—	2·222	—	—	—	—
15—	2·330	4·286	—	—	—
20—	5·470	2·368	6·000	—	—
25—	5·599	5·440	4·500	6·000	—
30—	7·209	5·296	5·270	4·615	30·000
35—	3·750	4·500	6·732	6·602	8·182
40—	—	5·000	7·059	7·561	6·724
45—	—	—	—	2·308	7·500

No. 30.—BENGAL ARTILLERY.—STRENGTH.

AGE and PERIOD of SERVICE in INDIA of the NON-COMMISSIONED OFFICERS and MEN in the BENGAL ARTILLERY, in the Three Years 1848, 1851, and 1856, showing the AGE on entering INDIA.

Period of Service.	Age on entering India, Years.				
	10–20	15–25	20–30	25–35	30–40
Years.					
0–5	130	2,660	1,961	129	8
5–10	83	1,544	1,082	120	6
10–15	25	666	459	51	—
15–20	18	359	123	13	—
20 and upwards	12	116	12	3	1

No. 31.—BENGAL ARTILLERY.—DEATHS.

AGE and PERIOD of SERVICE in INDIA, of the NON-COMMISSIONED OFFICERS and MEN in the BENGAL ARTILLERY, in the Ten Years 1847–56, showing the AGE on entering INDIA.

Period of Service.	Age on entering India, Years.				
	10–20	15–25	20–30	25–35	30–40
Years.					
0–5	10	485	366	31	1
5–10	7	280	191	18	1
10–15	4	117	103	12	—
15–20	3	79	31	1	—
20 and upwards	4	26	3	—	—

No. 32.—BENGAL ARTILLERY.

AVERAGE ANNUAL MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN in the BENGAL ARTILLERY, in the Ten Years 1847–56, at different PERIODS of SERVICE, showing the AGE on entering INDIA.

Period of Service.	Age on entering India, Years.				
	10–20	15–25	20–30	25–35	30–40
0–5 years -	2·308	5·470	5·599	7·209	3·750
5–10 „ -	2·530	5·440	5·296	4·500	5·000
10–15 „ -	4·800	5·270	6·732	7·059	—
15–20 „ -	5·000	6·602	7·561	2·308	—
20 and upwards	10·000	6·724	7·500	—	—

No. 33.—BENGAL ARTILLERY.

TABLE showing amongst the NON-COMMISSIONED OFFICERS and MEN of the BENGAL ARTILLERY, the PROPORTION per Cent. LEAVING the CORPS ANNUALLY, (1) by DEATH, (2) from other CAUSES, in the Ten Years 1847–56.

Period of Service.	Proportion per cent. leaving the Corps annually.		
	From all Causes.	By Death.	Pensioned, invalided, discharged, transferred to Town Major's List, &c.
Years.			
0—	8·445	5·475	2·970
5—	11·651	5·270	6·381
10—	16·987	5·895	11·092
15—	22·746	6·667	16·079
20 and upwards	60·416	6·875	53·541

No. 34.—BENGAL ARTILLERY.—CASUALTIES.

TABLE showing the PROPORTION per Cent. of NON-COMMISSIONED OFFICERS AND MEN of the BENGAL ARTILLERY LEAVING the CORPS ANNUALLY, from various CAUSES, in the Ten Years 1847-56.

Casualties.	Period of Service, Years.				
	0—	5—	10—	15—	20 and upwards.
Leaving the corps from various causes.	2·970	6·381	11·092	16·079	53·541
Pensioned - - -	·012	·021	·050	·760	25·208
Invalided to Europe - -	·804	1·450	2·623	2·982	8·333
Invalided to Chunar - -	·031	·233	1·524	8·538	14·583
Sent to lunatic asylum -	·086	·074	·125	·058	—
Discharged by purchase -	·552	·688	·550	—	—
Discharged (time expired or otherwise).	·295	·529	1·749	·585	·625
Promoted - - -	·006	—	·050	·058	1·667
Transferred to Town Maj. list	·853	3·312	4·296	2·982	3·125
Transferred to other corps -	·043	·032	—	—	—
Deserted - - -	·282	·042	·125	·058	—
Missing - - -	—	—	—	—	—
Other causes - - -	·006	—	—	·058	—

The table may be read thus :—Out of every 100 non-commissioned officers and men of the Bengal artillery 11·092 left the corps annually after having completed 10 and under 15 years' service, viz. :—·050 were pensioned, 2·623 were invalided to Europe, 1·524 were invalided to Chunar, 1·749 were discharged otherwise than by purchase, 4·296 were transferred to town major's list, and so on.

No. 35.—1ST BENGAL FUSILIERS.

ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 1ST BENGAL FUSILIERS, in each of the Ten Years 1847-56.

Years ending August 31.	Mean Strength.	Deaths in the Year.	Annual Rate of Mortality per cent.
1846-7	737	38	5·156
1847-8	846	114	13·483
1848-9	847	80	9·445
1849-50	917	65	7·088
1850-1	936	173	18·483
1851-2	904	44	4·870
1852-3	919	134	14·581
1853-4	805	89	11·063
1854-5	758	57	7·525
1855-6	846	29	3·430
Average of the } 10 years.	851·5	82·3	9·668

No. 36.—1ST BENGAL FUSILIERS.

AVERAGE ANNUAL RATE of MORTALITY amongst the NON-COMMISSIONED OFFICERS and MEN of the 1ST BENGAL FUSILIERS, in the Ten Years 1847-56, at different AGES.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	863·3	823	9·533
10-15	3·0	—	—
15	3·0	—	—
16	1·0	1	10·000
17	2·7	2	7·500
18	3·3	5	15·000
19	40·3	19	4·711
10-20	53·3	27	5·063
20-25	374·0	401	10·722
25-30	292·7	248	8·474
30-35	106·3	110	10·345
35-40	31·0	32	10·323
40-45	5·3	4	7·500
45-50	·7	1	15·000
50-55	—	—	—
55 and upwards	—	—	—

No. 37.—1ST BENGAL FUSILIERS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 1ST BENGAL FUSILIERS, in the Ten Years 1847-56, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	863·3	823	9·533
0-1 year	176·4	151	8·563
1-2 „	133·3	121	9·075
2-3 „	36·3	97	26·697
3-4 „	68·3	106	15·512
4-5 „	113·3	54	4·765
0-5 years	527·6	529	10·025
5-10 „	258·7	201	7·771
10-15 „	50·7	78	15·395
15-20 „	22·0	11	5·000
20 and upwards	4·3	4	9·231

No. 38.—2ND BENGAL FUSILIERS.

ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 2ND BENGAL FUSILIERS, in each of the Ten Years 1847-56.

Years ending August 31st.	Mean Strength	Deaths in each Year.	Annual Rate of Mortality per cent.
1846-7	714	41	5·742
1847-8	730·5	32	4·381
1848-9	820·5	145	17·672
1849-50	947	62	6·547
1850-1	1,032·5	32	3·099
1851-2	1,004	15	1·494
1852-3	994	55	5·533
1853-4	890·5	115	12·914
1854-5	754·5	206	27·303
1855-6	780	45	5·769
Average of the } 10 years	866·75	74·8	8·630

No. 39.—2ND BENGAL FUSILIERS

AVERAGE ANNUAL RATE of MORTALITY amongst the NON-COMMISSIONED OFFICERS and MEN of the 2ND BENGAL FUSILIERS, in the Ten Years 1847-56, at different AGES.

Ages.	Mean Annual Strength, in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	865·00	748	8·647
10-15	·75	1	13·333
15	2·25	—	—
16	2·25	—	—
17	2·25	—	—
18	3·00	4	13·333
19	7·75	7	9·032
10-20	18·25	12	6·575
20-25	282·75	197	6·967
25-30	337·25	326	9·666
30-35	183·25	158	8·622
35-40	40·00	50	12·500
40-45	3·50	5	14·286
45-50	—	—	—
50-55	—	—	—
55 and upwards	—	—	—

No. 40.—2ND BENGAL FUSILIERS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 2ND BENGAL FUSILIERS, in the 10 Years 1847-56, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength. in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	865.00	748	8.647
0-1 year	118.75	126	10.611
1-2 "	122.25	80	6.544
2-3 "	64.50	35	5.426
3-4 "	50.50	28	5.545
4-5 "	40.50	63	15.556
0-5 years	396.50	332	8.373
5-10 "	358.75	281	7.833
10-15 "	88.00	115	13.068
15-20 "	21.50	18	8.372
20 & upwards	.25	2	80.000

No. 41.—3RD BENGAL EUROPEANS.

ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 3RD BENGAL EUROPEANS, in each of the Years 1854 to 1856.

Years ending August 31.	Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1846-7	—	—	—
1847-8	—	—	—
1848-9	—	—	—
1849-50	—	—	—
1850-1	—	—	—
1851-2	—	—	—
1852-3	—	—	—
1853-4	757	45	5.945
1854-5	904	35	3.872
1855-6	941	128	13.603
Average of the 3 years }	867	69	7.994

No. 42.—3RD BENGAL EUROPEANS.

AVERAGE ANNUAL MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 3RD BENGAL EUROPEANS, in the Three Years 1854, 1855, and 1856, at different AGES.

Age.	Strength in the 3 Years 1854-5-6.	Deaths in the 3 Years 1854-5-6.	Average Annual Rate of Mortality per cent.
Total - -	2,602	208	7.99
10-15	3	—	—
15	3	—	—
16	5	—	—
17	—	—	—
18	5	7	?
19	209	7	3.35
10-20	225	14	6.22
20-25	1,637	142	8.67
25-30	515	39	7.57
30-35	143	9	6.29
35-40	74	4	5.41
40-45	8	—	—
45-50	—	—	—
50-55	—	—	—
55 and upwards	—	—	—

No. 43.—3RD BENGAL EUROPEANS.

AVERAGE ANNUAL MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 3RD BENGAL EUROPEANS, in the Three Years, 1854, 1855, and 1856, at different PERIODS of SERVICE.

Period of Service.	Strength in the 3 Years 1854-5-6.	Deaths in the 3 Years 1854-5-6.	Average Annual Rate of Mortality per cent.
Total - -	2,602	208	7.99
0-1 year	846	77	9.10
1-2 "	746	48	6.43
2-3 "	579	60	10.36
3-4 "	33	—	—
4-5 "	29	4	13.79
0-5 years	2,233	189	8.46
5-10 "	208	8	3.85
10-15 "	102	6	5.88
15-20 "	59	5	8.47
20 and upwards	—	—	—

No. 44.—TOWN MAJOR'S LIST.

ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN on the TOWN MAJOR'S LIST, in each of the Ten Years 1847-56.

Years ending August 31.	Mean Strength.	Deaths in the Year.	Annual Rate of Mortality per cent.
1846-7	607	43	7.084
1847-8	619	42	6.785
1848-9	638	57	8.934
1849-50	642	45	7.009
1850-1	679	45	6.627
1851-2	716	41	5.726
1852-3	724	60	8.287
1853-4	725	49	6.759
1854-5	719	38	5.285
1855-6	732	35	4.781
Average of the 10 years }	680.1	45.5	6.690

No. 45.—TOWN MAJOR'S LIST.

AVERAGE ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN on the TOWN MAJOR'S LIST, in the Ten Years 1847-56, at different AGES.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	695.3	455	6.544
10-15	1.0	—	—
15	1.3	—	—
16	1.3	—	—
17	1.4	—	—
18	3.0	4	13.333
19	1.7	1	6.000
10-20	9.7	5	5.172
20-25	79.3	84	10.588
25-30	140.3	105	7.482
30-35	189.0	106	5.608
35-40	161.3	71	4.401
40-45	69.3	56	8.077
45-50	17.7	10	5.660
50-55	10.7	10	9.375
55 and upwards }	18.0	8	4.444

No. 46.—TOWN MAJOR'S LIST.

AVERAGE ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN on the TOWN MAJOR'S LIST, in the Ten Years 1847-56, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	695·3	455	6·544
0-1 years -	21·0	64	30·476
1-2 " -	21·7	12	5·538
2-3 " -	24·6	18	7·297
3-4 " -	23·7	12	5·070
4-5 " -	23·7	15	6·338
0-5 years -	114·7	121	10·552
5-10 " -	174·3	96	5·507
10-15 " -	184·0	91	4·946
15-20 " -	128·0	73	5·703
20 and upwards	94·3	74	7·845

No. 47.—EUROPEAN PENSIONERS.

ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN PENSIONERS in each of the Ten Years 1847-56.

Years ending August 31.	Mean Strength.	Deaths in the Year.	Annual Rate of Mortality per cent.
1846-7	140	10	7·143
1847-8	133	12	9·023
1848-9	140	8	5·714
1849-50	161	8	4·969
1850-1	166	6	3·614
1851-2	164	11	6·707
1852-3	167	14	8·383
1853-4	171	11	6·433
1854-5	173	8	4·624
1855-6	175	10	5·714
Average of the 10 years }	159	9·8	6·164

No. 48.—EUROPEAN PENSIONERS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN PENSIONERS in the Ten Years 1847-56, at different AGES.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	157·7	98	6·216
20—	—	—	—
25—	·7	1	15·000
30—	1·7	2	12·000
35—	3·3	2	6·000
40—	17·3	11	6·346
45—	40·7	19	4·672
50—	36·0	19	5·278
55—	28·7	14	4·884
60—	11·0	10	9·091
65—	9·0	12	13·333
70—	5·3	7	13·125
75 and upwards	4·0	1	2·500

No. 49.—EUROPEAN PENSIONERS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN PENSIONERS, in the Ten Years 1847-56, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	157·7	98	6·216
5—	1·3	3	22·500
10—	1·6	—	—
15—	2·7	1	3·750
20—	27·0	12	4·444
25—	42·0	28	6·667
30—	31·7	16	5·053
35—	23·3	13	5·571
40—	11·7	8	6·857
45—	4·7	7	15·000
50 and upwards	11·7	10	8·571

No. 50.—EUROPEAN INVALIDS.

ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN INVALIDS, in each of the Ten Years 1847-56.

Years ending August 31.	Mean Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1846-7	252	12	4·762
1847-8	253	20	7·905
1848-9	247	11	4·453
1849-50	234	11	4·701
1850-1	224	16	7·143
1851-2	216	9	4·167
1852-3	217	24	11·060
1853-4	215	10	4·651
1854-5	221	16	7·240
1855-6	233	32	13·734
Average of the 10 years }	231·2	16·1	6·964

No. 51.—EUROPEAN INVALIDS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN INVALIDS, in the Ten Years 1847-56, at different AGES.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years, 1847-56.	Average Annual Rate of Mortality per cent.
Total -	236·7	161	6·803
20—	1·3	1	7·500
25—	5·7	—	—
30—	16·7	9	5·400
35—	41·3	30	7·258
40—	81·3	71	8·730
45—	51·3	30	5·844
50—	25·0	12	4·800
55—	8·7	5	5·769
60—	4·0	2	5·000
65—	1·0	1	10·000
70—	·4	—	—
75 and upwards	—	—	—

No. 52.—EUROPEAN INVALIDS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN INVALIDS in the Ten Years 1847–56, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847–56.	Average Annual Rate of Mortality per cent.
Total.	236·7	161	6·803
5—	12·3	2	1·622
10—	12·3	16	12·973
15—	60·3	55	9·116
20—	85·7	56	6·537
25—	31·7	17	5·368
30—	17·3	7	4·038
35—	8·0	4	7·924
40—	6·0	2	3·333
45—	2·0	2	10·000
50 and upwards	1·1	—	—

No. 53.—EUROPEAN VETERANS.

ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN VETERANS in each of the Ten Years 1847–56.

Years ending August 31.	Mean Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1846–7	104	7	6·731
1847–8	95	6	6·316
1848–9	88	4	4·545
1849–50	82	6	7·317
1850–1	76	3	3·947
1851–2	71	4	5·634
1852–3	68	7	10·294
1853–4	62	3	4·839
1854–5	49	3	6·122
1855–6	38	3	7·895
Average of the 10 years }	73·3	4·6	6·276

No. 54.—EUROPEAN VETERANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN VETERANS in the Ten Years, 1847–56, at different AGES.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847–56.	Average Annual Rate of Mortality per cent.
Total - -	76·7	46	6·000
20—	—	—	—
25—	—	—	—
30—	—	—	—
35—	1·3	1	7·500
40—	5·3	3	5·625
45—	8·0	6	7·500
50—	17·4	11	6·364
55—	16·8	11	6·600
60—	12·3	4	3·243
65—	7·3	4	5·455
70—	4·0	1	2·500
75 and upwards.	4·3	5	11·538

No. 55.—EUROPEAN VETERANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN VETERANS in the Ten Years 1847–56, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847–56.	Average Annual Rate of Mortality per cent.
Total - -	76·7	46	6·000
5—	—	—	—
10—	·7	—	—
15—	·7	1	15·000
20—	5·7	5	8·824
25—	9·3	6	6·429
30—	16·0	12	7·500
35—	15·3	6	3·913
40—	17·3	8	4·615
45—	2·7	3	11·250
50 and upwards.	9·0	5	5·556

MADRAS.

No. 1.

TABLE showing the STRENGTH and DEATHS, in each of the Years 1846 to 1856, of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN FORCES of the late EAST INDIA COMPANY, in the PRESIDENCY of MADRAS.

Years.	Madras Artillery.		1st Madras Fusiliers.		2nd European Light Infantry.		3rd Madras Europeans.		Europeans attached to Sappers and Miners.		Effective Supernumeraries.		European Veterans.		European Pensioners.		Total.	
	Strength on 1st January.	Deaths during the Year.	Strength on 1st January.	Deaths during the Year.	Strength on 1st January.	Deaths during the Year.	Strength on 1st January.	Deaths during the Year.	Strength on 1st January.	Deaths during the Year.	Strength on 1st January.	Deaths during the Year.	Strength on 1st January.	Deaths during the Year.	Strength on 1st January.	Deaths during the Year.	Strength on 1st January.	Deaths during the Year.
1846	1,828	89	799	17	862	21	—	—	49	2	281	14	229	8	440	43	4,488	194
1847	1,678	79	904	15	823	31	—	—	50	2	279	7	223	15	443	16	4,400	165
1848	1,883	49	1,058	20	1,056	28	—	—	60	1	277	5	213	17	465	22	5,012	142
1849	2,049	64	1,104	34	1,104	45	—	—	66	2	279	13	213	8	473	39	5,288	205
1850	1,881	78	1,038	23	998	25	—	—	57	1	280	12	229	9	456	19	4,939	167
1851	2,103	68	1,008	24	888	69	—	—	61	2	286	4	241	11	449	35	5,036	214
1852	2,264	106	1,026	66	1,041	20	—	—	61	5	291	13	249	21	442	28	5,374	259
1853	2,176	133	1,008	87	1,060	30	—	—	58	3	289	10	250	14	414	44	5,255	321
1854	2,242	97	931	69	977	32	281	79	59	2	290	7	234	18	382	29	5,396	333
1855	2,233	66	814	46	880	24	912	22	64	2	308	12	246	13	367	22	5,824	207
1856	2,063	57	752	25	941	28	897	15	75	5	317	8	264	8	360	28	5,669	174
Total	22,400	886	10,442	426	10,630	353	2,090	116	660	28	3,177	105	2,591	142	4,691	325	56,681	2,381

No. 2.

TABLE showing the MORTALITY per Cent., in each of the Years 1847 to 1856, amongst the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN FORCES of the late EAST INDIA COMPANY in the PRESIDENCY of MADRAS.

Years, ending 31st Decem-ber.	Madras Artillery.		1st Madras Fusiliers.		2nd European Light Infantry.		3rd Madras Europeans.		Europeans attached to Sappers and Miners.		Effective Supernumeraries.		European Veterans.		European Pensioners.	
	Mortality per cent.	Station of Head-Quar-ters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quar-ters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quar-ters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quar-ters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quar-ters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quar-ters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quar-ters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quar-ters at the beginning and end of each Year.
1847	4.44	Saint Thomas's Mount.	1.53	{ Bellary Bellary }	3.30	{ Trichi-nopoly Trichi-nopoly }	—	—	3.64	{ Mercara Mercara }	2.52	{ ? ? }	6.88	{ ? ? }	3.52	Fort Saint George.
1848	2.49		1.85	{ Bellary Bellary }	2.59	{ Trichi-nopoly Trichi-nopoly }	—	—	1.59	{ Mercara Mercara }	1.80	{ ? ? }	7.98	{ ? ? }	4.69	
1849	3.26		3.17	{ Bellary ? }	4.28	{ Trichi-nopoly Secun-derabad }	—	—	3.25	{ Mercara Mercara }	4.65	{ ? ? }	3.62	{ ? ? }	8.40	
1850	3.92		2.25	{ ? Bellary }	2.65	{ Secun-derabad Secun-derabad }	—	—	1.69	{ Mercara Mercara }	4.24	{ ? ? }	3.83	{ ? ? }	4.20	
1851	3.11		2.36	{ Bellary Pegue }	7.15	{ Secun-derabad Secun-derabad }	—	—	4.92	{ Mercara Prome }	1.39	{ ? ? }	4.49	{ Vizaga-patam ? }	7.86	
1852	4.77		6.49	{ Pegue Tonghoo }	1.90	{ Secun-derabad Secun-derabad }	—	—	8.40	{ Prome Mercara }	4.48	{ ? ? }	8.42	{ ? ? }	6.54	
1853	6.02		8.97	{ Tonghoo Tonghoo }	2.95	{ Secun-derabad Secun-derabad }	—	—	5.13	{ Mercara Mercara }	3.45	{ Fort St. George Fort St. George }	5.79	{ ? ? }	11.06	
1854	4.34		7.91	{ Tonghoo Fort St. George }	3.45	{ Secun-derabad Fort St. George }	13.24	{ Secun-derabad Secun-derabad }	3.25	{ Mercara ? }	2.34	{ Fort St. George Fort St. George }	7.50	{ Vizaga-patam ? }	7.74	
1855	3.07	Saint Thomas's Mount.	5.87	{ Fort St. George Fort St. George }	2.64	{ Fort St. George Tonghoo }	2.43	{ Secun-derabad Secun-derabad }	2.88	{ ? Dowla-ishweram }	3.84	{ Fort St. George ? }	5.10	{ ? ? }	6.05	Fort Saint George.
1856	2.85		3.29	{ Fort St. George Fort St. George }	2.97	{ Tonghoo Tonghoo }	1.71	{ Secun-derabad Secun-derabad }	6.71	{ Dowla-ishweram ? }	2.52	{ ? ? }	2.81	{ ? ? }	7.66	
Average Annual Mortality in the 10 Years	3.85	—	4.27	—	3.38	—	4.88	—	4.17	—	3.12	—	5.58	—	6.69	—

No. 3.—STRENGTH OF EFFECTIVES.*

TABLE showing the AGE and PERIOD of SERVICE in INDIA of NON-COMMISSIONED OFFICERS and MEN of the MADRAS ARTILLERY, 1ST FUSILIERS, 2ND EUROPEAN LIGHT INFANTRY, EUROPEANS attached to SAPPERS and MINERS, and EFFECTIVE SUPERNUMERARIES, on 1st January 1847, 1852, and 1856.

Age.	Total.	Period of Service.									
		Years.									
		Under 1 Year.	1	2	3	4	Under 5 Years.	5—	10—	15—	20 and upwards.
Total.	12,565	824	847	446	778	1,186	4,081	3,917	2,772	1,359	436
10-15	72	50	17	2	3	—	72	—	—	—	—
15	31	12	16	1	1	—	30	1	—	—	—
16	32	14	8	1	5	2	30	2	—	—	—
17	27	6	4	1	5	1	17	10	—	—	—
18	24	5	3	4	5	6	23	1	—	—	—
19	109	86	5	1	5	6	103	6	—	—	—
10-20	295	173	53	10	24	15	275	20	—	—	—
20—	2,224	539	583	276	309	227	1,934	276	14	—	—
25—	4,199	102	198	145	419	848	1,712	2,316	165	4	2
30—	3,171	10	13	15	21	91	150	1,170	1,736	110	5
35—	1,792	—	—	—	5	5	10	132	748	871	31
40—	674	—	—	—	—	—	—	3	101	332	238
45—	138	—	—	—	—	—	—	—	8	30	100
50—	43	—	—	—	—	—	—	—	—	7	36
55 and upwards	29	—	—	—	—	—	—	—	—	5	24

* Throughout the following tables relating to Madras, the EFFECTIVES comprise the Madras Artillery, 1st and 2nd Madras Europeans, the Europeans attached to the Sappers and Miners, and the Effective Supernumeraries (the 3rd Madras Europeans are excluded, unless otherwise stated, inasmuch as the regiment was not formed until 1854); the NON-EFFECTIVES comprise the European Pensioners and Veterans.

No. 4.—DEATHS OF EFFECTIVES.

TABLE showing the AGE and PERIOD of SERVICE in INDIA of NON-COMMISSIONED OFFICERS and MEN of the MADRAS ARTILLERY, 1ST FUSILIERS, 2ND EUROPEAN LIGHT INFANTRY, EUROPEANS attached to SAPPERS and MINERS, and EFFECTIVE SUPERNUMERARIES, during the Ten Years 1847-56.

Age.	Total.	Period of Service, Years.									
		Under 1 Year.	1	2	3	4	Under 5 Years.	5—	10—	15—	20 and upwards.
Total.	1,655	203	115	109	75	81	583	460	399	150	63
10-15	3	1	1	1	—	—	3	—	—	—	—
15	1	—	1	—	—	—	1	—	—	—	—
16	—	—	—	—	—	—	—	—	—	—	—
17	1	—	—	—	—	1	1	—	—	—	—
18	4	1	—	1	—	—	2	2	—	—	—
19	6	5	—	—	1	—	6	—	—	—	—
10-20	15	7	2	2	1	1	13	2	—	—	—
20-25	355	164	74	59	36	11	344	11	—	—	—
25-30	466	30	36	46	37	61	210	239	17	—	—
30-35	439	2	2	2	1	6	13	174	236	16	—
35-40	243	—	1	—	—	2	3	33	119	81	7
40-45	102	—	—	—	—	—	—	1	24	47	30
45-50	24	—	—	—	—	—	—	—	1	6	17
50-55	6	—	—	—	—	—	—	—	1	—	5
55 and upwards	5	—	—	—	—	—	—	—	1	—	4

No. 5.—STRENGTH OF NON-EFFECTIVES.

TABLE showing the AGE and PERIOD of SERVICE in INDIA of NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN VETERANS and EUROPEAN PENSIONERS, on the 1st January 1847, 1852, and 1856.

Age.	Total.	Period of Service, Years.											
		Under 5 Years.	5—	10—	15—	20—	25—	30—	35—	40—	45—	50—	55 and upwards.
Total	1,981	4	9	32	333	494	496	288	170	77	52	11	15
20—	4	2	2	—	—	—	—	—	—	—	—	—	—
25—	10	1	7	1	1	—	—	—	—	—	—	—	—
30—	32	—	—	11	18	1	2	—	—	—	—	—	—
35—	215	1	—	15	187	7	4	1	—	—	—	—	—
40—	484	—	—	4	97	313	61	6	3	—	—	—	—
45—	529	—	—	1	28	138	297	64	1	—	—	—	—
50—	290	—	—	—	1	17	78	148	41	5	—	—	—
55—	151	—	—	—	—	9	20	33	63	21	5	—	—
60—	113	—	—	—	1	8	20	10	30	28	16	—	—
65—	78	—	—	—	—	1	10	18	19	11	16	3	—
70—	44	—	—	—	—	—	3	6	8	8	12	5	2
75 and upwards	31	—	—	—	—	—	1	2	5	4	3	3	13

No. 6.—DEATHS OF NON-EFFECTIVES.

TABLE showing the AGE and PERIOD of SERVICE in INDIA of NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN VETERANS and EUROPEAN PENSIONERS during the Ten Years 1847-56.

Age.	Total.	Period of Service, Years.											
		Under 5 Years.	5—	10—	15—	20—	25—	30—	35—	40—	45—	50—	55 and upwards.
Total - -	416	1	1	6	46	118	108	64	28	24	10	4	6
Years.													
20—	1	1	—	—	—	—	—	—	—	—	—	—	—
25—	2	—	1	—	1	—	—	—	—	—	—	—	—
30—	2	—	—	2	—	—	—	—	—	—	—	—	—
35—	38	—	—	3	27	7	1	—	—	—	—	—	—
40—	106	—	—	1	13	76	15	1	—	—	—	—	—
45—	111	—	—	—	5	24	64	15	1	2	—	—	—
50—	57	—	—	—	—	9	19	23	6	—	—	—	—
55—	29	—	—	—	—	—	1	13	9	6	—	—	—
60—	20	—	—	—	—	1	3	2	2	8	2	2	—
65—	25	—	—	—	—	1	5	4	5	3	5	1	1
70—	12	—	—	—	—	—	—	4	3	4	1	—	—
75 and upwards	13	—	—	—	—	—	—	2	2	1	2	1	5

No. 7.—CASUALTIES OF EFFECTIVES.

NUMBER of DEATHS, DISCHARGES, and OTHER CASUALTIES amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS ARTILLERY, 1ST MADRAS FUSILIERS, 2ND EUROPEAN LIGHT INFANTRY, EUROPEANS attached to SAPPERS and MINERS, and EFFECTIVE SUPERNUMERARIES, for the Ten Years 1847-56, at different PERIODS of SERVICE.

	Total.	Period of Service.											
		Under 1 Year.	1	2	3	4	Under 5 Years.	5—	10—	15—	20 and upwards.		
DEATHS - - - - -	1,655	203	115	109	75	81	583	460	399	150	63		
LEAVING THE CORPS - - - - -	2,214	316	60	84	57	54	571	379	473	402	389		
Pensioned - - - - -	382	—	—	5	7	5	17	20	43	55	247		
Invalided to Europe - - - - -	311	—	—	2	1	1	4	6	75	168	58		
„ Chunar, or other parts of India - - - - -													
Sent to lunatic asylum - - - - -	16	—	—	3	—	1	4	9	2	1	—		
Discharged by purchase - - - - -	91	9	7	11	7	9	43	39	7	2	—		
„ (time expired or otherwise) - - - - -	505	49	31	35	23	15	153	157	136	57	2		
Promoted - - - - -	87	—	—	—	—	2	2	3	4	23	55		
Transferred to Town Major's list - - - - -	—	—	—	—	—	—	—	—	—	—	—		
„ to other corps - - - - -	743	237	16	17	6	13	289	129	202	96	27		
Deserted - - - - -	78	21	6	11	13	7	58	16	4	—	—		
Missing - - - - -	1	—	—	—	—	1	1	—	—	—	—		
Other causes - - - - -	—	—	—	—	—	—	—	—	—	—	—		
JOINING THE CORPS - - - - -	—	—	—	—	—	—	—	—	—	—	—		
Remanded from Town Major's list - - - - -	—	—	—	—	—	—	—	—	—	—	—		
From other corps - - - - -	—	—	—	—	—	—	—	—	—	—	—		
Enlisted in India - - - - -	—	—	—	—	—	—	—	—	—	—	—		
„ in Europe - - - - -	—	—	—	—	—	—	—	—	—	—	—		
Rejoined from desertion - - - - -	—	—	—	—	—	—	—	—	—	—	—		
Entertained - - - - -	—	—	—	—	—	—	—	—	—	—	—		
Casualty not specified - - - - -	—	—	—	—	—	—	—	—	—	—	—		

No. 10.

TABLE showing the STRENGTH, DEATHS, and AVERAGE ANNUAL RATE of MORTALITY per Cent., in the Ten Years, 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS, at different AGES.

Ages.	Strength.			Deaths.			Average Annual Rate of Mortality per cent.		
	Total.	Effectives.	Non-Effectives.	Total.	Effectives.	Non-Effectives.	Total.	Effectives.	Non-Effectives.
Total -	14,546	12,565	1,981	2,071	1,655	416	4.27	3.95	6.30
10-15	72	72	—	3	3	—	1.25	1.25	—
15	31	31	—	1	1	—	.97	.97	—
16	32	32	—	—	—	—	—	—	—
17	27	27	—	1	1	—	1.11	1.11	—
18	24	24	—	4	4	—	5.00	5.00	—
19	109	109	—	6	6	—	1.65	1.65	—
10-20	295	295	—	15	15	—	1.53	1.53	—
20-25	2,228	2,224	4	356	355	1	4.79	4.79	7.50
25-30	4,209	4,199	10	468	466	2	3.34	3.33	6.00
30-35	3,203	3,171	32	441	439	2	4.13	4.15	1.88
35-40	2,007	1,792	215	281	243	38	4.20	4.07	5.30
40-45	1,158	674	484	208	102	106	5.39	4.54	6.57
45-50	667	138	529	135	24	111	6.07	5.22	6.29
50-55	333	43	290	63	6	57	5.68	4.19	5.90
55 & upwards	446	29	417	104	5	99	7.00	5.17	7.12

No. 11.—EFFECTIVES.

AVERAGE ANNUAL RATE of MORTALITY per Cent., in the Ten Years 1847 to 1856, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	4,188	1,655	3.95
0- 1 years	275	203	7.39
1- 2 "	282	115	4.07
2- 3 "	149	109	7.33
3- 4 "	259	75	2.89
4- 5 "	395	81	2.05
0- 5 "	1,360	583	4.29
5-10 "	1,306	460	3.52
10-15 "	924	399	4.32
15-20 "	453	150	3.31
20 and upwards	145	63	4.33

No. 12.—NON-EFFECTIVES.

AVERAGE ANNUAL RATE of MORTALITY per Cent., in the Ten Years 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the NON-EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	661	416	6.30
0- 1 years	1	1	7.50
5-10 "	3	1	3.33
10-15 "	11	6	5.63
15-20 "	111	46	4.14
20-25 "	165	118	7.17
25-30 "	165	108	6.53
30-35 "	96	64	6.67
35-40 "	57	28	4.94
40-45 "	26	24	9.35
45-50 "	17	10	5.77
50-55 "	4	4	10.91
55 & upwards	5	6	12.00

No. 13.—EFFECTIVES.

AVERAGE ANNUAL RATE of MORTALITY per Cent., in the Ten Years 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS, at different AGES.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	4,188	1,655	3.95
10-15	24	3	1.25
15	10	1	.97
16	11	—	—
17	9	1	1.11
18	8	4	5.00
19	36	6	1.65
10-20	98	15	1.53
20-25	741	355	4.79
25-30	1,400	466	3.33
30-35	1,057	439	4.15
35-40	597	243	4.07
40-45	225	102	4.54
45-50	46	24	5.22
50-55	14	6	4.19
55 and upwards	10	5	5.17

No. 14.—NON-EFFECTIVES.

AVERAGE ANNUAL RATE of MORTALITY per Cent., in the Ten Years 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the NON-EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS, at different AGES.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years, 1847-56.	Average Annual Rate of Mortality per cent.
Total -	661	416	6.30
20-	1	1	7.50
25-	3	2	6.00
30-	11	2	1.88
35-	72	38	5.30
40-	161	106	6.57
45-	177	111	6.29
50-	97	57	5.90
55-	50	29	5.76
60-	38	20	5.31
65-	26	25	9.62
70-	15	12	8.18
75 and upwards	10	13	12.58

No. 15.—EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent., at different AGES and at different PERIODS of SERVICE, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS, during the Ten Years 1847-56.

Ages.	Years of Service.									
	Under 1 Year.	1	2	3	4	Under 5 Years.	5—	10—	15—	20 and upwards.
10-20	1·21	1·13	6·00	1·25	2·00	1·42	3·00	—	—	—
20-25	9·13	3·81	6·41	3·50	1·45	5·34	1·20	—	—	—
25-30	8·82	5·45	9·52	2·65	2·16	3·68	3·10	3·09	—	—
30-35	6·00	4·62	4·00	1·43	1·98	2·60	4·46	4·08	4·36	—
35-40	—	—	—	—	12·00	9·00	7·50	4·77	2·79	6·77
40-45	—	—	—	—	—	—	10·00	7·13	4·25	3·78
45-50	—	—	—	—	—	—	—	3·75	6·00	5·10
50-55	—	—	—	—	—	—	—	—	—	4·17
55 and upwards	—	—	—	—	—	—	—	—	—	5·00

No. 16.—NON-EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent., at different AGES and at different PERIODS of SERVICE, amongst the NON-COMMISSIONED OFFICERS and MEN of the NON-EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS, during the Ten Years 1847-56.

Ages.	Years of Service.											
	Under 5 Years.	5—	10—	15—	20—	25—	30—	35—	40—	45—	50—	55 and upwards.
20-25	15·00	—	—	—	—	—	—	—	—	—	—	—
25-30	—	4·29	—	30·00	—	—	—	—	—	—	—	—
30-35	—	—	5·45	—	—	—	—	—	—	—	—	—
35-40	—	—	6·00	4·33	30·00	7·50	—	—	—	—	—	—
40-45	—	—	7·50	4·02	7·28	7·38	5·00	—	—	—	—	—
45-50	—	—	—	5·36	5·22	6·46	7·03	30·00	—	—	—	—
50-55	—	—	—	—	15·88	7·31	4·66	4·39	—	—	—	—
55-60	—	—	—	—	—	1·50	11·82	4·29	8·57	—	—	—
60-65	—	—	—	—	3·75	4·50	6·00	2·00	8·57	3·75	—	—
65-70	—	—	—	—	30·00	15·00	6·67	7·89	8·18	9·38	10·00	—
70-75	—	—	—	—	—	—	20·00	11·25	15·00	2·50	—	—
75 and upwards	—	—	—	—	—	—	30·00	12·00	7·50	20·00	10·00	11·54

No. 17.—EFFECTIVES

AVERAGE ANNUAL MORTALITY per Cent., at different PERIODS of SERVICE, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS, during the Ten Years 1847-56, showing the AGE on entering INDIA.

Period of Service.	Age on entering India.						
	10-20	15-25	20-30	25-35	30-40	35-45	40-50
0-5	1·42	5·34	3·68	2·60	9·00	—	—
5-10	1·32	3·10	4·46	7·50	10·00	—	—
10-15	3·09	4·08	4·77	7·13	3·75	—	—
15-20	4·36	2·79	4·25	6·00	—	—	—
20 and upwards	6·77	3·78	5·10	4·17	5·00	—	—

No. 18.—EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY, in the Ten Years, 1847-56, from— (1) ALL CAUSES, (2) DEATH, and (3) OTHER CAUSES, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS, at different PERIODS of SERVICE.

Period of Service.	Proportion per cent. leaving the Corps annually.		
	From all Causes.	By Death.	Pensioned, invalided, discharged, transferred to other Corps, &c.
0- 5 years	8·49	4·29	4·20
5-10 "	6·42	3·52	2·90
10-15 "	9·44	4·52	5·12
15-20 "	12·18	3·31	8·87
20 and upwards	31·10	4·33	26·77

No. 19.—NON-EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY, in the Ten Years, 1847-56, from— (1) ALL CAUSES, (2) DEATH, and (3) OTHER CAUSES, amongst the NON-COMMISSIONED OFFICERS and MEN of the NON EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS, at different PERIODS of SERVICE.

Period of Service.	Proportion per cent. leaving the Corps annually.		
	From all Causes.	By Death.	Pensioned, invalided, discharged, transferred to other Corps, &c.
0-5	80·65	7·50	73·15
5-10	76·66	3·33	73·33
10-15	14·07	5·63	8·44
15-20	10·09	4·14	5·95
20-25	22·72	7·17	15·55
25-30	9·61	6·53	3·08
30-35	8·02	6·67	1·35
35-40	5·47	4·94	·53
40-45	9·35	9·35	—
45-50	5·77	5·77	—
50-55	10·91	10·91	—
55 and upwards	12·00	12·00	—

No. 20.—EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY, from various CAUSES, in the Ten Years, 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS.

Casualties.	Period of Service, Years.				
	0—	5—	10—	15—	20 and upwards.
Leaving the corps from various causes.	4·20	2·90	5·12	8·87	26·77
Pensioned - - -	·12	·15	·47	1·21	17·00
Invalided to Europe - - }	·03	·05	·81	3·71	3·99
Invalided (India) - - }					
Sent to lunatic asylum -	·03	·07	·02	·02	—
Discharged by purchase -	·32	·30	·08	·04	—
Discharged (time expired or otherwise).	1·12	1·20	1·47	1·26	·14
Promoted - - -	·01	·02	·04	·51	3·78
Transferred to Town Major's list.	—	—	—	—	—
Transferred to other corps -	2·13	·99	2·19	2·12	1·86
Deserted - - -	·43	·12	·04	—	—
Missing - - -	·01	—	—	—	—
Other causes - - -	—	—	—	—	—

No. 21.—NON-EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS from various CAUSES ANNUALLY, in the Ten Years 1847-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the NON-EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in MADRAS.

Casualties.	Period of Service, Years.								
	Total.	Under 5.	5—	10—	15—	20—	25—	30—	35—
Leaving the corps from various causes - -	6·54	73·15	73·33	8·44	5·95	15·55	3·08	1·35	·53
Pensioned - - -	2·01	—	—	—	·63	5·83	1·33	·62	·35
Invalided to Europe - - -	3·96	73·15	73·33	6·56	4·87	8·57	1·27	·42	—
Invalided (India) - - -									
Sent to lunatic asylum - - -	·03	—	—	—	·09	—	—	·10	—
Discharged by purchase - - -	—	—	—	—	—	—	—	—	—
Discharged (time expired or otherwise) - -	·03	—	—	—	—	—	·06	—	·18
Promoted - - -	—	—	—	—	—	—	—	—	—
Transferred to Town Major's list - - -	—	—	—	—	—	—	—	—	—
Transferred to other corps - - -	·51	—	—	1·88	·36	1·15	·42	·21	—
Deserted - - -	—	—	—	—	—	—	—	—	—
Missing - - -	—	—	—	—	—	—	—	—	—
Other causes - - -	—	—	—	—	—	—	—	—	—

No. 22.—MADRAS ARTILLERY.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the MADRAS ARTILLERY, in the Ten Years 1847-56.

Years ending December 31.	Mean Annual Strength.	Deaths in each Year.	Annual of Mortality per cent.
1847	1,780·5	79	4·44
1848	1,966	49	2·49
1849	1,965	64	3·26
1850	1,992	78	3·92
1851	2,183·5	68	3·11
1852	2,220	106	4·77
1853	2,209	133	6·02
1854	2,237·5	97	4·34
1855	2,148	66	3·07
1856	2,001	57	2·85
Average of the 10 years }	2,070·25	79·7	3·85

No. 23.—MADRAS ARTILLERY.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS ARTILLERY, at different AGES, in the Ten Years 1847-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	2,001·7	797	3·98
10-15	13·0	3	2·31
15	7·4	—	—
16	7·0	—	—
17	7·3	1	1·36
18	5·3	3	5·63
19	7·7	1	1·30
10-20	47·7	8	1·68
20-25	425·0	215	5·06
25-30	679·3	228	3·36
30-35	455·0	170	3·74
35-40	276·3	115	4·16
40-45	104·7	50	4·78
45-50	11·0	9	8·18
50-55	2·0	1	5·00
55 and upwards	0·7	1	15·00

No. 24.—MADRAS ARTILLERY.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS ARTILLERY, at different PERIODS of SERVICE, in the Ten Years 1847-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	2,002	797	3.98
0-1 year	113	119	10.56
1-2	240	76	3.18
2-3	106	75	7.05
3-4	167	44	2.63
4-5	207	44	2.12
0-5 years	833	358	4.30
5-10	560	189	3.38
10-15	352	137	3.89
15-20	204	89	4.36
20 and upwards	53	24	4.56

No. 25.—1ST MADRAS EUROPEANS.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 1ST MADRAS EUROPEANS, in the Ten Years 1847-56.

Years ending December 31.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1847	981	15	1.53
1848	1,081	20	1.85
1849	1,071	34	3.17
1850	1,023	23	2.25
1851	1,017	24	2.36
1852	1,017	66	6.49
1853	969.5	87	8.97
1854	872.5	69	7.91
1855	783	46	5.87
1856	760	25	3.29
Average of the 10 years }	957.50	409	4.27

No. 26.—1ST MADRAS EUROPEANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 1ST MADRAS EUROPEANS, at different AGES, in the Ten Years 1847-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	894	409	4.57
10-15	5.7	—	—
15	.7	1	15.00
16	1.3	—	—
17	1.3	—	—
18	2	1	5.00
19	21	1	.48
10-20	32	3	.94
20-25	150.3	48	3.19
25-30	296	131	4.43
30-35	251.7	138	5.48
35-40	128.7	67	5.21
40-45	31	21	6.77
45-50	3	1	3.33
50-55	1.3	—	—
55 and upwards	—	—	—

No. 27.—1ST MADRAS EUROPEANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 1ST MADRAS EUROPEANS, at different PERIODS of SERVICE, in the Ten Years 1847-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	894	409	4.57
0-1 years	74.7	31	4.15
1-2 "	12	14	11.67
2-3 "	33.3	19	5.70
3-4 "	45.3	13	2.87
4-5 "	78	12	1.54
0-5 years	243.3	89	3.66
5-10 "	340.3	164	4.82
10-15 "	229	128	5.59
15-20 "	73.3	25	3.41
20 and upwards	8	3	3.75

No. 28.—2ND MADRAS EUROPEANS.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 2ND MADRAS EUROPEANS, in the Ten Years 1847-56.

Years ending December 31.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1847	939.5	31	3.30
1848	1,080	28	2.59
1849	1,051	45	4.28
1850	943	25	2.65
1851	964.5	69	7.15
1852	1,050.5	20	1.90
1853	1,018.5	30	2.95
1854	928.5	32	3.45
1855	910.5	24	2.64
1856	941.5	28	2.97
Average of the 10 years }	982.75	332	3.38

No. 29.—2ND MADRAS EUROPEANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 2ND MADRAS EUROPEANS, at different AGES, in the Ten Years 1847-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	935	332	3.55
10-15	5.3	—	—
15	2.3	—	—
16	2.3	—	—
17	.4	—	—
18	.7	—	—
19	7.7	4	5.22
10-20	18.7	4	2.14
20-25	149.3	85	5.69
25-30	380	94	2.47
30-35	272.7	103	3.78
35-40	98.3	39	3.97
40-45	15.3	6	3.91
45-50	.7	1	15.00
50-55	—	—	—
55 and upwards	—	—	—

No. 30.—2ND MADRAS EUROPEANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 2ND MADRAS EUROPEANS, at different PERIODS of SERVICE, in the Ten Years 1847-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	935	332	3.55
0-1 years	83	49	5.90
1-2 "	19.7	22	11.19
2-3 "	1.3	14	?
3-4 "	38	17	4.47
4-5 "	101	22	2.18
0-5 years	243	124	5.10
5-10 "	359.3	87	2.42
10-15 "	256.7	105	4.09
15-20 "	75.7	16	2.11
20-25 "	.3	—	—

No. 31.—3RD MADRAS EUROPEANS.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 3RD MADRAS EUROPEANS, in the Three Years 1854-56.

Years ending Dec. 31st.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1847	—	—	—
1848	—	—	—
1849	—	—	—
1850	—	—	—
1851	—	—	—
1852	—	—	—
1853	—	—	—
1854	596.5	79	13.24
1855	904.5	22	2.43
1856	878	15	1.71
Average of the 3 years }	793	38.7	4.88

No. 32.—3RD MADRAS EUROPEANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 3RD MADRAS EUROPEANS, at different AGES, in the Three Years 1854-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 3 Years 1854-56.	Average Annual Rate of Mortality per cent.
Total -	696.7	101	4.83
10-15	13.0	1	2.56
15	4.6	—	—
16	3.0	—	—
17	2.7	—	—
18	1.7	5	?
19	61.7	12	6.49
10-20	86.7	18	6.92
20-25	472.0	59	4.17
25-30	80.3	24	9.96
30-35	47.0	—	—
35-40	10.7	—	—
40-45	—	—	—
45-50	—	—	—
50-55	—	—	—
55 and upwards	—	—	—

No. 33.—3RD MADRAS EUROPEANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 3RD MADRAS EUROPEANS, at different PERIODS of SERVICE, in the Three Years 1854-56.

Period of Service.	Mean Annual Strength in the 3 Years.	Deaths in the 3 Years 1854-56.	Annual Rate of Mortality per cent.
Total -	697	101	4.83
0-1 year	292	84	9.60
1-2 "	277	17	2.05
2-3 "	70	—	—
3-4 "	—	—	—
4-5 "	2	—	—
0-5 year	641	101	5.25
5-10 "	14	—	—
10-15 "	34	—	—
15-20 "	8	—	—
20 and upwards	—	—	—

No. 34.—MADRAS EUROPEANS ATTACHED TO SAPPERS AND MINERS.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EUROPEANS attached to SAPPERS and MINERS, in the Ten Years 1847-56.

Years ending December 31st.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1847	55	2	3.64
1848	63	1	1.59
1849	61.5	2	3.25
1850	59	1	1.69
1851	61	3	4.92
1852	59.5	5	8.40
1853	58.5	3	5.13
1854	61.5	2	3.25
1855	69.5	2	2.88
1856	74.5	5	6.71
Average of the 10 years }	62.3	2.6	4.17

No. 35.—MADRAS EUROPEANS ATTACHED TO SAPPERS AND MINERS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EUROPEANS attached to SAPPERS and MINERS, in the Ten Years 1847-56, at different AGES.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total -	62.0	26	4.19
10-15	—	—	—
15	—	—	—
16	—	—	—
17	—	—	—
18	—	—	—
19	—	—	—
10-20	—	—	—
20-25	14.3	6	4.19
25-30	25.0	10	4.00
30-35	15.7	6	3.83
35-40	6.3	4	6.32
40-45	.4	—	—
45-50	.3	—	—
50-55	—	—	—
55 and upwards	—	—	—

No. 36.—MADRAS EUROPEANS ATTACHED TO SAPPERS AND MINERS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EUROPEANS attached to SAPPERS and MINERS, in the Ten Years 1847-56, at different PERIODS of SERVICE.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	62'0	26	4'19
Years.			
0-1	4'3	4	9'23
1-2	11'3	3	2'65
2-3	5'1	—	—
3-4	6'0	1	1'67
4-5	7'0	3	4'50
0-5	33'7	11	3'27
5-10	18'7	12	6'43
10-15	8'3	3	3'60
15-20	1'0	—	—
20 and upwards	'3	—	—

No. 37.—MADRAS EFFECTIVE SUPERNUMERARIES.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EFFECTIVE SUPERNUMERARIES, in the Ten Years 1847-56.

Years ending December 31st.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1847	278	7	2'52
1848	278	5	1'80
1849	279'5	13	4'65
1850	283	12	4'24
1851	288'5	4	1'39
1852	290	13	4'48
1853	289'5	10	3'45
1854	299	7	2'34
1855	312'5	12	3'84
1856	317	8	2'52
Average of the } 10 years	291'5	9'1	3'12

No. 38.—MADRAS EFFECTIVE SUPERNUMERARIES.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EFFECTIVE SUPERNUMERARIES, at different AGES, in the Ten Years 1847-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	295'7	91	3'08
Years.			
10-15	—	—	—
15	—	—	—
16	—	—	—
17	—	—	—
18	—	—	—
19	—	—	—
10-20	—	—	—
20-25	2'3	1	4'29
25-30	19'3	3	1'55
30-35	62'0	22	3'55
35-40	87'7	18	2'05
40-45	73'3	25	3'41
45-50	31'0	13	4'19
50-55	11'0	5	4'55
55 and upwards	9'0	4	4'44

No. 39.—MADRAS EFFECTIVE SUPERNUMERARIES.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EFFECTIVE SUPERNUMERARIES, at different PERIODS of SERVICE, in the Ten Years 1847-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	295'7	91	3'08
Years.			
0-1	—	—	—
1-2	—	—	—
2-3	2'3	1	4'29
3-4	2'7	—	—
4-5	2'3	—	—
0-5	7'3	1	1'36
5-10	27'7	8	2'89
10-15	78'0	26	3'33
15-20	98'7	20	2'03
20 and upwards	84'0	36	4'29

No. 40.—MADRAS EUROPEAN PENSIONERS.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EUROPEAN PENSIONERS, in the Ten Years 1847-56.

Years ending December 31st.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1847	454	16	3'52
1848	469	22	4'69
1849	464'5	39	8'40
1850	452'5	19	4'20
1851	445'5	35	7'86
1852	428	28	6'54
1853	398	44	11'06
1854	374'5	29	7'74
1855	363'5	22	6'05
1856	365'5	28	7'66
Average of the } 10 years	421'5	28'2	6'69

No. 41.—MADRAS EUROPEAN PENSIONERS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EUROPEAN PENSIONERS, at different AGES, in the Ten Years 1847-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	415'0	282	6'80
20—	1'0	1	10'00
25—	1'7	1	6'00
30—	4'3	2	4'62
35—	24'0	14	5'83
40—	82'7	62	7'50
45—	107'0	75	7'01
50—	71'7	37	5'16
55—	40'3	24	5'95
60—	34'0	18	5'29
65—	24'0	24	10'00
70—	14'3	12	8'37
75 and upwards	10'0	12	12'00

No. 42.—EUROPEAN PENSIONERS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EUROPEAN PENSIONERS, at different PERIODS of SERVICE, in the Ten Years 1847-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years, 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	415.0	282	6.80
0-5 years.	1.0	1	10.00
5-10 "	1.7	1	6.00
10-15 "	5.3	4	7.50
15-20 "	32.3	14	4.33
20-25 "	93.7	69	7.37
25-30 "	112.3	79	7.03
30-35 "	74.3	48	6.46
35-40 "	48.0	26	5.42
40-45 "	22.7	23	10.15
45-50 "	16.0	10	6.25
50-55 "	3.0	3	10.00
55 and upwards	4.7	4	8.57

No. 43.—EUROPEAN VETERANS.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EUROPEAN VETERANS, in the Ten Years 1847-56.

Years ending December 31st.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1847	218	15	6.88
1848	213	17	7.98
1849	221	8	3.62
1850	235	9	3.83
1851	245	11	4.49
1852	249.5	21	8.42
1853	242	14	5.79
1854	240	18	7.50
1855	255	13	5.10
1856	284.5	8	2.81
Average of the 10 years }	240.3	13.4	5.58

No. 44.—EUROPEAN VETERANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EUROPEAN VETERANS, at different AGES, in the Ten Years 1847-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Rate of Mortality per cent.
Total - -	245.3	134	5.46
20—	.3	—	—
25—	1.7	1	6.00
30—	6.3	—	—
35—	47.7	24	5.03
40—	78.7	44	5.59
45—	69.3	36	5.19
50—	25.0	20	8.00
55—	10.0	5	5.00
60—	3.7	2	5.45
65—	2.0	1	5.00
70—	.3	—	—
75 and upwards	.3	1	30.00

No. 45.—EUROPEAN VETERANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the MADRAS EUROPEAN VETERANS, at different PERIODS of SERVICE, in the Ten Years 1847-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1847-56.	Average Annual Mortality per cent.
Total - -	245.3	134	5.46
0-5 years	.3	—	—
5-10 "	1.3	—	—
10-15 "	5.3	2	3.75
15-20 "	78.7	32	4.07
20-25 "	71.0	49	6.90
25-30 "	53.0	29	5.47
30-35 "	21.7	16	7.38
35-40 "	8.7	2	2.31
40-45 "	3.0	1	3.33
45-50 "	1.3	—	—
50-55 "	.7	1	15.00
55 and upwards	.3	2	60.00

BOMBAY.

No. 1.

TABLE showing the STRENGTH and DEATHS in each of the Years 1845 to 1849,* and 1851 to 1856, of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN FORCES of the late EAST INDIA COMPANY in the PRESIDENCY of BOMBAY.

Years ending 30th Sept.	Bombay Artillery.		1st Bombay Europeans.		2nd Bombay Europeans.		3rd Bombay Europeans.		Town Major's Non-Effective List.		Total.	
	Strength on 30th Sept.	Deaths during the Year ending 30th Sept.	Strength on 30th Sept.	Deaths during the Year ending 30th Sept.	Strength on 30th Sept.	Deaths during the Year ending 30th Sept.	Strength on 30th Sept.	Deaths during the Year ending 30th Sept.	Strength on 30th Sept.	Deaths during the Year ending 30th Sept.	Strength on 30th Sept.	Deaths during the Year ending 30th Sept.
1845	1,132	61	731	21	754	45	—	—	337	20	2,954	147
1846	1,138	103	669	113	777	33	—	—	368	25	2,952	274
1847	1,335	44	931	21	701	52	—	—	372	15	3,339	132
1848	1,327	31	875	34	1,039	20	—	—	363	8	3,604	93
1849	1,360	97	974	62	905	21	—	—	379	23	3,618	203
1850*	*	*	*	*	*	*	*	*	*	*	*	*
1851	1,461	54	1,053	25	1,048	34	—	—	353	11	3,915	124
1852	1,503	41	1,052	20	986	38	—	—	360	20	3,901	119
1853	1,527	39	972	21	915	30	—	—	366	6	3,780	96
1854	1,507	75	798	34	769	20	551	14	378	23	4,003	166
1855	1,471	66	861	20	915	26	847	8	383	13	4,477	133
1856	1,451	44	975	17	905	26	819	10	419	16	4,569	113
Total -	15,212	655	9,891	388	9,714	345	2,217	32	4,078	180	41,112	1,600

* At the time this Table was made, the Muster and Casualty Rolls for the year ending September 30th, 1850, could not be found.

No. 2.

TABLE showing the MORTALITY per Cent. in each of the Years 1846 to 1849,* and 1851 to 1856, of the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN FORCES of the late EAST INDIA COMPANY in the PRESIDENCY of BOMBAY.

Years.	Bombay Artillery.		1st Bombay Europeans.		2nd Bombay Europeans.		3rd Bombay Europeans.		Town Major's Non-Effective List.		Total.
	Mortality per cent.	Station of Head-Quarters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quarters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quarters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quarters at the beginning and end of each Year.	Mortality per cent.	Station of Head-Quarters at the beginning and end of each Year.	
1846	9.07	Poonah, Ahmednuggur, and Bombay.	16.14	{ Kurrachee	4.31	{ Belgaum	—	—	7.09	Bombay.	9.28
1847	3.56		2.63	{ Kurrachee	7.04	{ Belgaum	—	—	4.05		4.20
1848	2.33		3.77	{ Kurrachee	2.30	{ Aden	—	—	2.18		2.68
1849	7.22		6.71	{ Kurrachee	2.16	{ Aden	—	—	6.20		5.62
1850*	*		*	{ Peshawur	*	{ Aden	—	—	*		*
1851	3.83		2.47	{ ?	3.48	{ ?	—	—	3.01		3.29
1852	2.77		1.90	{ Poona	3.74	{ Belgaum	—	—	5.61		3.05
1853	2.57		2.08	{ Poona	3.16	{ Belgaum	—	—	1.65		2.50
1854	4.94	Poonah.	3.84	{ Aden	2.38	{ Kurrachee	2.54	Poonah.	6.18	Poonah.	4.27
1855	4.43		2.41	{ Kurrachee	3.09	{ Kurrachee	.94		3.42		3.14
1856	3.01		1.85	{ Kurrachee	2.86	{ Hyderabad	1.22		3.99		2.50
1856	3.01		1.85	{ Kurrachee	2.86	{ Hyderabad	1.22		3.99		2.50
Average Annual Mortality per cent.	4.27	—	4.06	—	3.38	—	1.44	—	4.32	—	3.89

* At the time this Table was made the Muster and Casualty Rolls for the year ending September 30th, 1850, could not be found.

No. 6.—DEATHS OF EFFECTIVES.

TABLE showing the AGE and PERIOD of SERVICE of the NON-COMMISSIONED OFFICERS and MEN of the BOMBAY ARTILLERY and the 1ST and 2ND BOMBAY EUROPEANS, for the Ten Years 1846-49 and 1851-56.

Age.	Total.	Period of Service.													
		Months.				Years.									
		0—	3—	6—	9—	Total under 1 Year.	1	2	3	4	Total under 5 Years.	5—	10—	15—	20 and upwards.
Total - -	1,261	16	25	60	16	117	118	105	101	96	537	432	212	63	17
10—15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—
18	3	—	1	—	—	1	—	—	1	—	2	1	—	—	—
19	9	—	2	4	2	8	—	—	—	—	8	1	—	—	—
10—20	13	—	3	4	2	9	—	—	1	—	10	3	—	—	—
20—25	363	14	17	39	10	80	82	69	45	27	303	60	—	—	—
25—30	442	2	4	15	4	25	35	33	50	61	204	218	20	—	—
30—35	303	—	1	2	—	3	1	3	4	8	19	135	145	4	—
35—40	112	—	—	—	—	—	—	—	—	—	—	16	45	46	5
40—45	27	—	—	—	—	—	—	—	1	—	1	—	2	13	11
45—50	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1
50—55	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
55 and upwards -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

No. 7.—STRENGTH OF NON-EFFECTIVES.

TABLE showing the AGE and PERIOD of SERVICE of NON-COMMISSIONED OFFICERS and MEN on the TOWN MAJOR'S NON-EFFECTIVE LIST, for the Three Years 1847, 1852, and 1856.

Age.	Total.	Period of Service.													
		Months.				Years.									
		0—	3—	6—	9—	Total under 1 Year.	1	2	3	4	Total under 5 Years.	5—	10—	15—	20 and upwards.
Total - -	1,151	1	2	4	6	13	47	78	61	50	249	309	195	193	205
10—15	2	—	—	—	—	—	—	2	—	—	2	—	—	—	—
15	5	—	—	—	—	—	4	1	—	—	5	—	—	—	—
16	9	—	—	—	2	2	2	5	—	—	9	—	—	—	—
17	4	—	—	—	1	1	—	2	1	—	4	—	—	—	—
18	7	—	—	—	2	2	—	3	2	—	7	—	—	—	—
19	5	—	—	—	—	—	—	1	2	2	5	—	—	—	—
10—20	32	—	—	—	5	5	6	14	5	2	32	—	—	—	—
20—25	90	1	—	1	1	3	29	20	11	6	69	21	—	—	—
25—30	256	—	1	3	—	4	11	33	32	30	110	136	9	1	—
30—35	283	—	—	—	—	—	1	10	11	8	30	131	101	20	1
35—40	208	—	1	—	—	1	—	1	—	3	5	20	69	112	2
40—45	151	—	—	—	—	—	—	—	2	1	3	1	14	53	80
45—50	90	—	—	—	—	—	—	—	—	—	—	—	2	6	82
50—55	35	—	—	—	—	—	—	—	—	—	—	—	—	1	34
55 and upwards -	6	—	—	—	—	—	—	—	—	—	—	—	—	—	6

No. 8.—DEATHS OF NON-EFFECTIVES.

TABLE showing the AGE and PERIOD of SERVICE in INDIA of NON-COMMISSIONED OFFICERS and MEN on the TOWN MAJOR'S NON-EFFECTIVE LIST, for the Ten Years 1846-49 and 1851-56.

Age.	Total.	Period of Service.													
		Months.				Years.									
		0—	3—	6—	9—	Total under 1 Year.	1	2	3	4	Total under 5 Years.	5—	10—	15—	20 and upwards.
Total - -	160	1	—	4	1	6	8	2	5	10	31	37	27	33	32
10-15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10-20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20-25	14	1	—	3	—	4	4	1	1	2	12	2	—	—	—
25-30	34	—	—	—	1	1	4	1	4	7	17	15	2	—	—
30-35	38	—	—	1	—	1	—	—	—	1	2	19	14	3	—
35-40	37	—	—	—	—	—	—	—	—	—	—	1	10	24	2
40-45	18	—	—	—	—	—	—	—	—	—	—	—	1	5	12
45-55	13	—	—	—	—	—	—	—	—	—	—	—	—	1	12
50-55	5	—	—	—	—	—	—	—	—	—	—	—	—	—	5
55 and upwards -	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1

No. 11.—CASUALTIES.—NON-EFFECTIVES.

NUMBER OF DEATHS, DISCHARGES, and other CASUALTIES amongst the NON-COMMISSIONED OFFICERS and MEN of the TOWN MAJOR'S LIST, for the Ten Years 1846-49 and 1851-56.

	Total.	Months.				Total under 1 Year.	1	2	3	4	Total under 5 Years.	5—	10—	15—	20 and upwards.
		0—	3—	6—	9—										
DEATHS - - - - -	160	1	—	4	1	6	8	2	5	10	31	37	27	33	32
LEAVING THE CORPS - - - - -	355	2	5	4	3	14	14	20	15	17	80	99	61	32	83
Pensioned - - - - -	76	—	—	—	—	—	—	1	—	—	1	—	3	10	62
Invalided to Europe - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ Chunar, or other parts of India	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sent to lunatic asylum - - - - -	12	—	—	—	—	—	1	2	2	3	8	2	1	1	—
Discharged by purchase - - - - -	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—
„ (time expired or otherwise) -	75	—	—	3	1	4	6	8	6	3	27	27	17	1	3
Promoted - - - - -	8	—	—	—	—	—	—	—	—	—	—	—	—	1	7
Transferred to Town Major's list	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ to other corps - - - - -	179	2	5	1	2	10	6	9	7	11	43	66	40	19	11
Deserted - - - - -	4	—	—	—	—	—	1	—	—	—	1	3	—	—	—
Missing - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other causes - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
JOINING THE CORPS - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Remanded from Town Major's list	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
From other corps - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Enlisted in India - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ in Europe - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rejoined from desertion - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Entertained - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Casualty not specified - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

No. 12.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent., in the Ten Years 1846-49 and 1851-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BOMBAY.

Years ending 30th Sept.	Mean Strength.			Deaths in each Year.			Annual Rate of Mortality per cent.		
	Total.	Effectives.*	Non-Effectives.	Total.	Effectives.	Non-Effectives.	Total.	Effectives.	Non-Effectives.
1846	2,953	2,600·5	352·5	274	249	25	9·28	9·58	7·09
1847	3,145·5	2,775·5	370	132	117	15	4·20	4·22	4·05
1848	3,471·5	3,104·0	367·5	93	85	8	2·68	2·74	2·18
1849	3,611	3,240	371	203	180	23	5·62	5·56	6·20
1850	*	*	*	*	*	*	*	*	*
1851	3,766·5	3,400·5	366	124	113	11	3·29	3·32	3·01
1852	3,908	3,551·5	356·5	119	99	20	3·05	2·79	5·61
1853	3,840·5	3,477·5	363	96	90	6	2·50	2·59	1·65
1854	3,891·5	3,519·5	372	166	143	23	4·27	4·06	6·18
1855	4,240	3,859·5	380·5	133	120	13	3·14	3·11	3·42
1856	4,523	4,122	401	113	97	16	2·50	2·35	3·99
Average of the 10 years }	3,735·05	3,365·05	370·0	145·3	129·3	16	3·89	3·84	4·32

* Includes 3rd Bombay Europeans.

No. 16.—EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent., at different AGES and at different PERIODS of SERVICE, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BOMBAY, during the Ten Years 1846-49 and 1851-56.

Ages.	Years of Service.									
	Under 1 Year.	1	2	3	4	Under 5 Years.	5—	10—	15—	20 and upwards.
10-20	1·86	—	—	7·50	—	1·33	?	—	—	—
20-25	3·15	3·33	3·74	8·39	3·68	3·73	6·23	—	—	—
25-30	3·66	4·43	3·67	5·42	4·22	4·30	2·88	4·58	—	—
30-35	15·00	1·20	6·43	10·00	4·71	5·28	4·19	4·81	·68	—
35-40	—	—	—	—	—	—	6·86	3·93	4·29	37·50
40-45	—	—	—	—	—	30·00	—	3·33	4·48	8·05
45-50	—	—	—	—	—	—	—	—	—	7·50
50-55	—	—	—	—	—	—	—	—	—	—
55 and upwards	—	—	—	—	—	—	—	—	—	—

No. 17.—NON-EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent., at different AGES and at different PERIODS of SERVICE, amongst the NON-COMMISSIONED OFFICERS and MEN of the NON-EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BOMBAY, during the Ten Years 1846-49 and 1851-56.

Ages.	Years of Service.									
	Under 1 Year.	1	2	3	4	Under 5 Years.	5—	10—	15—	20 and upwards.
10-20	—	—	—	—	—	—	—	—	—	—
20-25	40·00	4·14	1·50	2·73	10·00	5·22	2·86	—	—	—
25-30	7·50	10·91	·91	3·75	7·00	4·64	3·31	6·67	—	—
30-35	—	—	—	—	3·75	2·00	4·35	4·16	4·50	—
35-40	—	—	—	—	—	—	1·50	4·35	6·43	30·30
40-45	—	—	—	—	—	—	—	2·14	2·83	4·50
45-50	—	—	—	—	—	—	—	—	5·00	4·39
50-55	—	—	—	—	—	—	—	—	—	4·41
55 and upwards	—	—	—	—	—	—	—	—	—	5·00

No. 18.—EFFECTIVES.

AVERAGE ANNUAL MORTALITY per Cent., at different PERIODS of SERVICE, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BOMBAY, during the Ten Years 1846-49 and 1851-56, showing the AGE on entering INDIA.

Period of Service.	Age on entering India.						
	10-20	15-25	20-30	25-35	30-40	35-45	40-50
0-5 years.	1·33	3·73	4·30	5·28	—	30·00	—
5-10 "	6·52	2·88	4·19	6·86	—	—	—
10-15 "	4·58	4·81	3·90	3·33	—	—	—
15-20 "	·68	4·29	4·48	—	—	—	—
20 and upwards	37·50	8·05	7·50	—	—	—	—

No. 19.—EFFECTIVES AND NON-EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY in the Ten Years 1846-49 and 1851-56, from (1) ALL CAUSES, (2) DEATH, and (3) OTHER CAUSES, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES and NON-EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BOMBAY, at different PERIODS of SERVICE.

Period of Service.	Proportion per cent. leaving the Corps annually.		
	From all Causes.	By Death.	Pensioned, invalided, discharged, transferred to other Corps, &c.
0-5 years	9·93	3·83	6·10
5-10 "	8·95	3·60	5·35
10-15 "	14·16	4·48	9·68
15-20 "	11·05	3·67	7·38
20 and upwards	31·29	5·76	25·53

No. 20.—EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY in the Ten Years 1846-49 and 1851-56, from (1) ALL CAUSES, (2) DEATH, and (3) OTHER CAUSES, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BOMBAY at different PERIODS of SERVICE.

Period of Service.	Proportion per cent. leaving the Corps annually.		
	From all Causes.	By Death.	Pensioned, invalided, discharged, transferred to other Corps, &c.
0-5 years	9·73	3·84	5·89
5-10 "	8·59	3·60	4·99
10-15 "	14·25	4·53	9·72
15-20 "	11·35	3·19	8·16
20 and upwards	90·60	10·20	80·40

No. 21.—NON-EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY in the Ten Years 1846-49 and 1851-56, from (1) ALL CAUSES, (2) DEATH, and (3) OTHER CAUSES, amongst the NON-COMMISSIONED OFFICERS and MEN of the NON-EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BOMBAY, at different PERIODS of SERVICE.

Period of Service.	Proportion per cent. leaving the Corps annually.		
	From all Causes.	By Death.	Pensioned, invalided, discharged, transferred to other Corps, &c.
0-5 years	13·37	3·73	9·64
5-10 "	13·20	3·59	9·61
10-15 "	13·53	4·15	9·38
15-20 "	10·10	5·13	4·97
20 and upwards	16·83	4·68	12·15

No. 22.—EFFECTIVES AND NON-EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY, from various CAUSES, in the Ten Years 1846-49 and 1851-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES and NON-EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BOMBAY, at different PERIODS of SERVICE.

Casualties.	Total.	Period of Service, Years.				
		Under 5 Years.	5—	10—	15—	20 and upwards.
Leaving the corps from various causes - -	6·90	6·10	5·35	9·68	7·38	25·53
Pensioned - - - - -	1·20	·17	·24	1·65	3·97	22·71
Invalided to Europe - - - - -	·75	·61	·54	1·99	·31	—
Invalided (India) - - - - -	·08	·10	·05	·09	·08	—
Sent to lunatic asylum - - - - -	·31	·34	·25	·56	·04	—
Discharged by purchase - - - - -	1·50	1·27	1·44	2·81	·76	·47
Discharged (time expired or otherwise) - - - - -	·02	—	·01	—	·04	·82
Promoted - - - - -	·31	·27	·29	·28	·73	—
Transferred to Town Major's list - - - - -	2·53	3·10	2·28	2·21	1·45	1·53
Transferred to other corps - - - - -	·20	·24	·25	·09	—	—
Deserted - - - - -	—	—	—	—	—	—
Missing - - - - -	—	—	—	—	—	—
Other causes - - - - -	—	—	—	—	—	—

No. 23.—EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY, from various CAUSES, in the Ten Years 1846-49 and 1851-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BOMBAY at different PERIODS of SERVICE.

Casualties.	Total.	Period of Service, Years.				
		Under 5 Years.	5—	10—	15—	20 and upwards.
Leaving the corps from various causes - -	6·62	5·89	4·99	9·72	8·16	80·40
Pensioned - - - - -	1·13	·17	·26	1·82	4·77	78·60
Invalided to Europe - - - - -	·84	·65	·58	2·26	·41	—
Invalided (India) - - - - -	·05	·05	·04	·09	·05	—
Sent to lunatic asylum - - - - -	·34	·36	·27	·64	·05	—
Discharged by purchase - - - - -	1·44	1·15	1·34	2·81	·96	·60
Discharged (time expired or otherwise) - - - - -	·01	—	·01	—	—	—
Promoted - - - - -	·34	·29	·32	·32	·96	—
Transferred to Town Major's list - - - - -	2·26	2·98	1·92	1·67	·96	1·20
Transferred to other corps - - - - -	·21	·24	·25	·11	—	—
Deserted - - - - -	—	—	—	—	—	—
Missing - - - - -	—	—	—	—	—	—
Other causes - - - - -	—	—	—	—	—	—

No. 24.—NON-EFFECTIVES.

TABLE showing the PROPORTION per Cent. LEAVING the CORPS ANNUALLY, from various CAUSES, in the Ten Years 1846-49 and 1851-56, amongst the NON-COMMISSIONED OFFICERS and MEN of the NON-EFFECTIVES of the EUROPEAN FORCES of the late EAST INDIA COMPANY in BOMBAY, at different PERIODS of SERVICE.

Casualties.	Total.	Period of Service, Years.				
		Under 5 Years.	5—	10—	15—	20 and upwards.
Leaving the corps from various causes - -	9·25	9·64	9·61	9·38	4·97	12·15
Pensioned - - - - -	1·98	·12	—	·46	1·55	9·08
Invalided to Europe - - - - -	—	—	—	—	—	—
Invalided (India) - - - - -	·31	·96	·19	·15	·16	—
Sent to lunatic asylum - - - - -	·03	—	·10	—	—	—
Discharged by purchase - - - - -	1·95	3·25	2·62	2·62	·16	·44
Discharged (time expired or otherwise) - - - - -	·21	—	—	—	·16	1·02
Promoted - - - - -	—	—	—	—	—	—
Transferred to Town Major's list - - - - -	4·67	5·19	6·41	6·15	2·94	1·61
Transferred to other corps - - - - -	·10	·12	·29	—	—	—
Deserted - - - - -	—	—	—	—	—	—
Missing - - - - -	—	—	—	—	—	—
Other causes - - - - -	—	—	—	—	—	—

No. 25.—BOMBAY ARTILLERY.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE OF MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the BOMBAY ARTILLERY, in the Ten Years 1846-49 and 1851-56.

Years.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1846	1,135	103	9.07
1847	1,236.5	44	3.56
1848	1,331	31	2.33
1849	1,343.5	97	7.22
1850	*	*	*
1851	1,410.5	54	3.83
1852	1,482	41	2.77
1853	1,515	39	2.57
1854	1,517	75	4.94
1855	1,489	66	4.43
1856	1,461	44	3.01
Average of the 10 years }	1,392	59.4	4.27

No. 26.—BOMBAY ARTILLERY.

AVERAGE ANNUAL RATE OF MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the BOMBAY ARTILLERY, at different AGES, in the Ten Years 1846-49 and 1851-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1846-49 and 1851-56.	Average Annual Rate of Mortality per cent.
Total -	1,429.7	594	4.15
10-15	1.7	—	—
15	1.3	—	—
16	2.0	—	—
17	2.3	1	4.29
18	3.3	1	3.00
19	5.7	1	1.76
10-20	16.3	3	1.84
20-25	359.7	150	4.17
25-30	560.3	231	4.12
30-35	314.3	132	4.20
35-40	138.7	65	4.69
40-45	37.7	13	3.45
45-50	2.0	—	—
50-55	.7	—	—
55 and upwards	—	—	—

No. 27.—BOMBAY ARTILLERY.

AVERAGE ANNUAL MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the BOMBAY ARTILLERY, at different PERIODS of SERVICE, in the Ten Years 1846-49 and 1851-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1846-49 and 1851-56.	Average Annual Rate of Mortality per cent.
Total -	1,429.7	594	4.15
0-1 years	173.3	56	3.23
1-2 "	126	66	5.24
2-3 "	161	62	3.85
3-4 "	110	51	4.64
4-5 "	93	45	4.84
0-5 years	663.3	280	4.22
5-10 "	486.7	192	3.95
10-15 "	184	81	4.40
15-10 "	81.7	34	4.16
20 & upwards	14	7	5.00

No. 28.—1ST BOMBAY EUROPEANS.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE OF MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 1ST BOMBAY EUROPEANS, in the Ten Years 1846-49 and 1851-56.

Years.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1846	700	113	16.14
1847	800	21	2.63
1848	903	34	3.77
1849	924.5	62	6.71
1850	*	*	*
1851	1,013.5	25	2.47
1852	1,052.5	20	1.90
1853	1,012	21	2.08
1854	885	34	3.84
1855	829.5	20	2.41
1856	918	17	1.85
Average of the 10 years }	903.8	36.7	4.06

No. 29.—1ST BOMBAY EUROPEANS.

AVERAGE ANNUAL RATE OF MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 1ST BOMBAY EUROPEANS, at different AGES, in the Ten Years 1846-49 and 1851-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1846-49 and 1851-56.	Average Annual Rate of Mortality per cent.
Total -	986	367	3.72
10-15	—	—	—
15	—	—	—
16	—	—	—
17	—	—	—
18	.6	—	—
19	39.7	5	1.26
10-20	40.3	5	1.24
20-25	309.7	140	4.52
25-30	362.7	102	2.81
30-35	201	84	4.18
35-40	64	24	3.75
40-45	7.7	11	14.35
45-50	.6	1	15.00
50-55	—	—	—
55 & upwards	—	—	—

No. 30.—1ST BOMBAY EUROPEANS.

AVERAGE ANNUAL MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 1ST BOMBAY EUROPEANS, at different PERIODS of SERVICE, in the Ten Years 1846-49 and 1851-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1846-49 and 1851-56.	Average Annual Rate of Mortality per cent.
Total -	986	367	3.72
0-1 year	176.8	42	2.38
1-2 "	92.3	30	3.25
2-3 "	42.3	23	5.43
3-4 "	6	38	?
4-5 "	80.3	26	3.24
0-5	397.7	159	4.00
5-10	374.7	121	3.23
10-15	142.3	59	4.15
15-20	69	18	2.61
20 & upwards	2.3	10	4.29

No. 31.—2ND BOMBAY EUROPEANS.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 2ND BOMBAY EUROPEANS, in the Ten Years 1846-49 and 1851-56.

Years.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1846	765·5	33	4·31
1847	739	52	7·04
1848	870	20	2·30
1849	972	21	2·16
1850	*	*	*
1851	976·5	34	3·48
1852	1,017	38	3·74
1853	950·5	30	3·16
1854	842	20	2·38
1855	842	26	3·09
1856	910	26	2·86
Average of the 10 years	} 888·45	30	3·38

No. 32.—2ND BOMBAY EUROPEANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 2ND BOMBAY EUROPEANS, at different AGES, in the Ten Years 1846-49 and 1851-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1846-49 and 1851-56.	Average Annual Rate of Mortality per cent.
Total -	864	300	3·47
10-15	—	—	—
15	—	—	—
16	—	—	—
17	—	—	—
18	·4	2	60·00
19	18·3	3	1·64
10-20	18·7	5	2·68
20-25	239·3	73	3·05
25-30	351·3	109	3·10
30-35	203	87	4·29
35-40	46·7	23	4·93
40-45	4·7	3	6·43
45-50	·3	—	—
50-55	—	—	—
55 and upwards	—	—	—

No. 33.—2ND BOMBAY EUROPEANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 2ND BOMBAY EUROPEANS, at different PERIODS of SERVICE, in the Ten Years 1846-49 and 1851-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1846-49, and 1851-56.	Average Annual Rate of Mortality per cent.
Total -	864	300	3·47
0-1 year	23	19	8·26
1-2 "	135	22	1·63
2-3 "	77·3	20	2·59
3-4 "	35·7	12	3·36
4-5 "	67	25	3·73
0-5 years	338	98	2·90
5-10 "	337·3	119	3·53
10-15 "	141·7	72	5·08
15-20 "	46·7	11	2·36
20 and upwards	·3	—	—

No. 34.—3RD BOMBAY EUROPEANS.

TABLE showing the STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the 3RD BOMBAY EUROPEANS, in the Three Years 1854, 1855, 1856.

Years ending September 30th.	Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1846	—	—	—
1847	—	—	—
1848	—	—	—
1849	—	—	—
1850	—	—	—
1851	—	—	—
1852	—	—	—
1853	—	—	—
1854	551	14	2·54
1855	847	8	·94
1856	819	10	1·22
Average of the 3 years	} 739	10·7	1·44

No. 35.—3RD BOMBAY EUROPEANS.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 3RD BOMBAY EUROPEANS, at different AGES, in the Three Years 1854, 1855, 1856.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 3 Years 1854-5-6.	Average Annual Rate of Mortality per cent.
Total -	739	32	1·44
10-15	2	—	—
15	—	—	—
16	·6	—	—
17	—	—	—
18	—	—	—
19	48·3	2	1·38
10-20	51	2	1·31
20-25	441·6	9	·68
25-30	178	15	2·81
30-35	49·7	4	2·68
35-40	13·7	2	4·88
40-45	5	—	—
45-50	—	—	—
50-55	—	—	—
55 and upwards	—	—	—

No. 36.—3RD BOMBAY EUROPEANS.

AVERAGE ANNUAL MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the 3RD BOMBAY EUROPEANS, at different PERIODS of SERVICE, in the Three Years 1854, 1855, 1856.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 3 Years 1854-5-6.	Average Annual Rate of Mortality per cent.
Total -	739	32	1·44
0-1 year	239·3	13	1·81
1-2 "	239·3	5	·70
2-3 "	133·7	2	·50
3-4 "	6·7	—	—
4-5 "	11·3	1	2·94
0-5 years	630·3	21	1·11
5-10 "	70·0	7	3·33
10-15 "	26·0	2	2·56
15-20 "	12·7	2	5·26
20 and upwards	—	—	—

No. 37.—TOWN MAJOR'S LIST.

TABLE showing the MEAN STRENGTH, DEATHS, and ANNUAL RATE of MORTALITY per Cent. of the NON-COMMISSIONED OFFICERS and MEN of the TOWN MAJOR'S NON-EFFECTIVE LIST, in the Ten Years 1846-49 and 1851-56.

Years.	Mean Annual Strength.	Deaths in each Year.	Annual Rate of Mortality per cent.
1846	352·5	25	7·09
1847	370	15	4·05
1848	367·5	8	2·18
1849	371	23	6·20
1850	*	*	*
1851	366	11	3·01
1852	356·5	20	5·61
1853	363	6	1·65
1854	372	23	6·18
1855	380·5	13	3·42
1856	401	16	3·99
Average of the 10 years	370·0	16	4·32

No. 38.—TOWN MAJOR'S LIST.

AVERAGE ANNUAL RATE of MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the TOWN MAJOR'S NON-EFFECTIVE LIST, at different AGES, in the Ten Years 1846-49 and 1851-56.

Ages.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1846-49 and 1851-56.	Average Annual Rate of Mortality per cent.
Total -	383·7	160	4·17
10-15	·7	—	—
15	1·7	—	—
16	3	—	—
17	1·3	—	—
18	2·3	—	—
19	1·7	—	—
10-20	10·7	—	—
20-25	30	14	4·67
25-30	85·3	34	3·98
30-35	94·4	38	4·03
35-40	69·3	37	5·34
40-45	50·3	18	3·58
45-50	30	13	4·33
50-55	11·7	5	4·29
55 and upwards	2	1	5·00

No. 39.—TOWN MAJOR'S LIST.

AVERAGE ANNUAL MORTALITY per Cent. amongst the NON-COMMISSIONED OFFICERS and MEN of the TOWN MAJOR'S NON-EFFECTIVE LIST, at different PERIODS of SERVICE, in the Ten Years 1846-49 and 1851-56.

Period of Service.	Mean Annual Strength in 3 Years.	Deaths in the 10 Years 1846-49 and 1851-56.	Average Annual Rate of Mortality per cent.
Total - - - -	383·7	160	4·17
0-1 years - - - -	4·3	6	13·85
1-2 " - - - -	15·7	8	5·11
2-3 " - - - -	26	2	·77
3-4 " - - - -	20·3	5	2·46
4-5 " - - - -	16·7	10	6·00
0-5 years - - - -	83	31	3·73
5-10 " - - - -	103	37	3·59
10-15 " - - - -	65	27	4·15
15-20 " - - - -	64·3	33	5·13
20 and upwards - - - -	68·4	32	4·68

BENGAL—ENGLAND.—DISEASES.

TABLE 1.—Showing the DEATHS and ANNUAL RATE of MORTALITY to 1,000,000 STRENGTH, in the Sixteen Years 1830–45, amongst the NON-COMMISSIONED OFFICERS and MEN of the whole of the EUROPEAN FORCES in the PRESIDENCY of BENGAL; and the DEATHS and ANNUAL RATE of MORTALITY to 1,000,000 MALES living of the AGE 15–45 in ENGLAND, in the Seven Years 1848–54.

Strength of the European Forces (*Queen's and Company's*) in Bengal in the 16 Years 1830–45 - 213,192
 Male Population in England and Wales aged 15–45, estimated to the middle of 1851 - 4,012,273

Class.	DISEASES, &c.	Bengal.	England.	Bengal.	England.	Class.	DISEASES, &c.	Bengal.	England.	Bengal.	England.
		Deaths amongst the European Forces in the 16 Years 1830–45.	Male Deaths in the 7 Years 1848–54, of the Age 15–45.	Average Annual Mortality amongst the European Forces to 1,000,000 Strength (1830–45).	Average Annual Mortality to 1,000,000 Males living of the Age 15–45 (1848–54).			Deaths amongst the European Forces in the 16 Years 1830–45.	Male Deaths in the 7 Years 1848–54, of the Age 15–45.	Average Annual Mortality amongst the European Forces to 1,000,000 Strength (1830–45).	Average Annual Mortality to 1,000,000 Males living of the Age 15–45 (1848–54).
	ALL CAUSES - -	14,271	283,167	66,940	10,082		ORDER 2.				
	SPECIFIED CAUSES	13,142	278,042	—	—		Pericarditis - - -	1	927	5	34
							Aneurism - - -	1	691	5	25
							Varix - - -	—	—	—	—
							Heart disease, &c. -	—	9,542	—	346
	CLASSES.						ORDER 3.				
I.	ZYMOTIC DISEASES	11,358	63,999	57,853	2,320		Laryngitis - - -	—	498	—	18
II.	CONSTITUTIONAL	509	115,991	2,593	4,206		Bronchitis - - -	—	5,531	—	201
III.	LOCAL - - -	1,120	68,935	5,705	2,500		Pleurisy - - -	1	1,407	5	51
IV.	DEVELOPMENTAL	3	1,369	15	50		Pneumonia - - -	208	9,133	1,060	331
V.	VIOLENCE - - -	152	27,748	774	1,006		Asthma - - -	23	1,821	117	66
							Lung disease, &c. -	—	2,909	—	105
I.	ORDERS.						ORDER 4.				
	ORDER 1.— <i>Miasmatic Diseases.</i>						Gastritis - - -	1	460	5	17
	Small-pox - - -	55	3,097	280	112		Enteritis - - -	66	2,807	336	102
	Measles - - -	—	158	—	6		Peritonitis - - -	5	1,348	25	49
	Scarlatina - - -	—	1,677	—	61		Ascites - - -	1	506	5	18
	Quinsy - - -	—	287	—	10		Ulceration of intestines	—	836	—	30
	Croup - - -	—	38	—	1		Hernia - - -	—	457	—	17
	Catarrh and Influenza	71	749	362	27		Ileus and colic - - -	18	719	92	26
	Whooping cough - -	—	17	—	1		Intussusception - -	—	247	—	9
	Eye disease - - -	17	—	87	—		Stricture of intestine	—	109	—	4
	Fever (C. C.) - - -	—	—	—	—		Fistula - - -	—	165	—	6
	Typhus - - -	—	—	—	—		Stomach disease, &c. -	2	936	10	34
	Typhoid - - -	1,228	24,905	6,255	904		Pancreas disease, &c. -	—	14	—	1
	Ephemeral - - -	—	—	—	—		Jaundice - - -	13	508	66	18
	Erysipelas - - -	—	1,874	—	68		Spleen disease, &c. -	45	71	229	3
	Carbuncle - - -	—	141	—	5		ORDER 5.				
	Dysentery - - -	3,034	1,395	15,453	51		Nephritis - - -	—	283	—	10
	Hepatitis and liver disease.	895	5,352	4,559	193		Ischuria - - -	—	80	—	3
	Diarrhoea - - -	894	2,361	4,554	86		Nephria - - -	—	1,060	—	38
	Cholera - - -	2,590	15,063	13,191	546		Diabetes - - -	—	900	—	33
	Ague - - -	575	195	2,929	7		Stone - - -	—	127	—	5
	Remittent fever - -	1,599	214	8,145	8		Cystitis - - -	—	186	—	7
	Rheumatism - - -	106	2,405	540	87		Kidney disease, &c. -	10	1,442	51	52
	Ditto, with heart diseases.	—	—	—	—		ORDER 6.				
	ORDER 2.— <i>Enthetic Diseases.</i>						Orchitis - - -	—	—	—	—
	Syphilis, &c. - - -	64	602	326	22		Hydrocele - - -	—	—	—	—
	Stricture of urethra -	—	327	—	12		Urethra disease, &c. -	—	33	—	1
	Hydrophobia - - -	—	34	—	1		ORDER 7.				
	ORDER 3.— <i>Dietic Dis.</i>						Arthritis - - -	—	113	—	4
	Privation - - -	—	89	—	3		Joint disease, &c. -	4	1,724	20	63
	Purpura and Scurvy -	6	294	31	11		ORDER 8.				
	Alcoholism, { <i>a.</i> Delirium tremens	224	1,991	1,141	72		Phlegmon - - -	24	255	122	9
	Alcoholism, { <i>b.</i> Intemperance	—	724	—	26		Abscess - - -	—	—	—	—
	ORDER 4.— <i>Parasitic Diseases.</i>						Ulcer - - -	53	107	270	4
	Thrush - - -	—	10	—	4		Ditto, after contusion	—	—	—	—
	Psora - - -	—	—	—	—		Skin disease, &c. -	6	49	31	2
	Porrigi, &c. - - -	—	—	—	—	IV.	ORDER 1.				
II.	ORDER 1.— <i>Diathetic Diseases.</i>						Cyanosis - - -	—	37	—	1
	Gout - - -	—	116	—	4		Spina bifida - - -	—	5	—	2
	Dropsy - - -	89	4,196	453	153		Other malformations	—	21	—	1
	Cancer - - -	3	1,850	15	67		ORDER 4.				
	Noma - - -	—	8	—	3		Atrophy and debility	3	1,306	15	48
	Mortification - - -	2	367	10	13	V.	ORDER 1.				
	ORDER 2.— <i>Tubercular Diseases.</i>						Neglect - - -	—	2	—	1
	Scrofula - - -	—	4,300	—	156		Cold - - -	—	107	—	4
	Tubercles mesenterica	—	681	—	25		Poison - - -	—	553	—	20
	Phthisis - - -	415	103,941	2,115	3,769		Burns, &c. - - -	6	1,621	31	59
	Hydrocephalus - - -	—	532	—	19		Sun stroke - - -	4	—	20	—
III.	ORDER 1.						Hanging and suffocation.	—	1,768	—	64
	Cephalitis - - -	22	3,339	112	121		Drowning - - -	—	6,108	—	221
	Apoplexy - - -	570	4,666	2,905	170		Fractures and contusions.	21	13,942	107	506
	Sudden deaths - - -	—	2,546	—	92		Wounds - - -	43	1,736	219	63
	Paralysis - - -	9	2,912	46	106		Concussio cerebri -	3	—	15	—
	Insanity - - -	15	670	76	24		Other violence - - -	75	1,911	382	69
	Chorea - - -	—	40	—	1		Cause not specified or ill-defined.	1,129	5,125	—	—
	Epilepsy - - -	19	3,098	97	112						
	Convulsions - - -	—	233	—	8						
	Otitis - - -	—	—	—	—						
	Brain disease, &c. -	3	3,430	15	124						

NOTE.—In calculating the mortality, a correction has been made for the diseases not specified by distributing them proportionally over the deaths from the various specified causes.

FATAL DISEASES OF INDIA AND ENGLAND COMPARED.

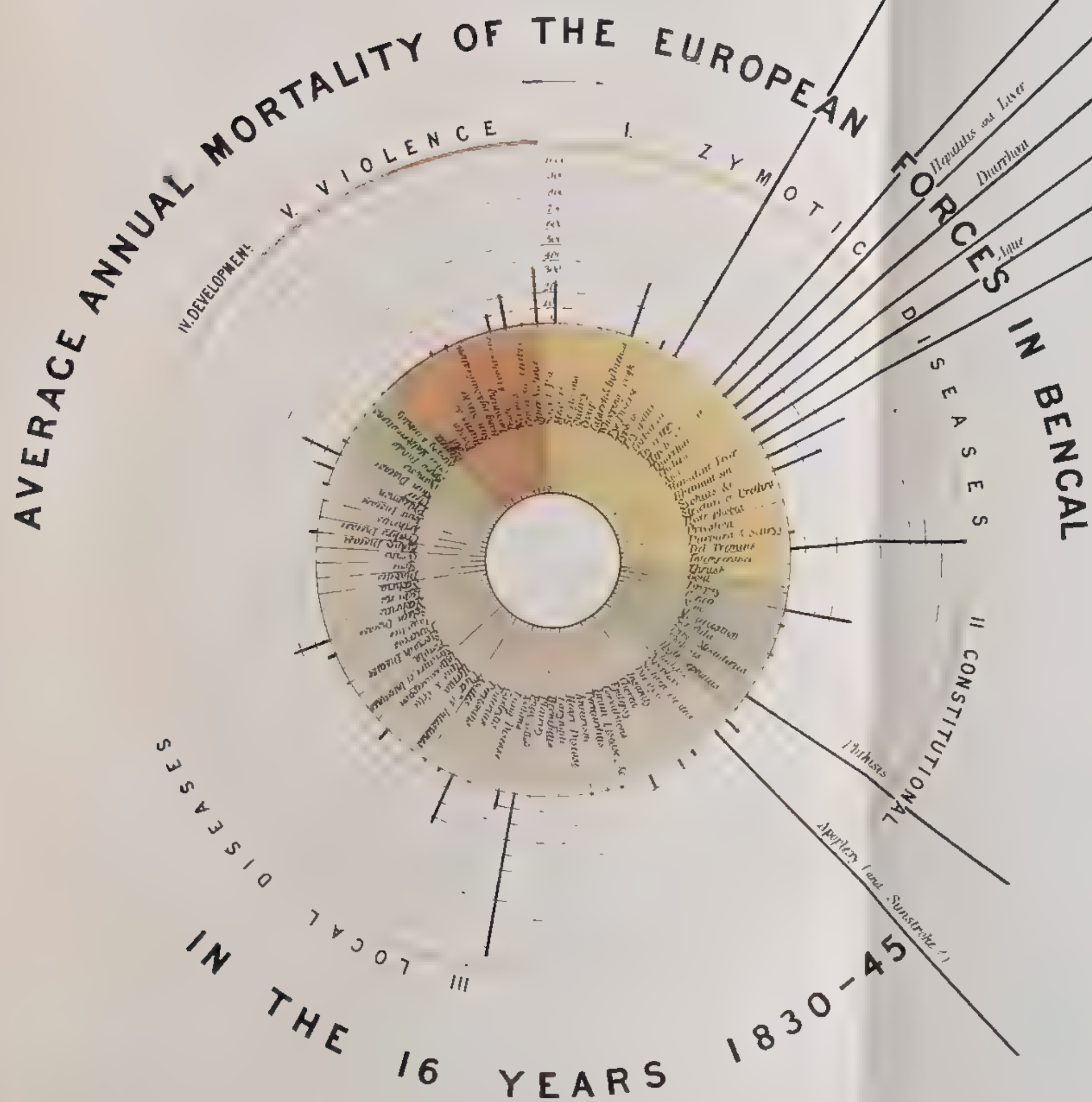
EXPLANATION.

Diagrams representing the Average Annual Mortality by each of 95 Causes (I) to 1,000,000 of the European Forces in Bengal in the 16 years 1830-45, (II) to 1,000,000 Males in England of the Military Age 15-45.

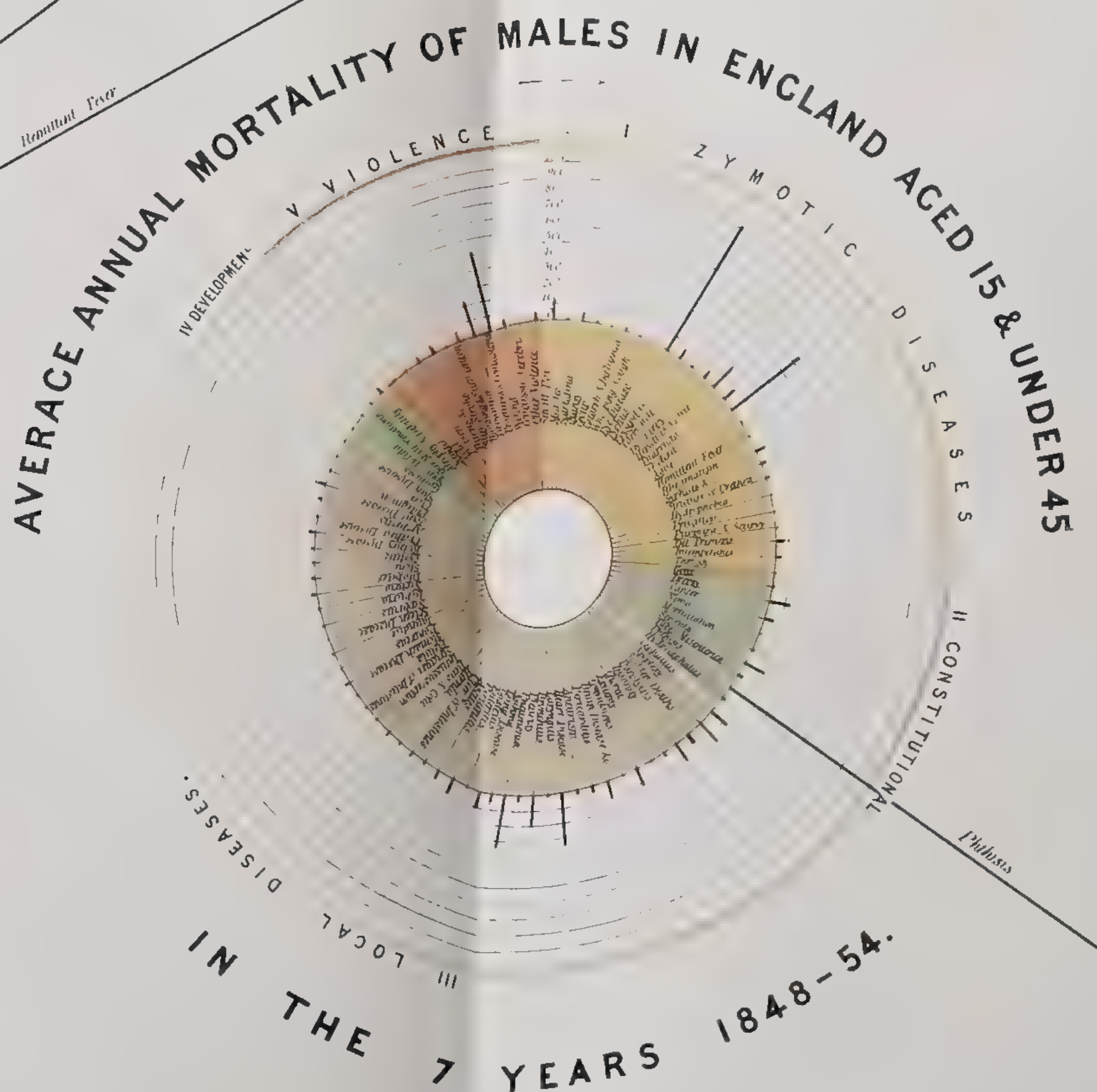
The radiating Black lines in Diagrams I and II, external to the circumference of the colored circle represent the relative number of Deaths by each cause, thus in Diagram I, to every 1,000,000 European Troops in Bengal living, on an average 280 died annually by Small Pox, 362 by Catarrh & Influenza, 6255 by Continued Fever, 15453 by Dysentery and so on. In Diagram II to every 1,000,000 Males of the Military Age 15-45 living, on an average 112 died annually by Small Pox, 27 by Catarrh & Influenza, 904 by Typhus & other Fevers, 51 by Dysentery & so on for other diseases.

The Scale of Deaths reckons from the external circumference of the Colored Circle to the last of the 10 thin black Circles & represents 1000 deaths; the space between each of the Thin black Circles represents 100 deaths.

I. BENGAL.



II. ENGLAND.



PRESIDENCY OF BENGAL.—DISEASES.

TABLE 2.—Showing the NUMBER of DEATHS by different DISEASES, and the AVERAGE ANNUAL MORTALITY to 1,000,000 STRENGTH, in the Sixteen Years 1830–45.

		Strength in the 16 years, 1830–45								- 213,192					
		Do.		8 years, 1830–37				Do.		8 years, 1838–45				- 95,105	
														- 118,087	
Class.	DISEASES, &c.	8 Years 1830–37.		8 Years 1838–45.		16 Years 1830–45.		Class.	DISEASES, &c.	8 Years 1830–37.		8 Years 1838–45.		16 Years 1830–45.	
		Deaths.	Deaths annually to 1,000,000 Strength.	Deaths.	Deaths annually to 1,000,000 Strength.	Deaths.	Deaths annually to 1,000,000 Strength.			Deaths.	Deaths annually to 1,000,000 Strength.	Deaths.	Deaths annually to 1,000,000 Strength.	Deaths.	Deaths annually to 1,000,000 Strength.
	ALL CAUSES - -	4,846	50,954	9,425	79,314	14,271	66,940		ORDER 2.						
	SPECIFIED CAUSES	4,337	—	8,805	—	13,142	—		Pericarditis - - -	—	—	1	9	1	5
									Aneurism - - -	—	—	1	9	1	5
									Varix - - -	—	—	—	—	—	—
									Heart disease, &c.	—	—	—	—	—	—
	CLASSES.								ORDER 3.						
I.	ZYMOTIC DISEASES	3,713	43,623	7,645	69,300	11,358	57,853		Laryngitis - - -	—	—	—	—	—	—
II.	CONSTITUTIONAL	242	2,843	267	2,420	509	2,593		Bronchitis - - -	—	—	—	—	—	—
III.	LOCAL - - -	313	3,677	807	7,315	1,120	5,705		Pleurisy - - -	—	—	1	9	1	5
IV.	DEVELOPMENTAL	—	—	3	27	3	15		Pneumonia - - -	60	705	148	1,342	208	1,060
V.	VIOLENCE - -	69	811	83	752	152	774		Asthma - - -	7	82	16	145	23	117
									Lung disease, &c.	—	—	—	—	—	—
	ORDERS.								ORDER 4.						
I.	ORDER 1.—Miasmatic Diseases.								Gastritis - - -	—	—	1	9	1	5
	Small-pox - - -	23	270	32	290	55	280		Enteritis - - -	23	270	43	390	66	336
	Measles - - -	—	—	—	—	—	—		Peritonitis - - -	1	12	4	36	5	25
	Scarlatina - - -	—	—	—	—	—	—		Ascites - - -	—	—	1	9	1	5
	Quinsy - - -	—	—	—	—	—	—		Ulceration of intestines.	—	—	—	—	—	—
	Croup - - -	—	—	—	—	—	—		Hernia - - -	—	—	—	—	—	—
	Catarrh and influenza	—	—	71	644	71	362		Ileus and colic - - -	—	—	18	163	18	92
	Whooping cough - -	—	—	—	—	—	—		Intussusception - -	—	—	—	—	—	—
	Eye diseases - - -	9	106	8	73	17	87		Stricture of intestine	—	—	—	—	—	—
	Fever (C. C.) - - -	—	—	—	—	—	—		Fistula - - -	—	—	—	—	—	—
	Typhus - - -	—	—	—	—	—	—		Stomach disease, &c.	—	—	2	18	2	10
	Typhoid - - -	—	—	—	—	—	—		Pancreas disease, &c.	—	—	—	—	—	—
	Ephemeral - - -	—	—	—	—	—	—		Jaundice - - -	3	35	10	91	13	66
	Erysipelas - - -	—	—	—	—	—	—		Spleen disease, &c.	15	176	30	272	45	229
	Carbuncle - - -	—	—	—	—	—	—		ORDER 5.						
	Dysentery - - -	998	11,726	2,036	18,456	3,034	15,453		Nephritis - - -	—	—	—	—	—	—
	Hepatitis and liver disease.	406	4,770	489	4,433	895	4,559		Ischuria - - -	—	—	—	—	—	—
	Diarrhoea - - -	221	2,596	673	6,100	894	4,554		Nephria - - -	—	—	—	—	—	—
	Cholera - - -	628	7,373	1,962	17,785	2,590	13,191		Diabetes - - -	—	—	—	—	—	—
	Ague - - -	110	1,242	465	4,215	575	2,929		Stone - - -	—	—	—	—	—	—
	Remittent fever - -	696	8,177	903	8,185	1,599	8,145		Cystitis - - -	—	—	—	—	—	—
	Rheumatism - - -	61	717	45	408	106	540		Kidney disease, &c.	4	47	6	54	10	51
	Ditto, with heart diseases.	—	—	—	—	—	—		ORDER 6.						
	ORDER 2.—Euthetic Diseases.								Orchitis - - -	—	—	—	—	—	—
	Syphilis, &c. - - -	33	388	31	281	64	326		Hydrocele - - -	—	—	—	—	—	—
	Stricture of urethra -	—	—	—	—	—	—		Urethra disease, &c.	—	—	—	—	—	—
	Hydrophobia - - -	—	—	—	—	—	—		ORDER 7.						
	ORDER 3.—Dietic Diseases.								Arthritis - - -	—	—	—	—	—	—
	Privation - - -	—	—	—	—	—	—		Joint disease, &c.	—	—	4	36	4	20
	Purpura and scurvy -	—	—	6	54	6	31		ORDER 8.						
	Alcohol - - -	54	634	170	1,541	224	1,141		Phlegmon - - -	1	12	23	208	24	122
	ism. { a. Delirium tremens.	—	—	—	—	—	—		Abscess - - -	—	—	—	—	—	—
	{ b. Intemperance.	—	—	—	—	—	—		Ulcer - - -	35	411	18	163	53	270
	ORDER 4.—Parasitic Diseases.								Ditto, after contusion	—	—	—	—	—	—
	Thrush - - -	—	—	—	—	—	—		Skin disease, &c.	3	35	3	27	6	31
	Psora - - -	—	—	—	—	—	—								
	Porrigio, &c. - - -	—	—	—	—	—	—		IV.						
									ORDER 1.						
II.	ORDER 1.—Diathectic Diseases.								Cyanosis - - -	—	—	—	—	—	—
	Gout - - -	—	—	—	—	—	—		Spina bifida - - -	—	—	—	—	—	—
	Dropsy - - -	29	342	60	541	89	453		Other malformations -	—	—	—	—	—	—
	Cancer - - -	—	—	3	27	3	15		ORDER 4.						
	Noma - - -	—	—	—	—	—	—		Atrophy and Debility	—	—	3	27	3	15
	Mortification - - -	—	—	2	18	2	10								
	ORDER 2.—Tubercular Diseases.								V.						
	Serofula - - -	—	—	—	—	—	—		ORDER 1.						
	Tabes mesenterica - -	—	—	—	—	—	—		Neglect - - -	—	—	—	—	—	—
	Phthisis - - -	213	2,501	202	1,831	415	2,115		Cold - - -	—	—	—	—	—	—
	Hydrocephalus - - -	—	—	—	—	—	—		Poison - - -	—	—	—	—	—	—
III.	ORDER 1.								Burns, &c. - - -	—	—	6	54	6	31
	Cephalitis - - -	1	12	21	190	22	112		Sun-stroke - - -	—	—	4	36	4	20
	Apoplexy - - -	157	1,845	413	3,745	570	2,905		Hanging and suffocation.	—	—	—	—	—	—
	Sudden deaths - - -	—	—	—	—	—	—		Drowning - - -	—	—	—	—	—	—
	Paralysis - - -	—	—	9	82	9	46		Fractures and contusions.	6	70	15	136	21	107
	Insanity - - -	3	35	12	109	15	76		Wounds - - -	—	—	43	390	43	219
	Chorea - - -	—	—	—	—	—	—		Concussio cerebri - -	—	—	3	27	3	15
	Epilepsy - - -	—	—	19	172	19	97		Other violence - - -	63	741	12	109	75	382
	Convulsions - - -	—	—	—	—	—	—								
	Otitis - - -	—	—	—	—	—	—		Cause not specified or ill-defined.	509	—	620	—	1,129	—
	Brain disease, &c.	—	—	3	27	3	15								

NOTE.—In calculating the mortality a correction has been made for the causes not specified, by distributing them proportionally over the various specified causes of death. The facts are from the medical returns, which do not include deaths in action, or other deaths which fail to come under the notice of the medical officers.

PRESIDENCY OF BOMBAY.—DISEASES.

TABLE 3.—Showing the DEATHS and ANNUAL RATE of MORTALITY to 1,000,000 STRENGTH, in the Sixteen Years, 1830-45, by different DISEASES amongst the NON-COMMISSIONED OFFICERS and MEN of the whole of the EUROPEAN FORCES in the PRESIDENCY of BOMBAY.

OF THE EUROPEAN FORCES IN THE EAST.															
Strength in the 16 years, 1830-45															
Do. 8 years, 1830-37															
Do. 8 years, 1838-45															
- 103,702															
- 45,851															
- 57,851															
Class.	DISEASES, &c.	8 Years 1830-37.		8 Years 1838-45.		16 Years 1830-45.		Class.	DISEASES, &c.	8 Years 1830-37.		8 Years 1838-45.		16 Years 1830-45.	
		Deaths.	Annual Rate of Mortality to 1,000,000 Strength.	Deaths.	Annual Rate of Mortality to 1,000,000 Strength.	Deaths.	Annual Rate of Mortality to 1,000,000 Strength.			Deaths.	Annual Rate of Mortality to 1,000,000 Strength.	Deaths.	Annual Rate of Mortality to 1,000,000 Strength.	Deaths.	Annual Rate of Mortality to 1,000,000 Strength.
	ALL CAUSES - -	1,496	32,627	4,598	79,480	6,094	58,764		ORDER 2.						
	SPECIFIED CAUSES	1,290	—	4,425	—	5,715	—		Pericarditis - - -	—	—	—	—	—	—
	CLASSES.								Aneurism - - -	—	—	—	—	—	—
I.	ZYMOTIC DISEASES	1,110	28,674	3,934	70,661	5,014	51,865		Varix - - -	—	—	—	—	—	—
II.	CONSTITUTIONAL	118	2,984	87	1,563	205	2,108		Heart disease, &c. -	—	—	—	—	—	—
III.	LOCAL - - -	53	1,341	331	5,945	384	3,948		ORDER 3.						
IV.	DEVELOPMENTAL	—	—	4	72	4	41		Laryngitis - - -	—	—	—	—	—	—
V.	VIOLENCE - -	9	228	69	1,239	78	802		Bronchitis - - -	—	—	—	—	—	—
	ORDERS.								Pleurisy - - -	—	—	—	—	—	—
I.	ORDER 1.—Miasmatic Diseases.								Pneumonia - - -	7	177	95	1,705	102	1,048
	Small pox - - -	7	177	11	198	18	185		Asthma - - -	—	—	9	162	9	93
	Measles - - -	—	—	—	—	—	—		Lung disease, &c. -	—	—	—	—	—	—
	Scarlatina - - -	—	—	—	—	—	—		ORDER 4.						
	Quinsy - - -	—	—	1	18	1	10		Gastritis - - -	—	—	—	—	—	—
	Croup - - -	—	—	—	—	—	—		Enteritis - - -	—	—	—	—	—	—
	Catarrh and Influenza (see Pneumonia).	—	—	—	—	—	—		Peritonitis - - -	3	76	30	539	33	339
	Whooping cough -	—	—	—	—	—	—		Ascites - - -	—	—	—	—	—	—
	Ophthalmia (Eye Dis.)	1	25	1	18	2	21		Ulceration of intestines	—	—	—	—	—	—
	Fever (C. C.) - - -	—	—	—	—	—	—		Hernia - - -	—	—	—	—	—	—
	Typhus - - -	330	8,347	50	898	380	3,907		Ileus and colic - - -	—	—	—	—	—	—
	Typhoid - - -	—	—	—	—	—	—		Intussusception of	—	—	—	—	—	—
	Ephemeral - - -	—	—	—	—	—	—		Stricture of intestine	—	—	—	—	—	—
	Erysipelas - - -	—	—	—	—	—	—		Fistula - - -	—	—	—	—	—	—
	Carbuncle - - -	—	—	—	—	—	—		Stomach disease, &c. -	—	—	2	36	2	21
	Dysentery - - -	332	8,397	1,410	25,325	1,742	17,912		Pancreas disease, &c. -	—	—	—	—	—	—
	Hepatitis and liver disease.	144	3,642	303	5,442	447	4,596		Jaundice (see Liverdis.)	—	—	—	—	—	—
	Diarrhoea - - -	68	1,720	169	3,036	237	2,437		Spleen disease, &c. -	—	—	7	126	7	72
	Cholera - - -	140	3,541	783	14,064	923	9,491		ORDER 5.						
	Ague - - -	10	253	240	4,311	250	2,571		Nephritis - - -	—	—	—	—	—	—
	Remittent fever -	45	1,138	816	14,656	861	8,853		Ischuria - - -	—	—	—	—	—	—
	Rheumatism - - -	21	531	31	557	52	535		Nephria - - -	—	—	—	—	—	—
	Do. with heart diseases	—	—	—	—	—	—		Diabetes - - -	—	—	—	—	—	—
	ORDER 2.—Euthetic Diseases.								Stone - - -	—	—	—	—	—	—
	Syphilis, &c. - - -	3	76	12	216	15	154		Cystitis - - -	—	—	—	—	—	—
	Stricture of urethra -	3	76	11	198	14	144		Kidney disease, &c. -	—	—	6	108	6	62
	Hydrophobia - - -	—	—	—	—	—	—		ORDER 6.						
	ORDER 3.—Dietic Diseases.								Orchitis - - -	—	—	—	—	—	—
	Privation - - -	—	—	—	—	—	—		Hydrocele - - -	—	—	—	—	—	—
	Purpura and scurvy -	—	—	16	287	16	165		Urethra disease, &c. -	—	—	—	—	—	—
	Alcoholism. { a. Delirium tremens.	5	126	79	1,419	84	864		ORDER 7.						
	b. Intemperance.	—	—	1	18	1	10		Arthritis - - -	—	—	—	—	—	—
	ORDER 4.—Parasitic Diseases.								Joint disease, &c. -	—	—	—	—	—	—
	Thrush - - -	—	—	—	—	—	—		ORDER 8.						
	Psora - - -	—	—	—	—	—	—		Phlegmon - - -	—	—	8	141	8	82
	Dracunculus - - -	1	25	—	—	1	10		Abscess - - -	—	—	—	—	—	—
									Ulcer - - -	5	126	2	36	7	72
									Do., after contusion -	—	—	—	—	—	—
									Skin disease, &c. -	2	51	5	90	7	72
II.	ORDER 1.—Diathetic Diseases.							IV.	ORDER 1.						
	Gout - - -	—	—	—	—	—	—		Cyanosis - - -	—	—	—	—	—	—
	Dropsy - - -	5	126	29	521	34	350		Spina bifida - - -	—	—	—	—	—	—
	Cancer - - -	—	—	—	—	—	—		Other malformations -	—	—	—	—	—	—
	Noma - - -	—	—	—	—	—	—		ORDER 4.						
	Mortification - - -	—	—	—	—	—	—		Atrophy and debility -	—	—	4	72	4	41
	ORDER 2.—Tubercular Diseases.								ORDER 1.						
	Scrofula - - -	—	—	—	—	—	—		Neglect - - -	—	—	—	—	—	—
	Tabes mesenterica -	—	—	—	—	—	—		Cold - - -	—	—	—	—	—	—
	Phthisis - - -	113	2,858	58	1,042	171	1,758		Poison - - -	—	—	—	—	—	—
	Hydrocephalus - - -	—	—	—	—	—	—		Burns, &c. - - -	—	—	—	—	—	—
III.	ORDER 1.								Sunstroke (see Apoplexy)	—	—	—	—	—	—
	Cephalitis - - -	—	—	13	234	13	134		Hanging and suffocation.	—	—	—	—	—	—
	Apoplexy - - -	36	911	147	2,639	183	1,881		Drowning - - -	—	—	—	—	—	—
	Sudden deaths - - -	—	—	—	—	—	—		Fractures and contusions.	2	51	6	108	8	82
	Paralysis - - -	—	—	—	—	—	—		Wounds - - -	7	177	62	1,113	69	710
	Insanity - - -	—	—	6	108	6	62		Concussio cerebri -	—	—	1	18	1	10
	Chorea - - -	—	—	—	—	—	—		Other violence - - -	—	—	—	—	—	—
	Epilepsy - - -	—	—	—	—	—	—		Cause not specified or ill-defined.	206	—	173	—	379	—
	Convulsions - - -	—	—	—	—	—	—								
	Otitis - - -	—	—	—	—	—	—								
	Brain disease, &c. -	—	—	1	18	1	10								

PRESIDENCY OF BENGAL.—DISEASES.

TABLE 4.—Showing the NUMBER of DEATHS among the NON-COMMISSIONED OFFICERS and MEN of the whole of the EUROPEAN FORCES in the PRESIDENCY of BENGAL by different DISEASES, for each of the 8 Years 1830–37.

Strength in 1830, 12,589; 1831, 12,590; 1832, 12,377; 1833, 11,081; 1834, 11,598; 1835, 11,364; 1836, 11,598; 1837, 11,908.

Class.	DISEASES, &c.	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.
	ALL CAUSES - -	660	682	601	780	692	443	480	508
	SPECIFIED CAUSES	571	605	534	710	633	410	417	457
	CLASSES.								
I.	ZYMOTIC DISEASES	518	542	472	599	524	332	346	380
II.	CONSTITUTIONAL -	27	34	41	28	32	29	30	21
III.	LOCAL - - - -	17	19	17	71	65	43	32	49
IV.	DEVELOPMENTAL -	—	—	—	—	—	—	—	—
V.	VIOLENCE - - -	9	10	4	12	12	6	9	7
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Diseases.</i>								
	Small-pox - - -	—	5	—	2	7	—	1	8
	Measles - - - -	—	—	—	—	—	—	—	—
	Scarlatina - - -	—	—	—	—	—	—	—	—
	Quinsy - - - -	—	—	—	—	—	—	—	—
	Croup - - - - -	—	—	—	—	—	—	—	—
	Catarrh and influenza	—	—	—	—	—	—	—	—
	Whooping cough -	—	—	—	—	—	—	—	—
	Eye Diseases - -	3	1	1	—	—	1	—	3
	Fever (C. C.) - -	—	—	—	—	—	—	—	—
	Typhus - - - -	—	—	135	199	70	27	28	15
	Typhoid - - - -	—	—	—	—	—	—	—	—
	Ephemeral - - -	—	—	—	—	—	—	—	—
	Erysipelas - - -	—	—	—	—	—	—	—	—
	Carbuncle - - - -	—	—	—	—	—	—	—	—
	Dysentery - - - -	132	138	174	115	146	98	104	91
	Hepatitis and liver	50	53	48	63	53	59	45	35
	disease.	—	—	—	—	—	—	—	—
	Diarrhoea - - - -	8	23	39	38	37	15	27	34
	Cholera - - - - -	87	84	37	131	80	48	48	113
	Ague - - - - -	—	—	10	20	39	12	13	16
	Remittent fever -	230	215	12	15	72	54	53	45
	Rheumatism - - -	5	16	8	8	7	8	—	4
	Ditto, with heart	—	—	—	—	—	—	—	—
	diseases.	—	—	—	—	—	—	—	—
	ORDER 2.— <i>Enthetic Diseases.</i>								
	Syphilis, &c. - - -	3	7	5	1	4	6	5	2
	Stricture of urethra	—	—	—	—	—	—	—	—
	Hydrophobia - - -	—	—	—	—	—	—	—	—
	ORDER 3.— <i>Dietic Diseases.</i>								
	Privation - - - -	—	—	—	—	—	—	—	—
	Purpura and scurvy	—	—	—	—	—	—	—	—
	Alcoholism { a. Delirium	—	—	3	7	9	4	17	14
	b. Intemperance.	—	—	—	—	—	—	—	—
	ORDER 4.— <i>Parasitic Diseases.</i>								
	Thrush - - - - -	—	—	—	—	—	—	—	—
	Psora - - - - -	—	—	—	—	—	—	—	—
	Porrigio, &c. - - -	—	—	—	—	—	—	—	—
II.	ORDER 1.— <i>Diathetic Diseases.</i>								
	Gout - - - - -	—	—	—	—	—	—	—	—
	Dropsy - - - - -	—	—	1	6	7	4	6	5
	Cancer - - - - -	—	—	—	—	—	—	—	—
	Noma - - - - -	—	—	—	—	—	—	—	—
	Mortification - -	—	—	—	—	—	—	—	—
	ORDER 2.— <i>Tubercular Diseases.</i>								
	Scrofula - - - - -	—	—	—	—	—	—	—	—
	Tabes mesenterica	—	—	—	—	—	—	—	—
	Phthisis - - - - -	27	34	40	22	25	25	24	16
	Hydrocephalus - -	—	—	—	—	—	—	—	—
III.	ORDER 1.								
	Cephalitis - - - -	—	—	—	—	—	—	—	1
	Apoplexy - - - - -	10	13	5	41	30	13	15	30
	Sudden deaths - -	—	—	—	—	—	—	—	—
	Paralysis - - - - -	—	—	—	—	—	—	—	—
	Insanity - - - - -	—	—	—	1	1	—	1	—
	Chorea - - - - -	—	—	—	—	—	—	—	—
	Epilepsy - - - - -	—	—	—	—	—	—	—	—
	Convulsions - - -	—	—	—	—	—	—	—	—
	Otitis - - - - -	—	—	—	—	—	—	—	—
	Brain disease, &c.	—	—	—	—	—	—	—	—
	ORDER 2.								
	Pericarditis - - -	—	—	—	—	—	—	—	—
	Aneurism - - - - -	—	—	—	—	—	—	—	—
	Varix - - - - -	—	—	—	—	—	—	—	—
	Heart disease, &c.	—	—	—	—	—	—	—	—
	ORDER 3.								
	Laryngitis - - - -	—	—	—	—	—	—	—	—
	Bronchitis - - - -	—	—	—	—	—	—	—	—
	Pleurisy - - - - -	—	—	—	—	—	—	—	—
	Pneumonia - - - -	—	—	3	11	17	11	9	9
	Asthma - - - - -	—	—	—	3	—	2	1	1
	Lung disease, &c.	—	—	—	—	—	—	—	—
	ORDER 4.								
	Gastritis - - - - -	—	—	—	—	—	—	—	—
	Enteritis - - - - -	—	—	5	5	3	4	3	3
	Peritonitis - - - -	—	—	—	—	1	—	—	—
	Ascites - - - - -	—	—	—	—	—	—	—	—
	Ulceration of intestines.	—	—	—	—	—	—	—	—
	Hernia - - - - -	—	—	—	—	—	—	—	—
	Ileus and colic - -	—	—	—	—	—	—	—	—
	Intussusception - -	—	—	—	—	—	—	—	—
	Stricture of intestine	—	—	—	—	—	—	—	—
	Fistula - - - - -	—	—	—	—	—	—	—	—
	Stomach disease, &c.	—	—	—	—	—	—	—	—
	Pancreas disease, &c.	—	—	—	—	—	—	—	—
	Jaundice - - - - -	—	—	1	1	1	7	6	—
	Spleen disease, &c.	—	—	—	—	—	—	—	1
	ORDER 5.								
	Nephritis - - - - -	—	—	—	—	—	—	—	—
	Ischuria - - - - -	—	—	—	—	—	—	—	—
	Nephria - - - - -	—	—	—	—	—	—	—	—
	Diabetes - - - - -	—	—	—	—	—	—	—	—
	Stone - - - - -	—	—	—	—	—	—	—	—
	Cystitis - - - - -	—	—	—	—	—	—	—	—
	Kidney disease, &c.	—	—	—	1	—	2	1	—
	ORDER 6.								
	Orchitis - - - - -	—	—	—	—	—	—	—	—
	Hydrocele - - - - -	—	—	—	—	—	—	—	—
	Urethra disease, &c.	—	—	—	—	—	—	—	—
	ORDER 7.								
	Arthritis - - - - -	—	—	—	—	—	—	—	—
	Joint disease, &c. -	—	—	—	—	—	—	—	—
	ORDER 8.								
	Phlegmon - - - - -	—	—	—	—	—	—	—	1
	Abscess - - - - -	—	—	—	—	—	—	—	—
	Ulcer - - - - -	7	6	3	7	3	5	1	3
	Do. after contusion	—	—	—	—	—	—	—	—
	Skin disease, &c. -	—	—	—	—	2	—	—	1
IV.	ORDER 1.								
	Cyanosis - - - - -	—	—	—	—	—	—	—	—
	Spina bifida - - -	—	—	—	—	—	—	—	—
	Other malformations	—	—	—	—	—	—	—	—
	ORDER 4.								
	Atrophy and debility	—	—	—	—	—	—	—	—
V.	ORDER 1.								
	Neglect - - - - -	—	—	—	—	—	—	—	—
	Cold - - - - -	—	—	—	—	—	—	—	—
	Poison - - - - -	—	—	—	—	—	—	—	—
	Burns, &c. - - - -	—	—	—	—	—	—	—	—
	Sun stroke (see Apoplexy)	—	—	—	—	—	—	—	—
	Hanging and suffocation.	—	—	—	—	—	—	—	—
	Drowning - - - - -	—	—	—	—	—	—	—	—
	Fractures and contusions.	—	—	—	—	—	—	1	3
	Wounds - - - - -	—	—	—	—	—	—	—	—
	Concussio cerebri -	—	—	—	—	—	—	—	—
	Other violence - - -	9	10	4	12	12	5	6	5
	Cause not specified or ill-defined.	89	77	67	70	59	33	63	51

NOTE.—In calculating the mortality a correction has been made for the causes not specified, by distributing them proportionally over the various specified causes of death. The facts are from the medical returns, which do not include deaths in action, or other deaths which fail to come under the notice of the medical officers.

PRESIDENCY OF BENGAL.—DISEASES.

TABLE 5.—RETURN showing the NUMBER of DEATHS among the NON-COMMISSIONED OFFICERS and MEN of the whole of the EUROPEAN FORCES in the PRESIDENCY of BENGAL by different DISEASES for each of the 8 Years 1838-45.

Strength in 1838, 11,221 ; 1839, 10,852 ; 1840, 13,506 ; 1841, 14,964 ; 1842, 17,695 ; 1843, 17,986 ; 1844, 16,548 ; 1845, 15,315.

Class.	DISEASES, &c.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.
	ALL CAUSES - -	634	596	1,140	1,137	1,802	1,604	834	1,678
	SPECIFIED CAUSES	588	554	1,063	1,025	1,661	1,506	789	1,619
	CLASSES.								
I.	ZYMOTIC DISEASES	494	451	907	908	1,477	1,360	628	1,420
II.	CONSTITUTIONAL -	26	30	60	34	19	28	26	44
III.	LOCAL - - - -	62	71	90	79	139	110	111	145
IV.	DEVELOPMENTAL -	—	—	—	—	3	—	—	—
V.	VIOLENCE - - -	6	2	6	4	23	8	24	10
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Diseases.</i>								
	Small-pox - - -	1	2	—	2	19	6	2	—
	Measle - - - -	—	—	—	—	—	—	—	—
	Scarlatina - - -	—	—	—	—	—	—	—	—
	Quinsy - - - -	—	—	—	—	—	—	—	—
	Croup - - - - -	—	—	—	—	—	—	—	—
	Catarrh and influenza -	—	—	—	8	8	15	8	32
	Whooping cough - -	—	—	—	—	—	—	—	—
	Eye diseases - - -	—	—	—	1	—	3	3	1
	Fever (C. C.) - - -	—	—	—	—	—	—	—	—
	Typhus - - - -	24	17	27	115	167	192	78	134
	Typhoid - - - -								
	Ephemeral - - - -								
	Erysipelas - - -	—	—	—	—	—	—	—	—
	Carbuncle - - - -	—	—	—	—	—	—	—	—
	Dysentery - - - -	109	137	334	298	358	418	156	226
	Hepatitis and liver disease.	38	34	52	90	43	85	64	78
	Diarrhoea - - - -	34	111	124	69	127	152	21	35
	Cholera - - - - -	156	31	110	158	440	201	135	741
	Ague - - - - -	28	29	124	37	105	89	29	24
	Remittent fever - -	82	58	107	93	176	167	113	107
	Rheumatism - - -	6	7	6	10	2	5	5	4
	Ditto, with heart diseases.	—	—	—	—	—	—	—	—
	ORDER 2.— <i>Enthetic Diseases.</i>								
	Syphilis, &c. - - -	2	6	5	1	4	5	4	4
	Stricture of urethra -	—	—	—	—	—	—	—	—
	Hydrophobia - - -	—	—	—	—	—	—	—	—
	ORDER 3.— <i>Dietic Diseases.</i>								
	Privation - - - -	—	—	—	—	—	—	—	—
	Purpura and Scurvy -	—	—	—	—	2	1	—	3
	Alcoholism { <i>a.</i> Delirium tremens.	14	19	18	26	21	21	20	31
	<i>b.</i> Intemperance.	—	—	—	—	—	—	—	—
	ORDER 4.— <i>Parasitic Diseases.</i>								
	Thrush - - - - -	—	—	—	—	—	—	—	—
	Psora - - - - -	—	—	—	—	—	—	—	—
	Porrigio, &c. - - -	—	—	—	—	—	—	—	—
II.	ORDER 1.— <i>Diathetic Diseases.</i>								
	Gout - - - - -	—	—	—	—	—	—	—	—
	Dropsy - - - - -	7	9	22	3	2	2	6	9
	Cancer - - - - -	—	—	—	—	2	—	—	1
	Noma - - - - -	—	—	—	—	—	—	—	—
	Mortification - - -	—	—	—	1	—	—	—	1
	ORDER 2.— <i>Tubercular Diseases.</i>								
	Scrofula - - - - -	—	—	—	—	—	—	—	—
	Tabes mesenterica -	19	21	38	30	15	26	20	33
	Phthisis - - - -	—	—	—	—	—	—	—	—
	Hydrocephalus - - -	—	—	—	—	—	—	—	—
III.	ORDER 1.								
	Cephalitis - - - -	2	1	—	1	—	16	1	—
	Apoplexy - - - -	37	22	25	29	76	59	65	99
	Sudden deaths - - -	—	—	—	—	—	—	—	—
	Paralysis - - - -	—	—	—	2	2	—	1	4
	Insanity - - - - -	1	2	1	4	2	—	—	2
	Epilepsy - - - - -	—	—	—	—	—	—	—	—
	Convulsions - - - -	—	—	—	2	10	—	4	3
	Otitis - - - - -	—	—	—	—	—	—	—	—
	Brain disease, &c. -	—	—	—	2	—	1	—	—
	ORDER 2.								
	Pericarditis - - -	—	—	1	—	—	—	—	—
	Aneurism - - - -	—	—	—	—	1	—	—	—
	Varix - - - - -	—	—	—	—	—	—	—	—
	Heart disease, &c. -	—	—	—	—	—	—	—	—
	ORDER 3.								
	Laryngitis - - - -	—	—	—	—	—	—	—	—
	Bronchitis - - - -	—	—	—	—	—	—	—	—
	Pleurisy - - - - -	—	—	—	—	1	—	—	—
	Pneumonia - - - -	12	18	47	19	15	10	16	11
	Asthma - - - - -	—	4	3	1	3	1	2	2
	Lung disease, &c. -	—	—	—	—	—	—	—	—
	ORDER 4.								
	Gastritis - - - - -	—	—	—	—	—	1	—	—
	Enteritis - - - - -	4	7	6	1	5	7	9	4
	Peritonitis - - - -	—	—	—	—	—	4	—	—
	Ascites - - - - -	—	—	—	—	—	—	—	1
	Ulceration of intestines	—	—	—	—	—	—	—	—
	Hernia - - - - -	—	—	—	—	—	—	—	—
	Ileus and colic - - -	—	—	—	4	8	2	—	4
	Itussusception - - -	—	—	—	—	—	—	—	—
	Stricture of intestine -	—	—	—	—	—	—	—	—
	Fistula - - - - -	—	—	—	—	—	—	—	—
	Stomach disease, &c. -	—	—	—	1	—	—	1	—
	Pancreas disease, &c. -	—	—	—	—	—	—	—	—
	Jaundice - - - - -	—	—	—	1	1	2	1	5
	Spleen disease, &c. -	2	5	—	5	7	1	5	5
	ORDER 5.								
	Nephritis - - - - -	—	—	—	—	—	—	—	—
	Ischuria - - - - -	—	—	—	—	—	—	—	—
	Nephria - - - - -	—	—	—	—	—	—	—	—
	Diabetes - - - - -	—	—	—	—	—	—	—	—
	Stone - - - - -	—	—	—	—	—	—	—	—
	Cystitis - - - - -	—	—	—	—	—	—	—	—
	Kidney disease, &c. -	1	1	2	—	1	—	1	—
	ORDER 6.								
	Orchitis - - - - -	—	—	—	—	—	—	—	—
	Hydrocele - - - -	—	—	—	—	—	—	—	—
	Urethra disease, &c. -	—	—	—	—	—	—	—	—
	ORDER 7.								
	Arthritis - - - - -	—	—	—	1	1	—	1	1
	Joint disease, &c. - -	—	—	—	—	—	—	—	—
	ORDER 8.								
	Phlegmon - - - - -	1	2	1	6	1	6	2	4
	Abscess - - - - -	—	—	—	—	—	—	—	—
	Ulcer - - - - -	1	9	3	—	4	—	1	—
	Ditto, after contusion	—	—	—	—	—	—	—	—
	Skin disease, &c. - -	1	—	1	—	1	—	—	—
IV.	ORDER 1.								
	Cyanosis - - - - -	—	—	—	—	—	—	—	—
	Spina bifida - - - -	—	—	—	—	—	—	—	—
	Other malformations -	—	—	—	—	—	—	—	—
	ORDER 4.								
	Atrophy and debility -	—	—	—	—	3	—	—	—
V.	ORDER 1.								
	Neglect - - - - -	—	—	—	—	—	—	—	—
	Cold - - - - -	—	—	—	—	—	—	—	—
	Poison - - - - -	—	—	—	—	—	—	—	—
	Burns, &c. - - - -	—	—	—	—	—	—	5	1
	Sun stroke (see Apoplexy)	—	—	—	—	—	4	—	—
	Hanging and sullocation.	—	—	—	—	—	—	—	—
	Drowning - - - - -	—	—	—	—	—	—	—	—
	Fractures and contusions.	2	1	4	—	2	2	1	3
	Wound - - - - -	—	—	—	2	20	1	15	5
	Concussio cerebri - -	—	—	—	1	—	—	2	—
	Other violence - - -	4	1	2	1	1	1	1	1
	Cause not specified or ill-defined.	46	42	77	112	141	98	45	59

NOTE.—In calculating the mortality a correction has been made for the causes not specified, by distributing them proportionally over the various specified causes of death. The facts are from the medical returns, which do not include deaths in action, or other deaths which fail to come under the notice of the medical officers.

PRESIDENCY OF BOMBAY.—DISEASES.

TABLE 6.—Showing the STRENGTH of the whole of the EUROPEAN FORCES in the PRESIDENCY of BOMBAY during each of the Years 1830–45 inclusive, and also the DEATHS from different DISEASES in the same Years.

		Years.															
		1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.
Strength	-	5,984	6,005	6,130	5,832	5,571	5,341	5,589	5,399	5,246	5,381	5,176	7,433	8,366	8,681	8,960	8,608
Class.	DISEASES, &c.	Years.															
		1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.
	ALL CAUSES - - - - -	211	136	132	193	206	190	168	260	181	538	371	477	856	714	777	684
	SPECIFIED CAUSES - - - - -	184	117	113	166	179	158	137	236	168	519	357	461	818	691	731	680
	CLASSES.																
I.	ZYMOTIC DISEASES - - - - -	166	93	98	144	154	138	113	204	140	438	299	409	764	595	673	616
II.	CONSTITUTIONAL - - - - -	13	17	11	20	18	11	18	10	5	7	6	18	13	12	10	16
III.	LOCAL - - - - -	5	4	3	2	6	9	5	19	20	50	50	30	34	69	42	36
IV.	DEVELOPMENTAL - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
V.	VIOLENCE - - - - -	—	3	1	—	1	—	1	3	3	24	2	4	7	15	6	8
	ORDERS.																
I.	ORDER 1.— <i>Miasmatic Diseases.</i>																
	Small-pox - - - - -	2	—	1	1	2	1	—	—	1	1	—	—	2	—	7	—
	Measles - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Scarlatina - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Quinsy - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
	Croup - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Catarrh and influenza - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Whooping cough - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Ophthalmia (Eye disease) - - - - -	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	—
	Fever (C. C.) - - - - -	35	21	16	43	89	77	49	—	—	—	4	33	8	3	2	—
	Typhus - - - - -																
	Typhoid - - - - -																
	Ephemeral - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Erysipelas - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Carbuncle - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Dysentery - - - - -	69	39	27	23	23	36	43	72	33	157	85	175	119	198	246	397
	Hepatitis and liver disease - - - - -	26	13	12	19	17	11	12	34	33	40	36	45	35	35	39	40
	Diarrhoea - - - - -	11	5	4	8	13	5	5	17	10	35	13	13	38	14	23	23
	Cholera - - - - -	18	12	36	46	6	5	2	15	19	101	45	6	414	21	112	65
	Ague - - - - -	—	—	—	—	—	—	—	10	11	20	27	29	35	56	30	32
	Remittent fever - - - - -	—	—	—	—	—	—	—	45	21	69	73	91	72	248	192	50
	Rheumatism - - - - -	5	3	2	2	2	3	1	3	6	6	1	5	7	3	2	1
	Ditto, with heart diseases - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	ORDER 2.— <i>Enthetic Diseases.</i>																
	Syphilis, &c. - - - - -	—	—	—	2	—	—	1	—	2	2	1	—	2	1	4	—
	Stricture of urethra - - - - -	—	—	—	—	—	—	—	3	—	—	2	1	4	2	1	—
	Hydrophobia - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	ORDER 3.— <i>Dietic Diseases.</i>																
	Privation - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Purpura and scurvy - - - - -	—	—	—	—	—	—	—	—	—	2	2	3	5	3	1	—
	Alcoholism { <i>a.</i> Delirium tremens - - - - -	—	—	—	—	—	—	—	5	4	4	10	8	23	11	13	6
	{ <i>b.</i> Intemperance - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
	ORDER 4.— <i>Parasitic Diseases.</i>																
	Thrush - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Psora - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Dracunculus - - - - -	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
II.	ORDER 1.— <i>Diathectic Diseases.</i>																
	Gout - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Dropsy - - - - -	—	—	—	—	—	—	—	5	4	3	2	3	2	5	6	4
	Cancer - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Noma - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Mortification - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	ORDER 2.— <i>Tubercular Diseases.</i>																
	Scrofula - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Tubercles mesenterica - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Phthisis - - - - -	13	17	11	20	18	11	18	5	1	4	4	15	11	7	4	12
	Hydrocephalus - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE.—In calculating the mortality a correction has been made for the causes not specified, by distributing them proportionally over the various specified causes of death. The facts are from the medical returns, which do not include deaths in action, or other deaths which fail to come under the notice of the medical officers.

MISCELLANEOUS TABLES.
PRESIDENCY OF BOMBAY.—DISEASES.
TABLE 6.—continued.

Class.	DISEASE, &c.	Years.															
		1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.
III.	ORDER 1.																
	Cephalitis - - - - -	—	—	—	—	—	—	—	—	1	1	3	3	2	—	2	1
	Apoplexy - - - - -	4	4	3	2	4	8	4	7	5	12	25	8	7	51	27	12
	Sudden deaths - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Paralysis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Insanity - - - - -	—	—	—	—	—	—	—	—	—	1	2	—	1	1	1	—
	Chorea - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Epilepsy - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Convulsions - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Otitis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Brain disease, &c. - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	
	ORDER 2.																
	Pericarditis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Aneurism - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Varix - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Heart disease, &c. - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	ORDER 3.																
	Laryngitis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Bronchitis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Pleurisy - - - - -	—	—	—	—	—	—	—	7	6	23	11	10	13	10	8	14
	Pneumonia - - - - -	—	—	—	—	—	—	—	—	2	2	—	2	—	—	—	1
Asthma - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Lung disease, &c. - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	ORDER 4.																
	Gastritis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Enteritis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Peritonitis - - - - -	—	—	—	—	—	—	—	3	5	8	2	5	4	2	3	1
	Ascites - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Ulceration of intestines - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Hernia - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Ileus and colic - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Intussusception - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Stricture of intestine - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fistula - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	
Stomach disease, &c. - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Pancreas disease, &c. - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Jaundice - - - - -	—	—	—	—	—	—	—	—	—	1	1	—	—	2	1	1	
Spleen disease, &c. - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	ORDER 5.																
	Nephritis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Ischuria - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Nephria - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Diabetes - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Stone - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Cystitis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Kidney disease, &c. - - - - -	—	—	—	—	—	—	—	—	—	—	1	1	—	1	—	3
	ORDER 6.																
	Orchitis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hydrocele - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Urethra disease, &c. - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	ORDER 7.																
	Arthritis - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Joint disease, &c. - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	ORDER 8.																
	Phlegmon - - - - -	—	—	—	—	—	—	—	—	—	2	2	1	1	2	—	—
	Abscess - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Ulcer - - - - -	1	—	—	—	2	1	1	—	—	—	—	—	2	—	—	—
	Ditto, after contusion - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Skin disease, &c. - - - - -	—	—	—	—	—	—	—	2	—	—	2	—	2	1	—	—
	IV.	ORDER 1.															
Cyanosis - - - - -		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Spina bifida - - - - -		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other malformations - - - - -		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
ORDER 4.																	
Atrophy and debility - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	
V.	ORDER 1.																
	Neglect - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Cold - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Poison - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Burns, &c. - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Sun stroke - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Hanging and suffocation - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Drowning - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Fractures and contusions - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Wounds - - - - -	—	3	1	—	1	—	1	2	1	23	1	2	7	14	5	7
	Concussio cerebri - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
	Other violence - - - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Cause not specified, or ill defined - - - - -	27	19	19	27	27	32	31	24	13	19	14	16	38	23	46	4

No. 7.—ANNUAL GENERAL RETURN of SICK and WOUNDED of the HONORABLE COMPANY'S NATIVE TROOPS, in the BENGAL and NORTH-WESTERN PROVINCES from 1st April 1852 to 31st March 1853.

	Classes of Diseases.																Total.
	Fevers.	Eruptive Fevers.	Diseases of the Lungs.	Diseases of the Liver.	Diseases of the Stomach and Bowels.	Epidemic Cholera.	Diseases of the Brain.	Dropsies.	Rheumatic Affections.	Venereal Affections.	Abscesses and Ulcers.	Wounds and Injuries.	Punished.	Diseases of the Eyes.	Diseases of the Skin.	Other Diseases.	
Remained sick on 1st April 1852.	1,180	87	136	14	244	2	38	8	389	308	759	310	2	45	120	206	3,848
Admitted during the year (attacks).	82,864	592	2,603	245	15,090	587	464	104	5,242	3,461	17,837	7,515	28	1,542	2,737	4,558	145,469
Total treated - - -	84,044	679	2,739	259	15,334	589	502	112	5,631	3,769	18,596	7,825	30	1,587	2,857	4,764	149,317
Discharged cured during the year.	81,018	553	2,290	217	13,861	277	395	72	4,954	3,438	17,804	7,355	28	1,507	2,719	4,181	140,669
Transferred during the year -	1,348	11	133	13	510	5	25	9	269	83	157	120	—	13	34	258	2,988
Invalided during the year -	38	—	16	1	87	—	5	1	40	8	11	8	2	3	1	17	238
Died during the year -	615	62	196	17	434	295	41	27	54	17	25	47	—	2	—	107	1,939
Remaining on 31st March 1853.	1,025	53	104	11	442	12	36	3	314	223	599	295	—	62	103	201	3,483
Total treated - - -	84,044	679	2,739	259	15,334	589	502	112	5,631	3,769	18,596	7,825	30	1,587	2,857	4,764	149,317

Average monthly strength during the year - - - 123,143
Average daily sick - - - 5,607
Ratio per cent. of sick (attacks of sickness) to well - 121·25*
" of deaths to disease " - 1·30
" of deaths to strength " - 1·58
The average sick at the beginning and end of the term to 100 of mean strength was - - - 2·97

* This means the proportion of attacks of sickness + the sick remaining to 100 of mean strength.
The proportion treated to 100 strength was really 118·29; the number treated being nearly represented by the mean of the numbers admitted and discharged, including dead, during the year.

No. 8.—TABLE showing the RATIO per Cent. to STRENGTH of ATTACKS, REMAINING SICK, DEATHS, INVALIDED, and TRANSFERRED, from different CLASSES of DISEASES of the late EAST INDIA COMPANY'S NATIVE TROOPS in the BENGAL and NORTH-WESTERN PROVINCES, from 1st April 1852 to 31st March 1853.

Classes of Diseases.	Ratio per cent. to Strength.				
	Attacks.	Remaining sick.*	Deaths.	Invalided.	Transferred.
All diseases - - - -	118·132	2·976	1·574	·192	2·426
Fevers - - - -	67·291	·895	·499	·031	1·095
Eruptive fevers - - -	·481	·057	·050	—	·009
Epidemic cholera - - -	·477	·006	·240	—	·004
Diseases of the stomach and bowels -	12·254	·279	·352	·071	·414
Diseases of the liver - - -	·199	·010	·014	·001	·011
Rheumatic affections - - -	4·257	·285	·044	·032	·218
Venereal affections - - -	2·811	·216	·014	·006	·067
Diseases of the eye - - -	1·252	·043	·002	·002	·011
Diseases of the skin - - -	2·223	·091	—	·001	·028
Abscess and ulcer - - -	14·485	·551	·020	·009	·127
Diseases of the brain - - -	·377	·030	·033	·004	·020
Diseases of the lungs - - -	2·114	·097	·159	·013	·108
Dropsies - - - -	·084	·004	·022	·001	·007
Other diseases - - - -	3·701	·165	·087	·014	·210
Wounds and injuries - - -	6·103	·246	·038	·006	·097
Punished - - - -	·023	·001	—	·001	—

* The ratios in this column are calculated from the mean of the numbers remaining sick at the beginning and at the end of the year thus :—

Remaining sick (all diseases) on 1st April 1852 - 3,848
" " on 31st March 1853 - 3,483
2) 7,331
Mean numbers remaining sick - - - 3,665·5

They are therefore only approximative results, serving to illustrate the utility of such information as might have been deduced from weekly enumerations of the sick remaining from the several diseases. The classification is defective, and this also impairs the utility of the Indian Returns.

MADRAS-1848.

No. 9.—TABLE showing the PROPORTION per Cent. of DEATHS to STRENGTH amongst EUROPEAN and NATIVE TROOPS, at different AGES.

Years of Age	2			25			30			35			40			45			50			Above 50			Total.		
	Natives.			Natives.			Natives.			Natives.			Natives.			Natives.			Natives.			Natives.			Natives.		
	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.
Total	577	755	700	1,687	983	759	1,836	1,023	1,086	2,150	1,618	869	3,411	1,509	1,088	2,000	1,716	1,860	—	1,858	919	—	1,312	1,168	1,728	1,153	975
Presidency Division	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Centre	5,465	1,562	1,923	4,824	355	694	3,813	405	553	4,320	1,225	2,409	4,761	1,149	—	—	—	—	—	—	—	—	—	—	1,399	377	422
Southern	5,236	1,400	1,823	4,761	1,779	1,731	2,912	724	912	4,320	1,225	2,409	4,761	1,149	—	—	—	—	—	—	—	—	—	—	3,410	763	639
Mysore	2,288	337	253	962	284	436	1,691	1,028	1,333	3,174	1,282	33,333	4,878	1,538	1,282	33,333	1,381	1,538	—	4,819	1,204	—	2,857	5,293	1,550	3,058	2,195
Malabar and Canara	2,142	1,190	1,304	2,631	555	671	1,455	924	913	2,419	1,456	769	6,000	1,652	1,162	—	1,136	1,282	—	6,250	3,253	—	3,630	7,112	1,325	890	1,016
Ceded Districts	1,013	602	425	618	680	247	361	928	445	310	437	—	4,347	1,583	1,317	—	1,383	1,317	—	5,555	1,204	—	—	—	2,177	688	1,347
Hyderabad Subsidiary Force	819	238	330	2,535	534	534	3,375	986	572	2,369	1,479	1,136	1,868	1,442	732	—	1,290	1,219	—	1,666	1,002	—	—	—	2,576	786	550
Nagpore	—	369	623	1,234	762	643	1,123	689	982	2,000	851	3,703	—	1,412	606	—	4,761	869	—	5,769	2,222	—	4,347	—	1,355	792	620
Saugor Division	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tenasserim Provinces	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Singapore, Penang, and Malacca	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aden	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

No. 10.—TABLE showing the PROPORTION per Cent. of DEATHS to STRENGTH amongst EUROPEAN and NATIVE TROOPS, at different PERIODS of SERVICE.

Years of Service	Under 1 year.			1-2			2-3			3-4			4-5			5-6			6-7		
	Natives.			Natives.			Natives.			Natives.			Natives.			Natives.			Natives.		
	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.
Total	4,329	501	1,052	1,177	468	598	1,527	1,086	410	1,456	571	512	837	697	941	2,676	908	1,647	—	1,277	606
Presidency Division	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Centre	2,857	—	—	3,333	—	1,886	5,882	6,896	—	1,785	3,030	—	—	—	—	11,764	5,882	2,941	—	1,986	—
Southern	4,326	—	—	—	—	—	2,008	2,408	—	—	—	—	—	—	—	2,380	5,797	6,451	—	8,379	—
Mysore	917	—	—	—	—	—	1,248	1,402	—	—	—	—	—	—	—	—	1,197	6,451	—	2,127	—
Malabar and Canara	3,895	—	—	1,863	854	1,402	2,631	2,631	1,204	1,063	555	1,923	2,362	552	563	5,633	5,797	6,451	—	609	—
Ceded Districts	42,857	3,125	2,857	389	—	—	714	1,922	4,515	6,250	953	1,008	833	775	775	2,739	2,500	1,315	—	386	—
Hyderabad Subsidiary Force	2,173	5405	2,631	534	—	—	—	1,922	840	1,234	1,783	1,162	2,403	663	386	2,233	—	4,761	—	264	—
Nagpore	2,651	—	—	2,857	—	—	3,157	3,157	—	1,960	—	—	2,403	—	—	—	—	4,782	—	406	—
Saugor Division	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tenasserim Provinces	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Singapore, Penang, and Malacca	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aden	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

continued.

Years of Service	7-10			10-15			15-20			20-25			25-30			Above 30			Total.		
	Natives.			Natives.			Natives.			Natives.			Natives.			Natives.			Natives.		
	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.	Europeans.	Hindoos.	Mahom. medans.
Total	1,256	1,025	1,102	2,432	1,366	990	1,587	1,364	770	2,409	1,381	1,456	2,559	1,564	—	—	1,855	1,536	1,728	1,153	975
Presidency Division	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Centre	1,428	262	847	7,216	1,562	813	33,333	—	1,449	—	1,492	—	—	—	—	—	—	—	1,399	377	422
Southern	5,263	1,049	552	36,363	3,722	928	1,960	—	4,140	—	—	—	—	—	—	—	—	—	3,410	763	639
Mysore	676	1,975	3,405	1,587	1,678	1,156	—	—	—	5,555	3,030	4,195	2,830	1,041	—	—	—	—	1,850	3,058	2,195
Malabar and Canara	956	735	1,666	1,587	386	1,438	—	—	877	—	—	1,913	3,252	3,333	—	—	—	—	1,325	890	1,016
Ceded Districts	1,974	735	414	—	—	—	—	—	—	—	—	1,652	2,000	3,683	—	—	—	—	1,325	890	1,016
Hyderabad Subsidiary Force	477	1,240	279	1,754	430	363	2,439	1,255	1,230	12,500	1,310	1,938	2,000	1,941	709	—	—	—	2,127	670	786
Nagpore	2,290	795	359	1,162	1,068	875	5,000	1,522	896	—	—	—	840	—	—	—	—	—	2,558	792	620
Saugor Division	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1,355	902	717
Tenasserim Provinces	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Singapore, Penang, and Malacca	5,882	1,030	1,470	—	1,041	694	—	1,904	1,986	—	1,360	1,408	5,128	—	—	—	—	—	834	532	470
Aden	—	2,269	1,408	—	2,127	2,083	—	2,857	2,777	—	2,325	—	6,060	—	—	—	—	—	1,066	1,066	1,081

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Cannanore - - - - -	—	731	749	—
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Dugshai - - - - -	—	667	695	—
Deesa - - - - -	—	700	722	—
En route { Bengal - - - - -	619	639	686	—
„ { Bombay - - - - -	—	709	724	—
„ { Madras - - - - -	729	737	750	—
Fort St. George - - - - -	—	735	750	—
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Ferozepore - - - - -	615	631	{ 752 }	—
Govindghur - - - - -	—	675	696	—
Ghazepore - - - - -	—	678	697	—
Hyderabad - - - - -	—	715	725	—
Jullundur - - - - -	—	643	687	—
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Poona - - - - -	—	702	723	—
Poonamallee - - - - -	—	745	751	—
Rawul Pindi - - - - -	—	649	690	—
Sealkote - - - - -	623	655	692	—
Subathoo - - - - -	—	673	696	—
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Trichinopoly - - - - -	—	739	751	—
Umballa - - - - -	611	629	683	—
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MEMORANDUM.

The Admissions, Discharges, and Deaths of Her Majesty's Troops in India are entered *regimentally* in the Quarterly Returns of Sick, furnished by the Principal Medical Officer in each Presidency, and it has in consequence been found in many instances impossible to allot them to the actual *stations* at which they may have occurred. Thus, the sick of a regiment are occasionally entered at the station of the head quarters, although from other evidence it would appear that some portion of the corps was on detached duty.

Regiments are often returned as occupying two or

more stations during the period, without the details of each station being kept separate ; in such cases the numbers have been added to the Tables "Troops en route, &c.," as not being assignable correctly to any station.

Several clerical errors have also been found to exist in the original documents, which there are now no means of correcting.

It will, therefore, be evident that it has only been possible to present in these Tables a near approximation to the desired stational information.

SANITARY STATISTICS OF HER MAJESTY'S REGIMENTS SERVING IN INDIA.

No. 1.

B E N G A L.

PRESIDENTIAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

(A.)—SUMMARY OF ALL THE STATIONS.

Stations.	Number of Years under Observa- tion.	Aggregate Strength.	Mean Number constantly Sick in Hospital.	Admissions into Hospital.	Discharged from Hospital.	Deaths in and out of Hospital.
Meerut - - -	10	11,936	101	20,674	19,989	450
Umballa - - -	"	13,099	102	20,215	19,581	533
Ferozepore - - -	"	7,941	76	16,827	16,255	446
Lahore - - -	"	9,214	91	22,631	21,770	725
Fort William - - -	"	6,077	54	11,453	11,105	577
Landour - - -	"	1,103	15	2,188	2,098	30
Troops en route, &c. - - -	"	25,426	181	41,614	41,498	1,399
Dinapore - - -	9	7,018	72	13,406	12,773	446
Jullundur - - -	"	6,472	62	12,788	12,684	230
Darjeeling - - -	"	642	6	837	798	26
Wuzerabad - - -	8	10,908	110	17,349	17,084	428
Rawul Pindi - - -	"	7,136	70	17,317	17,073	215
Peshawur - - -	"	13,393	193	50,986	49,773	843
Kussowlic - - -	"	3,521	34	5,928	5,739	135
Sealkote - - -	7	4,562	47	7,881	7,706	120
Agra - - -	"	3,790	40	7,836	7,559	160
Dum Dum - - -	"	1,528	17	2,671	2,412	120
Cawnpore - - -	"	4,973	73	12,932	12,473	455
Allahabad - - -	"	816	7	1,122	1,078	83
Chinsurah - - -	6	692	5	829	805	25
Dugshai - - -	"	4,311	58	7,620	960	165
Murree - - -	"	425	13	958	922	38
Kurrachee - - -	4	572	8	680	676	19
Subathoo - - -	3	439	14	681	642	22
Govindghur - - -	2	107	2	187	186	1
Berhampore - - -	"	146	4	140	116	9
Basid Khail - - -	1	43	25	8	10	—
Ghazepore - - -	"	404	31	722	668	19
Lucknow - - -	"	628	39	836	840	81
Totals - - -	-	147,322	1,525·25	299,316	291,273	7,800

ANNUAL AVERAGES.

	Average Annual Strength.	Number constantly Sick.	Annual Average.		
			Admissions.	Discharges.	Deaths.
Stations occupied during 10 years - - -	7,479	620	13,560	13,229	416
" " 9 " - - -	1,370	140	3,003	2,917	78
" " 8 " - - -	4,370	407	11,447	11,208	203
" " 7 " - - -	2,238	184	4,663	4,461	134
" " 6 " - - -	903	76	1,568	1,431	38
" " 4 " - - -	143	8	170	169	5
" " 3 " - - -	146	14	227	214	7
" " 2 " - - -	126	6	164	151	5
" " 1 " - - -	1,075	70·25	1,560	994	100
Average annual results for the whole Presidency of Bengal - - -	17,850	1,525·25	36,362	85,774	986

No. 2.

BENGAL.—CAVALRY.

PRESIDENTIAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength - - - - - 14,681

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	11,920	11,534	342	8,088	7,951	111	20,038	19,485	453	1,364.9	30.85
	CLASSES.											
I.	ZYMOTIC DISEASES -	8,856	8,584	213	6,006	5,901	72	14,862	14,485	285	1,012.33	19.4
II.	CONSTITUTIONAL -	62	48	11	49	34	10	111	82	21	7.56	1.43
III.	LOCAL - - -	2,135	1,999	112	1,408	1,380	29	3,543	3,379	141	241.33	9.6
V.	VIOLENCE - - -	897	903	6	625	636	—	1,522	1,539	6	103.67	.41
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	13	11	2	13	9	3	11,238	10,894	254	765.48	17.3
	Vaccinia - - -	17	17	—	1	1	—					
	Measles - - -	—	—	—	1	1	—					
	Quinsy - - -	85	86	1	97	98	—					
	Catarrh and Influenza -	259	248	7	224	214	—					
	Ophthalmia - -	356	348	—	128	131	—					
	Fever (C. C.) - -	2,615	2,529	74	698	692	8					
	Erysipelas - -	29	29	—	10	10	—					
	Dysentery - - -	484	426	64	148	120	9					
	Diarrhœa - - -	578	552	29	378	373	5					
	Cholera - - -	54	54	1	67	53	20					
	Ague - - -	1,426	1,406	6	2,190	2,171	5					
	Remittent Fever -	254	233	9	208	198	9					
	Rheumatism - -	538	526	2	367	358	—					
	ORDER 2.— <i>Enthetic Dis.</i>							3,033	3,036	6	206.6	.41
	Syphilis, &c. - -	1,786	1,770	5	1,177	1,203	—					
	Stricture of Urethra -	38	34	—	32	29	1					
	ORDER 3.— <i>Dietic Dis.</i>							546	509	25	37.19	1.7
	Purpura and Scurvy -	10	10	2	6	4	—					
	Alcoholism { a. Del. Tremens	99	87	10	47	38	9					
	{ b. Intemperance	203	205	1	181	165	3					
	ORDER 4.— <i>Parasitic Dis.</i>							45	46	—	3.06	—
	Vermes - - -	12	13	—	29	28	—					
	Psora - - -	—	—	—	4	5	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>							41	36	3	2.79	.2
	Lumbago - - -	17	16	—	18	16	1					
	Dropsy - - -	4	3	1	2	1	1					
	ORDER 2.— <i>Tubercular Dis.</i>							70	46	18	4.77	1.23
	Morbus Coxarius -	1	1	—	1	—	—					
	Scrofula - - -	16	16	—	8	6	—					
	Phthisis - - -	15	7	9	16	7	8					
	Hæmoptysis - -	9	5	1	4	4	—					

No. 2.—Bengal ; Cavalry. Presidential Returns. European Troops ; H. M. Regiments—*continued*.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	58	58	1	60	63	—	322	265	56	21·93	3 81
	Odontalgia - - -	11	11	—	1	1	—					
	Apoplexy - - -	55	13	42	14	5	9					
	Hydrophobia - - -	1	—	1	—	—	—					
	Paralysis - - -	8	5	—	7	6	1					
	Insanity - - -	14	9	—	2	2	—					
	Epilepsy - - -	10	10	—	21	24	1					
	Otitis - - -	35	34	—	19	19	—					
	Brain Disease, &c. - -	2	1	1	—	—	—					
	Dyseecœa - - -	1	1	—	3	3	—					
	ORDER 2.											
	Pericarditis - - -	14	14	2	4	2	2	42	40	9	2·86	·61
	Aneurism - - -	3	1	2	2	1	1					
	Heart Disease, &c. - -	6	7	2	13	15	—					
	ORDER 3.											
	Epistaxis - - -	3	3	—	2	1	—	155	142	8	10·56	·55
	Bronchitis - - -	12	11	—	3	3	—					
	Pleurisy - - -	45	44	3	27	26	1					
	Pneumonia - - -	23	19	4	18	17	—					
	Asthma - - -	16	12	—	6	6	—					
	ORDER 4.											
	Dyspepsia - - -	125	125	1	120	106	—	1,463	1,369	66	99·65	4·49
	Gastritis - - -	12	8	1	16	17	—					
	Enteritis - - -	3	1	1	3	2	1					
	Peritonitis - - -	5	4	2	—	—	—					
	Ascites - - -	2	2	—	4	1	2					
	Hæmatemesis - - -	—	—	—	1	1	—					
	Hernia - - -	9	11	—	4	4	—					
	Ileus and Colic - - -	126	114	—	50	56	—					
	Hæmorrhoids - - -	61	58	1	30	28	—					
	Fistula - - -	10	7	1	6	6	—					
	Obstipatio - - -	57	58	—	23	23	—					
Hepatitis - - -	378	325	44	197	191	11						
Jaundice - - -	80	83	—	56	56	—						
Spleen Disease, &c. - -	40	35	1	45	47	—						
ORDER 5.												
Nephritis - - -	10	10	—	11	8	—	43	33	1	2·93	·07	
Ischuria - - -	12	6	—	2	2	—						
Hæmaturia - - -	4	3	1	3	3	—						
Cystitis - - -	—	—	—	1	1	—						
ORDER 6.												
Hydrocele - - -	5	3	—	12	9	—	17	12	—	1·16	—	
ORDER 7.												
Hydrarthrus - - -	1	—	—	3	2	—	20	17	—	1·36	—	
Arthritis - - -	—	—	—	5	5	—						
Joint Disease, &c. - -	2	2	—	6	6	—						
Contractura - - -	3	2	—	—	—	—						
ORDER 8.												
Phlegmon - - -	616	625	1	391	388	—	1,481	1,501	1	100·88	·07	
Ulcer - - -	194	199	—	173	177	—						
Tumor - - -	8	7	—	5	6	—						
Skin Disease, &c. - -	55	58	—	39	41	—						
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	8	7	—	7	9	—	1,331	1,350	5	90·66	34
	Contusion - - -	556	572	—	320	323	—					
	Sub-luxation - - -	83	84	—	86	87	—					
	Luxation - - -	17	17	1	9	11	—					
	Fracture - - -	43	41	2	26	28	—					
	Wounds { Gunshot - - -	6	12	—	9	10	—					
	{ Incised - - -	81	72	—	75	75	—					
	Amputatio - - -	3	1	1	1	—	—					
	Otherwise - - -	1	1	—	—	—	—					
	Found dead - - -	—	—	1	—	—	—					
	ORDER 5.											
	Punitus - - -	63	35	—	5	6	—	191	189	1	13·01	·07
	Observatio - - -	63	61	1	87	87	—					

BENGAL.—INFANTRY.

PRESIDENTIAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength - - - - - 132,643.

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number of DISCHARGED to DUTY ; and (F.) the NUMBER of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	116,530	113,020	3,846	159,954	156,607	3,445	276,484	269,627	7,291	2,084.47	54.97
	CLASSES.											
I.	ZYMOTIC DISEASES -	95,216	91,948	2,762	131,017	128,459	2,522	226,233	220,407	5,284	1,705.64	39.83
II.	CONSTITUTIONAL -	961	766	193	1,197	981	173	2,158	1,747	366	16.27	2.76
III.	LOCAL - - -	15,748	15,418	817	21,543	21,061	686	37,291	36,479	1,503	281.13	11.33
IV.	DEVELOPMENTAL -	35	22	9	8	2	5	43	24	14	.32	.1
V.	VIOLENCE - - -	4,570	4,866	65	6,189	6,104	59	10,759	10,970	124	81.11	.95
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	128	91	35	73	57	15	195,185	189,464	5,115	1,471.5	38.56
	Varicella - - -	5	5	—	3	3	—					
	Measles - - -	9	9	2	48	44	4					
	Vaccinia - - -	6	6	—	—	—	—					
	Quinsy - - -	558	552	4	958	943	13					
	Catarrh and Influenza -	3,027	2,944	68	5,492	5,370	47					
	Ophthalmia - - -	8,157	8,093	1	4,125	4,161	—					
	Fever (C. C.) - - -	23,514	22,947	585	23,137	22,529	332					
	Typhus - - -	14	6	5	1	—	1					
	Typhoid - - -	1	1	—	—	—	—					
	Icterodes - - -	2	1	—	1	1	—					
	Erysipelas - - -	94	86	2	46	40	6					
	Dysentery - - -	9,971	9,052	1,075	6,161	5,327	653					
	Diarrhœa - - -	7,230	7,010	201	11,477	11,282	379					
	Cholera - - -	1,027	617	421	1,257	494	738					
	Ague - - -	18,107	17,706	113	52,561	52,861	173					
	Remittent Fever - - -	3,405	3,009	112	2,011	1,938	88					
	Rheumatism - - -	5,158	4,882	29	7,421	7,397	13					
	ORDER 2.— <i>Enthetic Dis.</i>							28,118	28,110	62	211.98	.47
	Syphilis, &c. - - -	13,064	13,253	37	14,633	14,476	21					
	Stricture of Urethra - -	141	124	1	280	257	3					
	ORDER 3.— <i>Dietic Dis.</i>							2,490	2,396	107	18.84	.8
	Purpura and Scurvy - -	353	324	14	296	272	7					
	Alcoholism { <i>a.</i> Del. Tremens <i>b.</i> Intemperance	539 530	511 543	42 15	251 521	228 518	26 3					
	ORDER 4.— <i>Parasitic Dis.</i>							440	437	—	3.32	—
	Vermes - - -	124	123	—	239	236	—					
	Psora - - -	52	53	—	25	25	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>							702	688	32	5.29	.24
	Lumbago - - -	191	193	—	322	341	—					
	Dropsy - - -	91	73	16	96	79	16					
	Cancer - - -	2	2	—	—	—	—					
	ORDER 2.— <i>Tubercular Dis.</i>							1,456	1,059	334	10.98	2.52
	Morbus Coxarius - - -	7	8	1	15	14	1					
	Scrofula - - -	258	255	3	202	204	2					
	Phthisis - - -	301	138	164	381	178	138					
	Hæmoptysis - - -	111	97	9	181	165	16					
III.	ORDER 1.							3,869	3,308	584	29.17	4.4
	Cephalitis - - -	232	227	4	627	611	4					
	Tetanus - - -	4	—	4	2	1	1					
	Apoplexy - - -	370	127	269	369	143	240					
	Odontalgia - - -	32	34	—	51	48	—					
	Paralysis - - -	127	123	15	154	140	9					
	Hydrophobia - - -	1	—	1	—	—	—					
	Insanity - - -	166	148	7	211	212	3					
	Epilepsy - - -	223	229	7	302	309	7					
	Otitis - - -	344	338	—	566	543	1					
	Brain Disease, &c. - -	24	24	5	27	17	7					
	Dysecœa " " - - -	6	5	—	31	29	—					

No. 3.—Bengal; Infantry. Presidential Returns. European Troops; H. M. Regiments—*continued.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 2.											
	Pericarditis - - -	152	129	19	574	546	37	1,189	1,098	70	8.96	.53
	Aneurism - - -	6	3	4	15	8	5					
	Varix - - -	29	26	—	81	57	—					
	Heart Disease, &c. - - -	63	63	2	269	266	3					
	ORDER 3.											
	Epistaxis - - -	32	30	2	55	53	—	2,204	1,985	193	16.62	1.45
	Bronchitis - - -	185	163	18	399	371	24					
	Hydrothorax - - -	4	—	3	1	—	1					
	Pleurisy - - -	272	250	17	243	226	7					
	Pneumonia - - -	336	274	59	387	322	56					
	Asthma - - -	116	129	4	174	167	2					
	ORDER 4.											
	Dyspepsia - - -	933	915	4	1,899	1,804	3	19,027	18,251	614	144.04	4.63
	Gastritis - - -	123	117	10	141	135	6					
	Enteritis - - -	51	36	14	47	36	10					
	Peritonitis - - -	60	40	19	64	46	17					
	Ascites - - -	24	14	10	44	31	9					
	Hæmatemesis - - -	17	14	3	26	21	5					
	Hernia - - -	38	31	—	87	80	—					
	Ileus and Colic - - -	1,461	1,475	4	1,623	1,623	5					
	Hæmorrhoids - - -	619	583	1	677	669	3					
	Prolapsus Ani - - -	4	4	—	25	25	—					
	Fistula - - -	61	58	—	121	121	1					
	Obstipatio - - -	510	499	1	539	526	—					
	Hepatitis - - -	3,085	2,851	272	4,277	4,012	192					
	Jaundice - - -	391	380	9	222	208	4					
	Spleen Disease, &c. - - -	601	584	6	1,257	1,253	6					
	ORDER 5.											
	Nephritis - - -	61	67	1	128	125	5	411	412	11	3.1	.08
	Hæmaturia - - -	2	2	—	5	5	—					
	Ischuria - - -	59	58	—	83	84	2					
	Enuresis - - -	16	14	—	23	23	—					
	Diabetes - - -	2	4	—	11	9	2					
	Stone - - -	1	1	—	1	1	—					
	Cystitis - - -	10	10	1	9	9	—					
	ORDER 6.											
	Hydrocele - - -	32	34	—	52	55	1	88	93	1	.06	.01
	Testis Disease, &c. - - -	—	—	—	4	4	—					
	ORDER 7.											
	Hydrarthrus - - -	20	21	—	20	19	—	223	219	2	1.68	.02
	Arthritis - - -	42	46	—	53	50	—					
	Joint Disease, &c. - - -	31	18	2	27	25	—					
	Contractura - - -	24	35	—	6	5	—					
	ORDER 8.											
	Phlegmon - - -	2,610	2,896	15	3,249	3,641	5	10,280	11,113	28	77.5	.21
	Ulcer - - -	1,802	1,939	4	1,768	1,762	2					
	Tumor - - -	22	22	—	95	96	—					
	Skin Disease, &c. - - -	312	328	1	422	429	1					
IV.	ORDER 4.											
	Atrophy - - -	35	22	9	8	2	5	43	24	14	.32	.1
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	102	108	1	96	90	—	8,043	8,291	72	60.64	.54
	Contusion - - -	1,946	2,116	4	2,480	2,465	4					
	Sub-luxation - - -	684	706	—	969	972	—					
	Luxation - - -	68	64	—	74	71	—					
	Fracture - - -	157	168	4	194	189	3					
	Wounds { Gunshot - - -	350	401	10	48	44	4					
	{ Incised - - -	436	461	2	421	422	2					
	Amputatio - - -	13	9	2	5	5	1					
	Drowned - - -	—	—	14	—	—	—					
	Found dead - - -	—	—	11	—	—	7					
	Not known - - -	—	—	1	—	—	2					
	ORDER 2.— <i>Battle.</i>											
	Wounds, Gunshot - - -	—	—	—	—	—	2	—	—	2	—	.02
	ORDER 3.— <i>Homicide.</i>											
	Assassinated - - -	—	—	—	—	—	1	—	—	1	—	.01
	ORDER 4.— <i>Suicide (attempted or accomplished).</i>											
	Wounds, Gunshot - - -	1	—	5	—	—	4	1	—	10	—	.09
	Suspendium - - -	—	—	1	—	—	—					
	ORDER 5.											
	Punitus - - -	222	225	—	109	106	—	2,715	2,679	39	20.47	.29
	Observatio - - -	591	608	10	1,793	1,740	29					

No. 4.

BOMBAY.

PRESIDENTIAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY’S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(A.)—SUMMARY.

STATIONS.					Number of Years under Observation.	Aggregate Strength.	Mean Number constantly sick in Hospital.	Admissions into Hospital.	Discharges from Hospital.	Deaths in and out of Hospital.
Kirkee	-	-	-	-	10	6,559	No stational information on the subject available. See Return below.*	13,588	13,541	131
Deesa	-	-	-	-	"	8,930		14,379	14,055	232
Poona	-	-	-	-	"	12,863		22,230	22,301	340
Kurrachee	-	-	-	-	9	10,605		19,415	18,928	361
Colaba	-	-	-	-	8	3,174		6,578	6,494	151
Troops en route, &c.	-	-	-	-	6	2,866		5,768	6,209	102
Belgaum	-	-	-	-	"	5,915		9,308	9,254	115
Aden	-	-	-	-	5	2,103		2,436	2,395	34
Hyderabad	-	-	-	-	4	1,728		4,030	4,036	62
Mount Aboo	-	-	-	-	1	83		101	94	7
Bombay	-	-	-	-	"	273		636	619	16
Peshawur	-	-	-	-	"	498		1,470	1,359	30
Total	-	-	-	-		55,597	—	99,939	99,285	1,581

ANNUAL AVERAGES.

				Average Annual Strength.	Number constantly Sick.	Annual Average.		
						Admitted.	Discharged.	Deaths.
Stations occupied during 10 years	-	-	-	2,835	—	5,020	4,990	70
"	9	"	-	1,178	—	2,157	2,103	40
"	8	"	-	397	—	822	812	19
"	6	"	-	1,463	—	2,512	2,577	36
"	5	"	-	420	—	487	478	7
"	4	"	-	432	—	1,007	1,009	15
"	1	"	-	854	—	2,207	2,072	53
Average annual Results for whole Presidency of Bombay				7,579	400	14,212	14,041	240

* RETURN showing the AVERAGE DAILY SICK of the TROOPS serving in the Presidency of Bombay during the 10 Years 1847–56.

Year ending 31 March					Average Daily Sick.
1848	-	-	-	-	522
"	1849	-	-	-	486
"	1850	-	-	-	545
"	1851	-	-	-	355
"	1852	-	-	-	365
"	1853	-	-	-	441
"	1854	-	-	-	401
"	1855	-	-	-	343
"	1856	-	-	-	286
"	1857	-	-	-	257
Annual average					400

No. 5.

BOMBAY.—CAVALRY.

PRESIDENTIAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength - - - - - 6,559

RETURN showing (C) the Number of ATTACKS of SICKNESS ; (E) the Number DISCHARGED to DUTY ; and (F) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	7,660	7,580	86	6,060	5,947	40	13,720	13,527	126	2,091.78	19.21
	CLASSES.											
I.	ZYMOTIC DISEASES -	4,905	4,879	56	4,165	4,084	27	9,070	8,963	83	1,382.84	12.65
II.	CONSTITUTIONAL -	27	18	11	31	29	3	58	47	14	8.84	2.13
III.	LOCAL - - -	2,079	2,033	19	1,367	1,346	10	3,446	3,379	29	525.38	4.42
V.	VIOLENCE - - -	649	650	—	497	488	2	1,146	1,138	—	174.72	—
	ORDERS.											
I.	ORDER 1.—Miasmatic Dis.											
	Small-pox - - -	—	—	—	3	5	—	7,107	7,028	82	1,083.56	12.5
	Measles - - -	—	—	—	3	3	—					
	Quinsy - - -	57	50	1	73	72	—					
	Catarrh and Influenza -	424	426	—	174	177	1					
	Ophthalmia - - -	125	125	—	68	61	—					
	Fever (C.C.) - - -	1,285	1,287	16	388	378	6					
	Erysipelas - - -	10	10	—	8	7	—					
	Dysentery - - -	171	179	14	68	63	3					
	Diarrhœa - - -	727	727	—	290	289	—					
	Cholera - - -	59	39	20	24	11	13					
	Ague - - -	418	409	—	1,682	1,670	1					
	Remittent Fever - - -	32	28	4	198	195	2					
	Rheumatism - - -	550	552	—	270	265	1					
	ORDER 2.—Enthetic Dis.							1,848	1,826	1	281.75	.15
	Syphilis, &c. - - -	984	985	1	829	810	—					
	Stricture of Urethra - -	13	12	—	22	19	—					
	ORDER 3.—Dietic Dis.											
	Alcoholism - { a. Del. Tremens	7	7	—	9	9	—	25	25	—	3.81	—
	- { b. Intemperance	—	—	—	9	9	—					
	ORDER 4.—Parasitic Dis.											
	Psora - - -	5	5	—	47	41	—	90	84	—	13.72	—
	Verues - - -	19	19	—	—	—	—					
	Dracunculus - - -	19	19	—	—	—	—					
II.	ORDER 1.—Diathetic Dis.											
	Gout - - -	—	—	—	2	2	—	18	18	3	2.74	.46
	Lumbago - - -	2	2	—	6	6	—					
	Dropsy - - -	2	2	1	6	6	1					
	ORDER 2.—Tubercular Dis.											
	Scrofula - - -	6	6	—	11	11	—	40	29	11	6.1	1.68
	Phthisis - - -	9	1	8	3	1	2					
	Hæmoptysis - - -	8	7	1	3	3	—					

No. 5.—Bombay ; Cavalry. Presidential Returns. European Troops ; H.M. Regiments—*continued.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.			
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.		
III.	ORDER 1.													
	Cephalitis	-	-	49	—	1	20	18	—	135	79	6	20·58	·92
	Apoplexy	-	-	4	2	4	—	—	—					
	Paralysis	-	-	8	8	—	8	7	—					
	Odontalgia	-	-	9	6	—	2	2	—					
	Insanity	-	-	—	1	—	2	2	—					
	Neuralgia	-	-	—	—	—	3	3	—					
	Epilepsy	-	-	3	3	—	6	5	1					
	Otitis	-	-	5	5	—	8	8	—					
	Dyseæa	-	-	4	5	—	3	3	—					
	Brain Disease, &c.	-	-	—	—	—	1	1	—					
	ORDER 2.													
	Pericarditis	-	-	12	10	—	23	24	—	116	114	1	17·68	·15
	Aneurism	-	-	—	—	—	6	5	1					
	Varix	-	-	6	6	—	8	8	—					
	Heart Disease, &c.	-	-	60	60	—	1	1	—					
	ORDER 3.													
	Epistaxis	-	-	1	1	—	—	—	—	61	58	3	9·31	·46
	Bronchitis	-	-	7	7	—	11	11	—					
	Pleurisy	-	-	—	—	—	15	15	—					
	Pneumonia	-	-	22	20	2	3	2	1					
	Asthma	-	-	2	2	—	—	—	—					
	ORDER 4.													
	Dyspepsia	-	-	312	310	—	154	158	—	1,477	1,478	19	225·19	2·89
	Gastritis	-	-	3	3	—	4	4	—					
	Enteritis	-	-	2	2	—	9	7	2					
	Peritonitis	-	-	—	—	—	1	1	—					
	Ascites	-	-	1	—	1	2	—	3					
	Hernia	-	-	10	10	—	2	1	1					
	Ileus and Colic	-	-	230	230	—	166	165	—					
	Prolapsus Ani	-	-	1	1	—	—	—	—					
	Fistula	-	-	7	7	—	5	5	—					
	Obstipatio	-	-	59	59	—	25	25	—					
	Hæmorrhoids	-	-	48	48	—	26	26	—					
	Hepatitis	-	-	211	222	10	122	119	1					
	Jaundice	-	-	28	28	—	16	14	1					
	Spleen Disease, &c.	-	-	17	17	1	16	16	—					
	ORDER 5.													
	Nephritis	-	-	—	—	—	5	4	—	14	13	—	2·13	—
	Ischuria	-	-	—	—	—	1	1	—					
	Dysuria	-	-	5	5	—	—	—	—					
	Hæmaturia	-	-	—	—	—	1	1	—					
	Stone	-	-	1	1	—	—	—	—					
	Cystitis	-	-	—	—	—	1	1	—					
	ORDER 6.													
Sarcocœle	-	-	1	1	—	—	—	—	5	5	—	·76	—	
Hydrocœle	-	-	2	2	—	2	2	—						
ORDER 7.														
Joint Diseases, &c.	-	-	4	4	—	3	3	—	8	8	—	1·22	—	
Contractura	-	-	—	—	—	1	1	—						
ORDER 8.														
Phlegmon	-	-	571	575	—	487	482	—	1,630	1,624	—	248·51	—	
Abscess	-	-												
Ulcer	-	-												
Tumor	-	-												
Skin Disease, &c.	-	-												
ORDER 1.— <i>Accident or Negligence.</i>														
Burns or Scalds	-	-	2	2	—	2	1	—	1,113	1,113	—	169·69	—	
Contusion	-	-	393	394	—	284	284	—						
Sub-luxation	-	-	109	113	—	90	89	—						
Luxation	-	-	2	1	—	2	3	—						
Fracture	-	-	14	14	—	5	4	—						
Wounds { Gunshot	-	-	1	—	—	1	2	—						
{ Incised	-	-	127	125	—	80	80	—						
Amputatio	-	-	—	—	—	1	1	—						
ORDER 5.														
Punitus	-	-	1	1	—	7	6	—	33	25	—	5·03	—	
Observatio	-	-	—	—	—	25	18	—						

No. 6.

BOMBAY.—INFANTRY.

PRESIDENTIAL RETURNS—EUROPEAN TROOPS.—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength - - - - - 49,038.

RETURN showing (C) the Number of ATTACKS of SICKNESS; (E) the Number DISCHARGED to DUTY; and (F) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died
	SPECIFIED CAUSES -	47,677	47,213	948	38,844	38,075	495	86,521	85,288	1,443	1,764'37	29'42
	CLASSES.											
I.	ZYMOTIC DISEASES -	34,578	34,298	625	27,577	27,125	252	62,155	61,423	877	1,267'5	17'88
II.	CONSTITUTIONAL -	594	523	69	574	527	48	1,168	1,050	117	23'82	2'38
III.	LOCAL - - -	10,436	10,310	228	8,960	8,721	167	19,396	19,031	395	395'53	8'05
IV.	DEVELOPMENTAL -	1	1	—	16	15	1	17	16	1	'34	'02
V.	VIOLENCE - - -	2,068	2,081	26	1,717	1,687	27	3,785	3,768	53	77'18	1'08
	ORDERS.											
	ORDER 1.—Miasmatic Dis.											
	Varicella - - -	3	3	—	—	—	—	48,871	48,244	830	996'59	16'93
	Small-pox - - -	22	16	5	30	22	6					
	Erythema - - -	1	1	—	—	—	—					
	Measles - - -	—	—	—	7	7	—					
	Parotitis - - -	4	4	—	—	—	—					
	Vaccinia - - -	9	9	—	4	4	—					
	Quinsy - - -	352	364	1	256	260	—					
	Catarrh and Influenza	1,440	1,451	13	1,421	1,371	5					
	Ophthalmia - -	1,641	1,643	—	841	850	—					
	Fever (C. C.) - -	5,709	5,685	53	1,634	1,693	4					
	Typhus - - -	2	—	2	1	1	—					
	Icterodes - - -	—	—	—	3	3	—					
	Erysipelas - -	45	41	2	22	20	1					
	Dysentery - - -	2,550	2,341	234	888	805	91					
	Diarrhœa - - -	3,335	3,315	33	1,565	1,545	9					
	Cholera - - -	314	195	163	52	30	21					
	Ague - - -	5,525	5,548	13	11,363	11,199	10					
	Remittent Fever -	2,268	2,255	75	2,164	2,096	82					
	Rheumatism - -	3,156	3,212	6	2,244	2,255	1					
	ORDER 2.—Euthetic Dis.							12,392	12,302	15	252'73	'30
	Syphilis, &c. - -	7,550	7,572	10	4,650	4,542	4					
	Stricture of Urethra -	66	59	1	124	127	—					
	Lepa - - -	2	2	—	—	—	—					
	ORDER 3.—Dietic Dis.							598	575	32	12'19	'65
	Purpura and Scurvy -	144	145	5	151	150	2					
	Alcoholism { a. Del. Tremens -	145	135	9	155	143	16					
	b. Intemperance -	1	—	—	2	2	—					
	ORDER 4.—Parasitic Dis.							294	302	—	5'99	—
	Psora - - -	90	93	—	—	—	—					
	Vermes - - -	86	97	—	—	—	—					
	Dracunculus - -	118	112	—	—	—	—					

No. 6.—Bombay ; Infantry. Presidential Returns. European Troops ; H.M. Regiments—*continued*.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Gout - - -	—	—	—	1	1	—	440	424	18	8·97	·37
	Lumbago - - -	114	109	1	216	218	—					
	Dropsy - - -	54	47	9	55	49	8					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	283	280	1	154	149	2	728	626	99	14·85	2·02
	Morbus Coxarius - - -	6	8	—	4	4	—					
	Phthisis - - -	107	51	57	112	77	36					
	Hæmoptysis - - -	30	28	1	32	29	2					
III.	ORDER 1.											
	Cephalitis - - -	89	89	—	372	368	1	1,630	1,545	98	33·74	2·00
	Vertigo - - -	3	3	—	—	—	—					
	Apoplexy - - -	75	31	50	45	23	20					
	Paralysis - - -	62	56	8	97	86	11					
	Odontalgia - - -	19	22	—	18	18	—					
	Insanity - - -	103	114	1	92	82	1					
	Neuralgia - - -	16	15	—	14	14	—					
	Epilepsy - - -	89	90	1	81	82	1					
	Otitis - - -	234	235	—	174	172	—					
	Chorea - - -	—	—	—	1	—	—					
	Dysecœa - - -	17	18	—	14	14	—					
	Brain Disease, &c. - - -	11	10	2	4	3	2					
	ORDER 2.											
	Trismus Idiopathicus - - -	1	—	1	—	—	—	823	767	48	16·78	·98
	Pericarditis - - -	198	190	5	298	266	26					
	Aneurism - - -	2	1	1	36	24	12					
	Varix - - -	29	30	—	81	82	—					
	Heart Disease, &c. - - -	123	118	3	55	56	—					
	ORDER 3.											
	Epistaxis - - -	11	10	1	8	9	—	911	879	39	18·58	·79
	Laryngitis - - -	—	—	—	1	1	—					
	Bronchitis - - -	186	178	9	173	172	4					
	Pleurisy - - -	44	46	1	73	75	1					
	Hydrothorax - - -	2	2	—	1	1	—					
	Pneumonia - - -	139	120	10	80	76	6					
	Asthma - - -	72	71	3	121	118	4					
	ORDER 4.											
	Dyspepsia - - -	1,594	1,593	2	1,716	1,701	3	10,997	10,734	203	223·74	4·14
	Gastritis - - -	28	28	1	42	40	2					
	Enteritis - - -	25	21	3	13	10	3					
	Peritonitis - - -	27	21	5	13	7	5					
	Ascites - - -	13	7	4	40	29	4					
	Colonitis - - -	1	1	—	—	—	—					
	Hernia - - -	32	30	—	45	49	—					
	Ileus and Colic - - -	738	713	1	552	542	—					
	Prolapsus Ani - - -	11	11	—	11	12	—					
	Stricture of Rectum - - -	5	4	—	—	—	—					
	Stricture of Intestine - - -	—	—	—	1	2	—					
	Fistula - - -	26	22	—	18	18	—					
	Obstipatio - - -	489	490	1	261	261	2					
	Hæmorrhoids - - -	298	312	—	208	208	—					
	Hepatitis - - -	2,106	1,995	108	1,564	1,487	49					
	Jaundice - - -	226	230	1	105	98	5					
	Spleen Disease - - -	326	332	2	439	437	—					
	Hæmatemesis - - -	15	15	—	9	8	2					
	ORDER 5.											
	Nephritis - - -	29	30	1	54	51	2	183	178	3	3·73	·06
	Enuresis - - -	17	17	—	16	14	—					
	Ischuria - - -	—	—	—	30	31	—					
	Dysuria - - -	28	29	—	—	—	—					
	Diabetes - - -	—	—	—	2	2	—					
	Stone - - -	1	1	—	—	—	—					
	Cystitis - - -	3	3	—	3	—	—					

No. 6.—Bombay ; Infantry. Presidential Returns. European Troops ; H.M. Regiments—*continued.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.		
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.	
III.	ORDER 6.												
	Sarcocele - - -	5	2	—	—	—	—	}	80	76	1	1·63	·02
	Orchitis - - -	1	1	—	—	—	—						
	Hydrocele - - -	32	31	—	42	42	1						
	ORDER 7.												
	Contractura - - -	1	—	—	5	5	—	}	69	63	—	1·41	—
	Arthritis - - -	4	3	—	—	—	—						
	Periostitis - - -	2	3	—	—	—	—						
	Joint Disease, &c. - - -	16	12	—	39	38	—						
	Hydrarthrus - - -	2	2	—	—	—	—						
	ORDER 8.												
	Phlegmon - - -	}	1,618	1,634	2	1,068	1,065	}	4,703	4,789	3	95·92	·06
	Abscess - - -												
	Ulcer - - -												
	Tumor - - -	3	11	—	34	32	—						
Skin Disease, &c. - - -	150	149	—	160	159	—							
IV.	ORDER 4.												
	Atrophy - - -	1	1	—	16	15	1	17	16	1	·34	·02	
V.	ORDER 1.— <i>Accident or Negligence.</i>												
	Burns or Scalds - - -	32	33	—	26	21	—	}	3,497	3,487	43	71·31	·88
	Contusion - - -	1,066	1,084	—	935	920	—						
	Concussio Cerebri - - -	1	—	1	1	1	—						
	Sub-luxation - - -	473	472	—	313	307	—						
	Luxation - - -	26	25	—	25	25	—						
	Fracture - - -	65	69	—	60	62	1						
	Wounds { Gunshot - - -	5	7	2	16	14	—						
	{ Incised - - -	260	257	2	187	184	—						
	Morsus Serpents - - -	1	1	—	—	—	—						
	Drowning - - -	—	—	8	—	—	8						
	Suffocatio - - -	—	—	—	1	1	—						
	Venenatio - - -	—	—	—	1	1	1						
	Amputatio - - -	1	—	1	2	3	—						
	Sudden Death - - -	—	—	2	—	—	2						
	Found Dead - - -	—	—	8	—	—	7						
	ORDER 4.— <i>Suicide (attempted or accomplished).</i>												
	Wounds { Gunshot - - -	—	—	—	—	—	1	}	—	—	4	—	·08
	{ Cut, Stab - - -	—	—	—	—	—	3						
	ORDER 5.												
	Punitus - - -	32	32	—	31	29	—	}	288	281	6	5·87	·12
	Observatio - - -	108	101	—	119	120	4						

No. 7.

MADRAS.

PRESIDENTIAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY’S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(A.)—SUMMARY.

STATIONS.					No of Years under Observation.	Aggregate Strength.	Mean Number constantly sick in Hospital.	Admissions into Hospital.	Discharged from Hospital.	Deaths in and out of Hospital.
Cannanore	-	-	-	-	10	9,032	58	13,252	13,036	195
Bangalore	-	-	-	-	„	13,424	97	18,446	18,200	269
Fort St. George	-	-	-	-	8	6,601	67	11,892	11,702	223
Troops en route, &c.	-	-	-	-	„	3,451	28	5,853	5,786	136
Trichinopoly	-	-	-	-	4	4,005	62	6,142	6,144	82
Secunderabad	-	-	-	-	3	3,022	69	4,806	4,692	96
Jackatalla	-	-	-	-	„	1,687	24	1,615	1,580	68
Poonamallee	-	-	-	-	2	201	7	297	364	19
Kamptee	-	-	-	-	1	767	41	1,023	1,025	27
Total					-	42,190	453	63,326	62,529	1,135

ANNUAL AVERAGES.

				Average Annual Strength.	Number constantly Sick.	Annual Average.		
						Admissions.	Discharges.	Deaths.
Stations occupied during 10 years				2,246	155	3,170	3,124	46
8	”	-	-	1,256	95	2,219	2,197	45
4	”	-	-	1,001	62	1,535	1,536	20
3	”	-	-	1,570	93	2,140	2,091	55
2	”	-	-	101	7	148	182	9
1	”	-	-	767	41	1,023	1,025	27
Average Annual Results for the whole Presidency of Madras				6,941	453	10,235	10,155	202

No. 8.

MADRAS.—CAVALRY.

PRESIDENTIAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength - - - - - 5,483.

RETURN showing (C) the Number of ATTACKS of SICKNESS; (E) the Number DISCHARGED to DUTY; and
(F) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	4,509	4,451	51	3,110	3,071	47	7,619	7,522	98	1,389·57	17·87
	CLASSES.											
I.	ZYMOTIC DISEASES -	2,522	2,489	21	1,828	1,808	24	4,350	4,297	45	793·36	8·21
II.	CONSTITUTIONAL -	40	30	5	48	44	2	88	74	7	16·05	1·27
III.	LOCAL - - -	1,342	1,320	20	898	888	17	2,240	2,208	37	408·53	6·75
IV.	DEVELOPMENTAL -	—	—	—	4	4	—	4	4	—	·73	—
V.	VIOLENCE - -	605	612	5	332	327	4	937	939	9	170·90	1·64
	ORDERS.											
I.	ORDER I.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	3	3	—	3	5	—	2,417	2,381	40	440·82	7·29
	Vaccinia - - -	—	—	—	1	1	—					
	Varicella - - -	1	1	—	—	—	—					
	Measles - - -	1	1	—	2	2	—					
	Quinsy - - -	52	51	—	27	29	—					
	Catarrh and Influenza -	156	152	—	97	96	—					
	Ophthalmia - - -	79	79	—	77	76	—					
	Fever (C.C.) - - -	278	270	4	197	192	5					
	Erythema - - -	—	—	—	1	1	—					
	Erysipelas - - -	2	2	—	10	10	—					
	Dysentery - - -	276	270	9	104	101	3					
	Diarrhœa - - -	152	151	—	190	195	3					
	Cholera - - -	14	12	2	15	8	7					
	Ague - - -	7	3	—	14	13	1					
	Remittent Fever - - -	34	35	3	48	45	3					
	Rheumatism - - -	316	315	—	260	262	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	1,083	1,080	2	731	723	1	1,831	1,816	3	333·94	·55
	Stricture of Urethra - -	11	8	—	6	5	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	1	1	—	—	—	—	88	86	2	16·05	·37
	Alcoholism { <i>a.</i> Del. Tremens	33	30	1	28	27	1					
	{ <i>b.</i> Intemperance	16	18	—	10	10	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	6	6	—	4	4	—	14	14	—	2·55	—
	Psora - - -	—	—	—	3	3	—					
	Porriço, &c. - - -	1	1	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	17	14	—	23	22	—	46	39	2	8·39	·36
	Gout - - -	—	—	—	1	1	—					
	Dropsy - - -	1	—	1	4	2	1					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	5	3	—	6	6	—	42	35	5	7·66	·91
	Scrofula - - -	11	11	—	11	11	—					
	Phthisis - - -	4	1	3	—	—	—					
	Hæmoptysis - - -	2	1	1	3	2	1					

No. 8.—Madras ; Cavalry. Presidential Returns. European Troops ; H. M. Regiments—*continued.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	37	37	—	77	76	1	226	209	15	41·22	2·74
	Meningitis - - -	2	2	—	—	—	—					
	Apoplexy - - -	4	1	3	3	1	3					
	Paralysis - - -	20	12	5	17	15	2					
	Insanity - - -	5	5	—	8	7	1					
	Odontalgia - - -	3	3	—	—	—	—					
	Epilepsy - - -	12	12	—	23	23	—					
	Otitis - - -	8	8	—	5	5	—					
	Brain Disease, &c. - -	1	1	—	—	—	—					
	Dyseæa - - -	1	1	—	—	—	—					
	ORDER 2.											
	Pericarditis - - -	60	58	2	22	23	—	95	91	4	17·32	·73
	Aneurism - - -	1	1	—	1	—	1					
	Varix - - -	1	1	—	3	3	—					
	Heart Disease, &c. - -	2	1	—	5	4	1					
	ORDER 3.											
	Pleurisy - - -	—	—	—	1	1	—	48	49	1	8·75	·18
	Pneumonia - - -	16	16	—	3	3	—					
	Asthma - - -	21	23	—	7	6	1					
	ORDER 4.											
	Dyspepsia - - -	50	50	—	32	32	—	817	807	17	149·01	3·10
	Gastritis - - -	16	16	—	6	6	—					
	Enteritis - - -	12	11	2	1	1	—					
	Hæmatemesis - - -	2	2	—	1	—	1					
	Hernia - - -	4	4	—	—	—	—					
	Ileus and Colic - - -	75	75	—	20	19	—					
	Hæmorrhoids - - -	14	16	—	26	26	—					
	Fistula - - -	2	2	—	7	7	—					
	Obstipatio - - -	66	63	—	19	19	—					
	Hepatitis - - -	249	247	7	156	152	6					
	Jaundice - - -	11	11	1	9	9	—					
	Spleen Disease, &c. - -	19	19	—	20	20	—					
	ORDER 5.											
	Nephritis - - -	3	3	—	8	8	—	36	35	—	6·57	—
	Ischuria - - -	19	18	—	2	2	—					
	Enuresis - - -	—	—	—	1	1	—					
	Cystitis - - -	2	2	—	1	1	—					
	ORDER 6.											
	Hydrocele - - -	2	3	—	2	2	—	4	5	—	·73	—
	ORDER 7.											
	Arthritis - - -	2	2	—	—	—	—	15	13	—	2·73	—
	Joint Disease, &c. - -	12	10	—	1	1	—					
	ORDER 8.											
	Phlegmon - - -	348	349	—	246	250	—	999	999	—	182·20	—
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Disease, &c. - -											
IV.	ORDER 4.											
	Atrophy - - -	—	—	—	4	4	—	4	4	—	·73	—
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	5	5	—	4	4	—	925	927	4	168·71	·73
	Contusion - - -	467	472	—	245	241	—					
	Sub-luxation - - -	55	54	—	14	15	—					
	Luxation - - -	7	7	—	—	—	—					
	Fracture - - -	18	18	—	8	7	—					
	Wounds, Incised - - -	48	51	—	47	47	—					
	Concussio Cerebri - -	3	3	—	4	3	1					
	Drowned - - -	—	—	2	—	—	1					
	ORDER 4.— <i>Suicide.</i>											
	Gunshot Wound - - -	—	—	3	—	—	1	—	—	5	—	·91
	Not stated - - -	—	—	—	—	—	1					
	ORDER 5.											
	Punitus - - -	1	1	—	—	—	—	12	12	—	2·19	—
	Observatio - - -	1	1	—	10	10	—					

No. 9.

MADRAS.—INFANTRY.

PRESIDENTIAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength - - - - - 36,707

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY;
and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	35,953	35,211	661	19,514	19,342	370	55,467	54,553	1,031	1,511·07	28·08
	CLASSES.											
I.	ZYMOTIC DISEASES -	24,237	23,916	364	12,892	12,821	206	37,129	36,737	570	1,011·5	15·53
II.	CONSTITUTIONAL -	468	393	79	300	285	32	768	678	111	20·92	3·02
III.	LOCAL - - -	9,169	8,869	193	5,147	5,051	118	14,316	13,920	311	390·01	8·47
IV.	DEVELOPMENTAL -	7	5	2	13	13	—	20	18	2	·54	·05
V.	VIOLENCE - -	2,072	2,028	23	1,162	1,172	14	3,234	3,200	37	88·10	1·01
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Anthrax - - -	3	3	—	7	7	—	24,204	23,751	528	659·38	14·38
	Small-pox - - -	26	21	4	8	9	—					
	Varicella - - -	4	4	—	11	10	—					
	Measles - - -	18	18	—	8	10	—					
	Scarlatina - - -	1	1	—	—	—	—					
	Quinsy - - -	333	336	—	190	191	—					
	Catarrh and Influenza -	2,389	2,370	13	1,127	1,122	7					
	Ophthalmia - - -	869	862	—	435	450	—					
	Fever (C. C.) - - -	3,439	3,424	43	1,248	1,232	21					
	Typhus - - -	—	—	—	1	—	1					
	Icterodes - - -	1	1	—	—	—	—					
	Ephemeral - - -	—	—	—	35	36	—					
	Erythema - - -	—	—	—	4	4	—					
	Erysipelas - - -	11	10	1	12	12	1					
	Dysentery - - -	2,291	2,151	196	881	836	64					
	Diarrhoea - - -	2,076	2,074	12	1,663	1,655	10					
	Cholera - - -	71	23	49	144	69	80					
	Ague - - -	1,534	1,531	1	1,518	1,494	2					
	Remittent Fever - - -	67	63	6	180	172	7					
	Rheumatism - - -	2,353	2,295	7	1,246	1,252	3					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	8,013	7,989	14	3,702	3,794	1	11,900	11,965	16	324·19	·44
	Stricture of Urethra - -	108	102	—	77	80	1					
	ORDER 3.— <i>Dietic Dis.</i>											
	Bronchocele - - -	1	1	—	—	—	—	803	804	26	21·88	·71
	Purpura and Scurvy - -	100	113	4	14	13	5					
	Alcoholism { <i>a.</i> Del. Tremens	178	175	10	77	62	3					
	{ <i>b.</i> Intemperance	302	300	4	131	140	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	49	46	—	88	87	—	222	217	—	6·05	—
	Psora - - -	—	—	—	85	84	—					

No. 9.—Madras ; Infantry. Presidential Returns. European Troops ; H. M. Regiments—*continued*.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	92	87	—	93	95	—	234	237	9	6·37	·24
	Dropsy - - -	17	16	2	31	38	7					
	Cancer - - -	—	—	—	1	1	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	5	5	—	2	2	—	534	441	102	14·55	2·78
	Scrofula - - -	146	144	2	56	54	1					
	Phthisis - - -	146	82	72	87	67	23					
	Hæmoptysis - - -	62	59	3	30	28	1					
III.	ORDER 1.											
	Cephalitis - - -	230	225	1	172	171	—	1,327	1,250	77	36·15	2·09
	Apoplexy - - -	28	6	28	33	17	20					
	Vertigo - - -	3	3	—	—	—	—					
	Paralysis - - -	71	64	7	50	46	2					
	Tetanus - - -	2	—	3	—	—	—					
	Insanity - - -	94	87	3	38	40	2					
	Chorea - - -	2	1	—	—	—	—					
	Epilepsy - - -	100	94	4	61	59	1					
	Neuralgia - - -	8	8	—	8	8	—					
	Otitis - - -	223	224	1	109	109	1					
	Odontalgia - - -	61	61	—	8	8	—					
	Brain Disease, &c. - - -	8	4	3	2	1	1					
	Dysecœa - - -	9	7	—	7	7	—					
	ORDER 2.											
	Pericarditis - - -	86	71	14	62	55	7	438	393	53	11·93	1·44
	Aneurism - - -	9	—	12	32	22	11					
	Varix - - -	41	40	2	12	13	—					
	Heart Disease, &c. - - -	40	38	4	152	150	3					
	Phlebitis - - -	4	4	—	—	—	—					
	ORDER 3.											
	Epistaxis - - -	4	4	—	4	4	—	537	518	21	14·63	·57
	Laryngitis - - -	—	—	—	3	3	—					
	Hydrothorax - - -	3	—	3	—	—	—					
	Bronchitis - - -	—	—	—	125	125	4					
	Pleurisy - - -	—	—	—	23	23	—					
	Pneumonia - - -	131	128	3	43	33	9					
	Asthma - - -	145	138	2	55	59	—					
	Sarcoma - - -	1	1	—	—	—	—					
	ORDER 4.											
	Dyspepsia - - -	654	652	2	709	707	3	6,629	6,447	150	180·59	4·09
	Gastritis - - -	138	137	1	54	53	1					
	Enteritis - - -	13	11	2	4	2	1					
	Peritonitis - - -	6	5	1	1	—	1					
	Ascites - - -	4	1	3	7	5	1					
	Hæmatemesis - - -	3	2	—	5	4	1					
	Hernia - - -	41	37	—	17	16	—					
	Ileus and Colic - - -	294	293	1	125	124	—					
	Hæmorrhoids - - -	359	354	—	187	188	1					
	Fistula - - -	36	37	—	6	6	—					
	Obstipatio - - -	1,021	1,022	1	414	386	—					
	Hepatitis - - -	1,691	1,589	85	664	656	38					
	Jaundice - - -	52	43	2	39	32	4					
	Spleen Disease, &c. - - -	58	58	1	27	27	—					
	ORDER 5.											
	Nephritis - - -	27	26	—	19	19	—	120	116	3	3·27	·08
	Ischuria - - -	29	29	—	22	22	—					
	Hæmaturia - - -	—	—	—	3	3	1					
	Enuresis - - -	2	2	—	—	—	—					
	Stone - - -	1	1	—	2	2	—					
	Cystitis - - -	10	9	1	5	3	1					
	ORDER 6.											
	Sarcocele - - -	5	5	—	—	—	—	65	65	1	1·77	·03
	Hydrocele - - -	35	35	1	2	25	—					

No. 9.—Madras ; Infantry. Presidential Returns. European Troops ; H.M. Regiments—*continued*.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1,00 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 7.											
	Arthritis - - -	6	5	—	8	8	—	}	46	45	1	1·25
	Joint Disease, &c. - - -	15	13	1	10	12	—					
	Hydrarthrus - - -	3	3	—	1	1	—					
	Contractura - - -	—	—	—	3	3	—					
	ORDER 8.											
	Phlegmon - - -	}	1,791	1,728	1	977	990	}	5,154	5,086	5	140·42
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Disease, &c. - - -	569	567	—	186	184	—					
IV.	ORDER 4.											
	Atrophy - - -	7	5	2	13	13	—	20	18	2	·54	·05
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	94	35	—	15	17	—	}	2,912	2,871	27	79·33
	Contusion - - -	1,023	1,038	1	524	527	1					
	Sub-luxation - - -	449	451	1	298	295	—					
	Luxation - - -	26	26	—	11	17	—					
	Fracture - - -	51	52	1	50	44	4					
	Wounds { Gunshot - - -	5	5	—	3	5	1					
	Incised - - -	252	253	1	92	88	—					
	Concussio Cerebri - - -	5	3	1	3	4	1					
	Amputatio - - -	—	—	—	9	9	—					
	Lightning Stroke - - -	—	—	—	1	1	1					
	Otherwise - - -	1	1	—	—	—	—					
	Killed by Elephant - - -	—	—	1	—	—	—					
	Drowning - - -	—	—	7	—	—	3					
	Found Dead - - -	—	—	2	—	—	1					
	ORDER 2.— <i>Battle.</i>											
	Wounds, Gunshot - - -	—	—	4	—	—	—	—	—	4	—	·11
	ORDER 4.— <i>Suicide.</i>											
	Wounds, Gunshot - - -	—	—	2	—	—	—	}	—	—	5	—
	Hanging - - -	—	—	1	—	—	—					
	Not stated - - -	—	—	1	—	—	1					
	ORDER 5.											
	Punitus - - -	17	15	—	13	16	—	}	322	329	1	8·77
	Observatio - - -	149	149	—	143	149	1					

No. 10.

B U R M A H.

GENERAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

(A.)—SUMMARY.

Years.	REGIMENTS.				Annual Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
1852	Her Majesty's Troops	-	-		1,635	169·25	4,328	3,679	376
1853	"	"	-	-	1,703	220·25	4,687	4,396	436
1854	"	"	-	-	960	54·75	1,326	1,304	30
1855	"	"	-	-	1,845	106·5	2,410	2,311	89
1856	"	"	-	-	2,223	185·75	3,667	2,470	111
	Total	-	-	-	8,366	736·	16,418	15,160	1,042

No. 11.

TROOPS ON FIELD SERVICE.

GENERAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

(A.)—SUMMARY.

Year.	Regiments.				Annual Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
1848	Her Majesty's Troops	-	-		1,898	104	3,415	3,403	173
1849	"	"	-	-	2,702	127	5,322	4,654	484
1850	"	"	-	-	27	—	3	—	—
1852	"	"	-	-	176	8·75	138	168	1
1854	"	"	-	-	184	5·5	244	314	6
1856	"	"	-	-	278	—	396	387	4
	Total	-	-	-	5,265	—	9,518	8,926	668

No. 12.

BURMAH.

GENERAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 5 Years - - - - 8,366.

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1852 to 1856.			Total for 5 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	17,937	16,502	1,016	17,937	16,502	1,016	2,144·1	121·44
	CLASSES.								
I.	ZYMOTIC DISEASES - -	12,985	11,786	856	12,985	11,786	856	1,552·1	102·32
II.	CONSTITUTIONAL - -	193	177	25	193	177	25	23·07	2·99
III.	LOCAL - -	3,742	3,545	102	3,742	3,545	102	447·29	12·19
IV.	DEVELOPMENTAL - -	23	17	7	23	17	7	2·75	·83
V.	VIOLENCE - -	994	977	26	994	977	26	113·81	3·11
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Diseases.</i>								
	Small-pox - -	12	8	4	11,963	10,764	855	1,430·02	102·20
	Varicella - -	5	5	—					
	Measles - -	3	1	—					
	Quinsy - -	70	71	—					
	Catarrh and Influenza - -	680	686	2					
	Ophthalmia - -	381	348	—					
	Fever (C. C.) - -	1,387	1,350	49					
	Ephemeral - -	42	42	—					
	Erysipelas - -	5	4	1					
	Anthrax - -	2	2	—					
	Dysentery - -	3,255	2,730	441					
	Diarrhœa - -	1,690	1,643	40					
	Cholera - -	785	366	235					
	Ague - -	1,696	1,675	12					
	Remittent Fever - -	1,299	1,182	71					
	Rheumatism - -	651	651	—					
	ORDER 2.— <i>Enthetic Diseases.</i>								
	Syphilis, &c. - -	836	846	1	871	879	1	104·11	·12
	Stricture of Urethra - -	35	33	—					
	ORDER 3.— <i>Dietic Diseases.</i>								
	Purpura and Scurvy - -	33	30	—	122	115	—	14·58	—
	Alcoholism { <i>a.</i> Delirium Tremens - -	48	44	—					
	{ <i>b.</i> Intemperance. - -	41	41	—					
	ORDER 4.— <i>Parasitic Diseases.</i>								
	Vermes - -	23	22	—	29	28	—	3·47	—
	Psora - -	6	6	—					
II.	ORDER 1.— <i>Diathetic Diseases.</i>								
	Lumbago - -	44	44	—	73	68	4	8·72	·48
	Dropsy - -	29	24	4					
	ORDER 2.— <i>Tubercular Diseases.</i>								
	Scrofula - -	43	46	1	120	109	21	14·35	2·51
	Phthisis - -	57	41	19					
	Hæmoptysis - -	20	22	1					
III.	ORDER 1.								
	Cephalitis - -	157	149	—	412	386	20	49·25	2·39
	Apoplexy - -	45	31	15					
	Paralysis - -	29	30	2					
	Odontalgia - -	6	6	—					
	Insanity - -	20	22	1					
	Epilepsy - -	49	48	—					
	Otitis - -	90	87	—					
	Neuralgia - -	12	11	—					
	Brain Disease, &c. - -	2	—	2	4	G	4		
	Dyseccœa - -	2	2	—					

No. 12.—Burmah. General Returns. European Troops ; H. M. Regiments—*continued*.

Class.	Diseases.	Five Years, 1852 to 1856.			Total for 5 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 2.								
	Pericarditis - - - -	23	20	1	92	83	5	10·99	·59
	Aneurism - - - -	3	1	2					
	Varix - - - -	13	13	—					
	Heart Disease, &c. - - -	53	49	2					
	ORDER 3.								
	Epistaxis - - - -	1	—	1	91	84	7	10·88	·83
	Laryngitis - - - -	3	3	—					
	Bronchitis - - - -	23	21	—					
	Pleurisy - - - -	24	26	—					
	Pneumonia - - - -	17	11	6					
	Asthma - - - -	23	23	—					
	ORDER 4.								
	Dyspepsia - - - -	322	313	2	1,854	1,741	66	221·62	7·90
	Gastritis - - - -	27	27	—					
	Enteritis - - - -	3	3	—					
	Peritonitis - - - -	4	3	1					
	Ascites - - - -	8	5	4					
	Hæmatemesis - - - -	5	4	1					
	Hernia - - - -	6	6	—					
	Ileus and Colic - - - -	137	136	—					
	Hæmorrhoids - - - -	155	151	3					
	Fistula - - - -	14	12	—					
	Obstipatio - - - -	134	135	—					
	Hepatitis - - - -	933	845	55					
	Jaundice - - - -	66	61	—					
	Spleen Disease, &c. - - -	40	40	—					
	ORDER 5.								
	Nephritis - - - -	22	22	—	39	38	1	4·66	·12
	Ischuria - - - -	12	11	1					
	Diabetes - - - -	1	1	—					
	Stone - - - -	1	1	—					
	Cystitis - - - -	3	3	—					
	ORDER 6.								
	Hydrocele - - - -	19	19	—	19	19	—	2·27	—
	ORDER 7.								
	Hydrarthrus - - - -	5	6	—	26	27	—	3·11	—
	Arthritis - - - -	12	13	—					
	Joint Disease, &c. - - -	8	7	—					
	Contractura - - - -	1	1	—					
	ORDER 8.								
	Phlegmon - - - -	655	607	2	1,209	1,167	3	144·51	·36
	Ulcer - - - -	457	474	1					
	Tumor - - - -	8	5	—					
	Skin Disease, &c. - - -	89	81	—					
IV.	ORDER 4.								
	Atrophy - - - -	23	17	7	23	17	7	2·75	·83
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Burns or Scalds - - - -	22	20	2	579	566	12	69·21	1·43
	Contusion - - - -	340	335	2					
	Sub-luxation - - - -	169	168	—					
	Luxation - - - -	18	16	—					
	Fracture - - - -	24	24	—					
	Concussion of Brain - - -	2	—	1					
	Amputation - - - -	4	3	1					
	Killed by fall of Earth - -	—	—	1					
	Killed by fall of House - -	—	—	1					
	Found dead - - - -	—	—	1					
	Drowned - - - -	—	—	3					
	ORDER 2.— <i>Battle.</i>								
	Gunshot Wound - - - -	143	135	9	267	260	9	31·91	1·07
	Cut, Stab - - - -	124	125	—					
	ORDER 3.								
	Homicide - - - -	—	—	3	—	—	3	—	·36
	ORDER 5.								
	Punitus - - - -	16	18	—	148	151	2	17·69	·25
	Observatio - - - -	132	133	2					

No. 13.

TROOPS ON FIELD SERVICE.

GENERAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY’S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 6 Years - - - - 5,265

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (D.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Six Years, 1848 to 1850, 1852, 1854, 1856.			Total for 6 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(D.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(D.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	9,415	8,991	667	9,415	9,021	667	1,788·24	126·69
	CLASSES.								
I.	ZYMOTIC DISEASES - -	6,807	8,626	160	6,807	6,626	160	1,292·9	30·39
II.	CONSTITUTIONAL - - -	79	66	12	79	66	12	15·00	2·28
III.	LOCAL - - - -	1,075	1,000	74	1,075	1,000	74	204·18	14·06
IV.	DEVELOPMENTAL - - -	—	1	—	—	1	—	—	—
V.	VIOLENCE - - - -	1,454	1,328	421	1,454	1,328	421	276·16	79·96
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Small-pox - - - -	13	14	3	5,743	5,534	158	1,090·81	30·01
	Measles - - - -	1	—	—					
	Quinsy - - - -	43	47	—					
	Catarrh and Influenza - - -	242	235	5					
	Ophthalmia - - - -	378	199	—					
	Fever (C. C.) - - - -	1,511	1,578	23					
	Erysipelas - - - -	6	6	—					
	Dysentery - - - -	959	808	97					
	Diarrhoea - - - -	445	405	13					
	Cholera - - - -	7	4	4					
	Ague - - - -	1,846	1,943	3					
	Remittent Fever - - - -	201	191	10					
	Rheumatism - - - -	91	104	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	982	984	1	993	998	2	188·61	·38
	Stricture of Urethra - - -	11	14	1					
	ORDER 3.— <i>Dietic Dis.</i>								
	Purpura and Scurvy - - -	10	6	—	63	85	—	11·96	—
	Alcoholism { <i>a.</i> Del. Tremens - - -	14	9	—					
	{ <i>b.</i> Intemperance - - -	39	70	—					
	ORDER 4.— <i>Parasitic Dis.</i>								
	Vermes - - - -	3	3	—	8	9	—	1·52	—
	Psora - - - -	5	6	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>								
	Lumbago - - - -	32	25	—	37	30	1	7·03	·19
	Dropsy - - - -	5	5	1					
	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	17	16	—	42	36	11	7·97	2·09
	Phthisis - - - -	21	14	10					
	Hæmoptysis - - - -	4	6	1					

No. 13.—Troops on Field Service. General Returns. European Troops ; H.M. Regiments—*cont.*

Class.	Diseases.	Six Years, 1848 to 1850, 1852, 1854, 1856.			Total for 6 Years.			Annual Ratio per 1000 of Mean Strength.				
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.			
III.	ORDER 1.											
	Cephalitis	-	-	-	18	19	—	110	84	34	20·89	6·46
	Apoplexy	-	-	-	33	4	32					
	Paralysis	-	-	-	11	12	—					
	Insanity	-	-	-	18	22	1					
	Odontalgia	-	-	-	2	1	—					
	Epilepsy	-	-	-	18	16	1					
	Tetanus	-	-	-	2	1	—					
	Otitis	-	-	-	8	8	—					
	Dyseccœa	-	-	-	—	1	—					
	ORDER 2.							28	33	3	5·32	·57
	Pericarditis	-	-	-	12	12	2					
	Aneurism	-	-	-	2	1	1					
	Varix	-	-	-	3	7	—					
	Heart Diseases, &c.	-	-	-	11	13	—					
	ORDER 3.							65	52	7	12·34	1·33
	Epistaxis	-	-	-	1	1	—					
	Bronchitis	-	-	-	9	6	1					
	Pleurisy	-	-	-	19	18	1					
	Pneumonia	-	-	-	19	14	5					
	Asthma	-	-	-	17	13	—					
	ORDER 4.							577	539	30	109·59	5·7
	Dyspepsia	-	-	-	57	47	1					
	Gastritis	-	-	-	1	2	—					
	Enteritis	-	-	-	2	—	1					
	Peritonitis	-	-	-	7	5	2					
	Ascites	-	-	-	3	2	2					
	Hernia	-	-	-	2	7	—					
	Ileus and Colic	-	-	-	95	94	—					
	Hæmorrhoids	-	-	-	41	37	—					
	Fistula	-	-	-	6	7	—					
	Obstipatio	-	-	-	17	17	—					
	Hepatitis	-	-	-	263	244	23					
	Jaundice	-	-	-	56	48	1					
	Spleen Disease, &c.	-	-	-	27	29	—					
	ORDER 5.							3	3	—	·57	—
	Nephritis	-	-	-	1	1	—					
	Ischuria	-	-	-	2	1	—					
	Hæmaturia	-	-	-	—	1	—					
	ORDER 6.							2	1	—	·38	—
	Hydrocele	-	-	-	2	1	—					
	ORDER 7.							—	1	—	—	—
	Joint Disease, &c.	-	-	-	—	1	—					
	ORDER 8.							290	286	—	55·09	—
	Phlegmon	-	-	-	134	133	—					
	Ulcer	-	-	-	149	142	—					
	Skin Diseases, &c.	-	-	-	7	11	—					
IV	ORDER 4.						—	1	—	—	—	
	Atrophy	-	-	-	—	1						—
V.	ORDER 1.— <i>Accident or Negligence.</i>						492	464	22	93·44	4·18	
	Burns or Scalds	-	-	-	29	29						1
	Contusion	-	-	-	290	274						4
	Sub-luxation	-	-	-	42	37						—
	Luxation	-	-	-	5	5						—
	Fracture	-	-	-	47	44						5
	Wounds, Incised	-	-	-	8	10						—
	Amputation	-	-	-	71	65						8
	Drowned	-	-	-	—	—						3
	Found dead	-	-	-	—	—						1
	ORDER 2.— <i>Battle.</i>							891	794	398	169·23	75·59
	Gunshot Wound	-	-	-	803	709	396					
	Cut, Stab	-	-	-	88	85	2					
	ORDER 5.							71	70	1	13·49	·19
	Punitus	-	-	-	48	47	—					
	Observatio	-	-	-	23	23	2					

No. 14.

BENGAL.—UMBALLA STATION.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS,—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 10 Years - - - - 6,097
 Mean Annual Strength - - - - 610

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	3,828	3,647	80	4,628	4,607	61	8,456	8,254	141	1,386·9	23·12
	CLASSES.											
I.	ZYMOTIC DISEASES -	2,680	2,562	48	3,550	3,541	47	6,230	6,103	95	1021·8	15·58
II.	CONSTITUTIONAL -	18	11	3	27	22	5	45	33	8	7·38	1·31
III.	LOCAL - - -	790	742	28	740	731	9	1,530	1,473	37	250·94	6·07
V.	VIOLENCE - - -	340	332	1	311	313	—	651	645	1	106·78	·16
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	1	1	—	1	—	—	4,704	4,617	86	771·53	14·11
	Vaccinia - - -	6	6	—	—	—	—					
	Measles - - -	—	—	—	1	1	—					
	Quinsy - - -	29	28	—	55	56	—					
	Catarrh and Influenza - -	98	98	—	154	153	—					
	Ophthalmia - - -	115	120	—	81	81	—					
	Fever (C. C.) - - -	729	700	12	410	409	2					
	Erysipelas - - -	5	5	—	5	5	—					
	Dysentery - - -	157	152	16	62	58	6					
	Diarrhoea - - -	207	191	10	248	246	4					
	Cholera - - -	24	25	—	42	24	18					
	Ague - - -	385	375	3	1,247	1,260	5	1,300	1,267	2	213·22	32
	Remittent Fever - - -	39	31	2	201	194	7					
	Rheumatism - - -	182	171	1	220	227	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c - - -	567	538	1	703	704	—	1,300	1,267	2	213·22	32
	Stricture of Urethra - -	20	16	—	10	9	1					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	4	4	—	3	2	—	192	186	7	31·49	1·15
	Alcoholism { <i>a.</i> Del. Tremens	34	26	3	24	20	3					
	{ <i>b.</i> Intemperance	73	71	—	54	63	1					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	5	4	—	28	28	—	34	33	—	5·57	—
	Psora - - -	—	—	—	1	1	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	6	6	—	11	11	—	19	18	—	3·12	—
	Dropsy - - -	1	—	—	1	1	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	—	—	—	1	—	—	26	15	8	4·26	1·31
	Scrofula - - -	2	2	—	5	5	—					
	Phthisis - - -	5	2	2	8	4	5					
	Hæmoptysis - - -	4	1	1	1	1	—					

No. 14.—Bengal ; Umballa Station ; Cavalry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.							
		(C.)	(E.)	(F.)	(C.)	(E.)	(F.)	(C.)	(E.)	(F.)	Attacked.	Died.						
		No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.	No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.	No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.								
III.	ORDER 1.																	
	Cephalitis - - -	28	26	1	34	34	—	141	134	8	23·13	1·32						
	Apoplexy - - -	6	—	5	5	3	2											
	Paralysis - - -	2	1	—	4	5	—											
	Insanity - - -	4	3	—	2	2	—											
	Epilepsy - - -	1	2	—	19	23	—											
	Odontalgia - - -	7	7	—	—	—	—											
	Otitis - - -	15	14	—	11	11	—											
	Brain Diseases, &c. - -	1	1	—	—	—	—											
	Dysecœa - - -	—	—	—	2	2	—											
	ORDER 2.																	
	Pericarditis - - -	3	2	2	1	1	—	22	21	3	3·61	·49						
	Aneurism - - -	1	1	—	1	1	—											
	Heart Disease, &c. - -	6	4	1	10	12	—											
	ORDER 3.																	
	Epistaxis - - -	—	—	—	1	1	—	48	43	2	7·87	·32						
	Bronchitis - - -	5	5	—	3	3	—											
	Pleurisy - - -	9	8	1	5	5	—											
	Pneumonia - - -	10	7	1	6	7	—											
	Asthma - - -	7	5	—	2	2	—											
	ORDER 4.																	
	Dyspepsia - - -	59	56	—	78	72	—	633	591	24	103·82	3·94						
	Gastritis - - -	6	5	—	10	10	—											
	Enteritis - - -	2	1	1	2	1	1											
	Peritonitis - - -	1	1	—	—	—	—											
	Ascites - - -	1	1	—	3	1	2											
	Hæmorrhoids - - -	20	20	—	17	17	—											
	Hernia - - -	3	4	—	—	—	—											
	Ileus and Colic - - -	51	52	—	12	12	—											
	Fistula - - -	7	6	1	4	4	—											
	Obstipatio - - -	21	19	—	10	10	—											
	Hepatitis - - -	124	99	15	88	84	4											
	Jaundice - - -	28	30	—	39	39	—											
	Spleen Disease, &c. - -	16	15	—	31	32	—											
	ORDER 5.																	
	Nephritis - - -	7	7	—	4	3	—	18	15	—	2·95	—						
	Ischuria - - -	2	—	—	1	1	—											
	Hæmaturia - - -	—	—	—	3	3	—											
	Cystitis - - -	—	—	—	1	1	—											
	ORDER 6.																	
	Hydrocele - - -	2	1	—	9	9	—	11	10	—	1·8	—						
	ORDER 7.																	
	Hydrarthrus - - -	—	—	—	2	2	—	9	9	—	1·47	—						
	Arthritis - - -	—	—	—	3	3	—											
	Joint Disease, &c. - -	1	1	—	3	3	—											
	ORDER 8.																	
	Phlegmon - - -	247	242	—	184	181	—	648	650	—	106·29	—						
	Abscess - - -																	
	Ulcer - - -												64	69	—	106	108	—
	Tumor - - -												5	4	—	2	3	—
	Skin Disease, &c. - -	18	23	—	22	20	—											
V.																		
ORDER 1.— <i>Accident or Negligence.</i>																		
Burns or Scalds - - -	2	1	—	3	4	—	557	556	1	91·36	·16							
Contusion - - -	253	253	—	157	155	—												
Sub-luxation - - -	26	24	—	37	37	—												
Luxation - - -	6	6	—	3	5	—												
Fracture - - -	8	9	1	12	13	—												
Wounds {	3	3	—	7	8	—												
	18	18	—	22	20	—												
ORDER 5.																		
Punitus - - -	8	6	—	2	3	—	94	89	—	15·42	—							
Observatio - - -	16	12	—	68	68	—												

No. 15.

BENGAL.—MEERUT STATION.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN,

Aggregate Strength for 6 Years - - - 3,780
Mean Annual Strength - - - 630

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
(F.) the NUMBER of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1847, 1848, and 1851.			Three Years,* 1852 to 1854.			Total for 6 Years.*			Annual Ratio per 1,000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	2,056	2,047	40	2,541	2,429	35	4,597	4,476	75	1216·2	19·83
	CLASSES.											
I.	ZYMOTIC DISEASES -	1,557	1,552	29	1,805	1,731	15	3,362	3,283	44	889·42	11·64
II.	CONSTITUTIONAL -	16	16	1	13	6	3	29	22	4	7·67	1·06
III.	LOCAL - - -	334	329	8	478	452	17	812	781	25	214·81	6·61
V.	VIOLENCE - - -	149	150	2	245	240	—	394	390	2	104·24	·52
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	—	—	—	11	9	2	2,539	2,470	37	671·7	9·79
	Vaccina - - -	4	4	—	1	1	—					
	Quinsy - - -	28	29	—	34	34	—					
	Catarrh and Influenza -	45	40	3	52	46	—					
	Ophthalmia - - -	63	66	—	37	39	—					
	Fever (C.C.) - - -	188	184	5	176	177	2					
	Erysipelas - - -	10	10	—	5	5	—					
	Dysentery - - -	69	55	13	34	17	2					
	Diarrhœa - - -	70	71	2	68	66	1					
	Cholera - - -	7	7	—	15	14	1					
	Ague - - -	430	449	2	843	823	—					
	Remittent Fever - - -	144	125	1	4	2	2					
	Rheumatism - - -	96	108	1	105	89	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	359	359	2	326	320	—	699	693	2	184·92	53
	Stricture of Urethra - -	2	1	—	12	13	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Alcoholism - { <i>a.</i> Del. Tremens	20	20	—	18	15	4	119	115	5	31·48	1·32
	- { <i>b.</i> Intemperance	18	20	—	63	60	1					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	4	4	—	1	1	—	5	5	—	1·32	—
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	6	3	—	3	2	1	9	6	1	2·38	·26
	Dropsy - - -	—	1	—	—	—	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	1	1	—	—	—	—	20	16	3	5·29	·8
	Serofula - - -	6	7	—	1	1	—					
	Phthisis - - -	2	2	1	6	—	2					
	Hæmoptysis - - -	1	2	—	2	3	—					

No. 15.—Bengal; Meerut Station; Cavalry. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1847, 1848, and 1851.			Three Years,* 1852 to 1854.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	17	16	—	24	27	—	73	61	8	19·31	2·12
	Apoplexy - - -	2	1	1	8	1	6					
	Paralysis - - -	1	1	—	3	1	1					
	Insanity - - -	3	1	—	—	—	—					
	Epilepsy - - -	2	2	—	—	—	—					
	Odontalgia - - -	2	2	—	—	—	—					
	Otitis - - -	3	2	—	7	6	—					
	Dysecœa - - -	—	—	—	1	1	—					
	ORDER 2.											
	Pericarditis - - -	3	3	—	3	1	2	13	8	5	3·44	1·32
	Aneurism - - -	2	—	2	1	—	1					
	Heart Disease, &c. - - -	1	1	—	3	3	—					
	ORDER 3.											
	Epistaxis - - -	1	1	—	1	—	—	44	39	2	11·64	·53
	Bronchitis - - -	2	1	—	—	—	—					
	Pleurisy - - -	11	10	1	19	17	1					
	Pneumonia - - -	3	3	—	2	2	—					
	Asthma - - -	2	2	—	3	3	—					
	ORDER 4.											
	Dyspepsia - - -	9	8	—	33	26	—	295	282	10	78·04	2·64
	Gastritis - - -	—	—	—	1	1	—					
	Peritonitis - - -	1	1	—	—	—	—					
	Ascites - - -	—	—	—	1	—	—					
	Hernia - - -	5	6	—	3	3	—					
	Ileus and Colic - - -	28	28	—	20	25	—					
	Hæmorrhoids - - -	15	15	—	10	7	—					
	Fistula - - -	1	—	—	2	2	—					
	Obstipatio - - -	5	1	—	—	—	—					
	Hepatitis - - -	52	54	3	78	73	6					
	Jaundice - - -	4	4	—	14	14	—					
	Spleen Disease, &c. - - -	4	5	1	9	9	—					
	ORDER 5.											
	Nephritis - - -	1	1	—	5	3	—	11	7	—	2·92	—
	Ischuria - - -	4	2	—	—	—	—					
	Hæmaturia - - -	1	1	—	—	—	—					
	ORDER 6.											
	Hydrocele - - -	1	1	—	—	—	—	1	1	—	·26	—
	ORDER 7.											
	Arthritis - - -	—	—	—	1	1	—	5	5	—	1·32	—
	Joint Disease, &c. - - -	—	—	—	2	2	—					
	Contractura - - -	2	2	—	—	—	—					
	ORDER 8.											
	Phlegmon - - -	86	98	—	157	152	—	370	378	—	97·88	—
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Disease, &c. - - -	12	10	—	14	16	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	3	3	—	4	5	—	360	357	1	95·25	·26
	Contusion - - -	67	69	—	120	119	—					
	Sub-luxation - - -	16	17	—	40	38	—					
	Luxation - - -	4	5	—	1	1	—					
	Fracture - - -	16	14	—	11	11	—					
	Wounds { Gunshot - - -	1	1	—	2	2	—					
	{ Incised - - -	22	22	—	49	49	—					
	Amputatio - - -	3	1	1	1	—	—					
	ORDER 5.											
	Punitus - - -	6	7	—	2	2	—	34	33	1	8·99	·26
	Observatio - - -	11	11	1	15	13	—					

* No Cavalry separately accounted for at this Station during the years 1849, 1850, 1855, and 1856.

No. 16.

BENGAL.—FEROZEPORE STATION.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Mean Annual Strength - - - - - 163

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1848.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	379	310	13	379	310	13	2,325·19	79·74
	CLASSES.								
I.	ZYMOTIC DISEASES - -	296	244	10	296	244	10	1,816·	61·35
II.	CONSTITUTIONAL - -	1	—	—	1	—	—	6·13	—
III.	LOCAL - - - -	65	52	3	65	52	3	398·77	18·39
V.	VIOLENCE - - - -	17	14	—	17	14	—	104·39	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Small-pox - - - -	2	1	—	254	208	9	1,558·33	55·22
	Quinsy - - - -	4	5	—					
	Catarrh and Influenza - -	3	8	—					
	Ophthalmia - - - -	8	9	—					
	Fever (C. C.) - - - -	201	160	8					
	Erysipelas - - - -	1	1	—					
	Dysentery - - - -	3	2	1					
	Diarrhœa - - - -	13	10	—					
	Cholera - - - -	2	2	—					
	Remittent Fever - - - -	8	7	—					
	Rheumatism - - - -	9	3	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	38	33	1	38	33	1	233·14	6·18
	ORDER 3.— <i>Dietic Dis.</i>								
	Alcoholism, Del. Tremens - -	4	3	—	4	3	—	24·53	—
II.	ORDER 2.— <i>Tubercular Dis.</i>								
	Phthisis - - - -	1	—	—	1	—	—	6·13	—
III.	ORDER 1.								
	Cephalitis - - - -	1	1	—	5	3	2	30·68	12·26
	Apoplexy - - - -	1	—	2					
	Paralysis - - - -	1	—	—					
	Otitis - - - -	2	2	—					

No. 16.—Bengal; Ferozepore Station; Cavalry. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.	One Year, 1848.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 2.								
	Pericarditis - - - -	1	—	—	1	—	—	6·13	—
	ORDER 3.								
	Pleurisy - - - -	3	2	—	} 4	3	—	24·53	—
	Pneumonia - - - -	1	1	—					
	ORDER 4.								
	Dyspepsia - - - -	5	5	—	} 30	26	1	184·06	6·13
	Enteritis - - - -	1	—	—					
	Ileus and Colic - - - -	4	4	—					
	Hæmorrhoids - - - -	1	1	—					
	Obstipatio - - - -	7	7	—					
	Hepatitis - - - -	10	9	1					
	Jaundice - - - -	1	—	—					
	Spleen Disease, &c. - - - -	1	—	—					
	ORDER 8.								
	Phlegmon - - - -	13	10	—	} 25	22	—	153·37	—
	Ulcer - - - -	7	7	—					
	Skin Disease, &c. - - - -	5	5	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Contusion - - - -	9	10	—	} 13	10	2	79·76	12·26
	Fracture - - - -	2	—	—					
	Wounds, Incised - - - -	2	2	—					
	ORDER 5.								
	Punitus - - - -	2	—	—	} 4	2	—	24·53	—
	Observatio - - - -	2	2	—					

* No Cavalry separately accounted for at this Station during the Years 1847, 1849, 1850, 1851, 1852, 1853, 1854, 1855, and 1856.

No. 17.

BENGAL.—LAHORE STATION.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 2 Years - - - - 1,059
Mean Annual Strength - - - - 530

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Two Years,* 1849 and 1850.			Total for 2 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	2,111	2,026	59	2,111	2,026	59	1593·41	55·69
	CLASSES.								
I.	ZYMOTIC DISEASES - -	1,605	1,545	46	1,605	1,545	46	1515·6	43·44
II.	CONSTITUTIONAL - -	10	5	2	10	5	2	9·44	1·88
III.	LOCAL - - - -	343	329	10	343	329	10	323·89	9·43
V.	VIOLENCE - - - -	153	147	1	153	147	1	144·48	·94
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Small-pox - - - -	5	6	—	1,234	1,177	41	1,165·27	38·71
	Quinsy - - - -	10	10	1					
	Catarrh and Influenza - -	64	60	3					
	Ophthalmia - - - -	82	72	—					
	Fever (C. C.) - - - -	457	448	16					
	Erysipelas - - - -	9	9	—					
	Dysentery - - - -	62	46	13					
	Diarrhoea - - - -	177	170	8					
	Cholera - - - -	9	9	—					
	Ague - - - -	288	279	—					
	Remittent Fever - - - -	2	2	—					
	Rheumatism - - - -	69	66	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	300	303	—	303	307	—	286·12	—
	Stricture of Urethra - -	3	4	—					
	ORDER 3.— <i>Dietic Dis.</i>								
	Purpura and Scurvy - -	1	1	—	68	61	5	64·21	4·73
	Alcoholism { <i>a.</i> Del. Tremens - -	21	16	5					
	<i>b.</i> Intemperance - -	46	44	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>								
	Lumbago - - - -	2	2	—	4	3	—	3·78	—
	Dropsy - - - -	2	1	—					
	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	3	2	—	6	2	2	5·66	1·88
	Phthisis - - - -	3	—	2					
III.	ORDER 1.								
	Cephalitis - - - -	4	4	—	23	17	4	21·72	3·76
	Apoplexy - - - -	4	—	4					
	Paralysis - - - -	2	2	—					
	Insanity - - - -	1	—	—					
	Epilepsy - - - -	4	3	—					
	Odontalgia - - - -	1	1	—					
	Otitis - - - -	7	7	—					

No. 17.—Bengal; Lahore Station; Cavalry. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.	Two Years, 1849 and 1850.*			Total for 2 Years.*			Annual Ratio per 1000 of Mean Strength.								
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.							
III.	ORDER 2.															
	Pericarditis	-	-	-	3	3	—	}	5	5	—	4.72	—			
	Heart Disease, &c.	-	-	-	2	2	—									
	ORDER 3.															
	Epistaxis	-	-	-	1	1	—	}	23	24	1	21.72	.94			
	Pleurisy	-	-	-	16	18	—									
	Pneumonia	-	-	-	5	4	1									
	Asthma	-	-	-	1	1	—									
	ORDER 4.															
	Dyspepsia	-	-	-	15	15	1	}	126	118	5	118.98	4.73			
	Gastritis	-	-	-	2	1	—									
	Ileus and Colic	-	-	-	9	11	—									
	Hæmorrhoids	-	-	-	10	10	—									
	Obstipatio	-	-	-	15	15	—									
	Hepatitis	-	-	-	52	45	4									
	Jaundice	-	-	-	18	18	—									
	Spleen Disease, &c.	-	-	-	5	3	—									
	ORDER 5.															
	Hæmaturia	-	-	-	1	1	—		1	1	—	.94	—			
	ORDER 8.															
	Phlegmon	-	-	-	} 118	118	—	}	165	164	—	155.81	—			
	Abscess	-	-	-												
	Ulcer	-	-	-										35	34	—
	Tumor	-	-	-										2	2	—
	Skin Disease, &c.	-	-	-										10	10	—
V.	ORDER 1.— <i>Accident or Negligence.</i>															
	Contusion	-	-	-	85	86	—	}	125	120	1	118.04	.94			
	Sub-luxation	-	-	-	13	13	—									
	Luxation	-	-	-	1	1	—									
	Fracture	-	-	-	8	8	1									
	Wounds { Gunshot	-	-	-	1	4	—									
	Wounds { Incised	-	-	-	16	7	—									
	Otherwise	-	-	-	1	1	—									
	ORDER 5.															
	Punitus	-	-	-	8	7	—	}	28	27	—	26.44	—			
	Observatio	-	-	-	20	20	—									

* No Cavalry separately accounted for at this Station during the Years 1847, 1848, 1851, 1852, 1853, 1854, 1855, and 1856.

No. 18.

BENGAL.—EN ROUTE, &c. &c.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 3 Years - - - 825
Mean Annual Strength - - - 275

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Two Years,* 1848 and 1849.			One Year,* 1855.			Total for 3 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	1,111	1,171	52	162	195	2	1,273	1,366	54	1,542.43	65.45
	CLASSES.											
I.	ZYMOTIC DISEASES -	796	835	15	103	122	2	899	957	17	1,089.7	20.60
II.	CONSTITUTIONAL -	3	6	3	—	—	—	3	6	3	3.63	3.64
III.	LOCAL - - -	250	242	32	38	45	—	288	287	32	349.09	38.79
V.	VIOLENCE - - -	62	88	2	24	28	—	83	116	2	100.61	2.42
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	4	2	2	—	—	—	643	665	14	779.39	16.97
	Quinsy - - -	6	6	—	1	1	—					
	Catarrh and Influenza - -	23	17	1	3	3	—					
	Ophthalmia - - -	48	42	—	6	7	—					
	Fever (C. C.) - - -	360	370	6	9	8	1					
	Erysipelas - - -	1	1	—	—	—	—					
	Dysentery - - -	43	40	—	1	1	—					
	Diarrhœa - - -	51	57	4	5	6	—					
	Cholera - - -	7	7	—	—	—	—					
	Ague - - -	15	22	—	13	18	—					
	Remittent Fever - - -	5	10	—	—	—	—	217	249	1	263.04	1.21
	Rheumatism - - -	34	38	—	8	9	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	161	181	1	52	65	—	38	41	2	46.06	2.42
	Stricture of Urethra - -	3	2	—	1	1	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Alcoholism { <i>a.</i> Del. Tremens	10	13	1	1	1	—	3	5	2	3.63	2.43
	{ <i>b.</i> Intemperance	24	25	—	3	2	1					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	1	2	—	—	—	—	1	2	—	1.21	—
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	—	1	—	—	—	—	—	1	1	—	1.21
	Dropsy - - -	—	—	1	—	—	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	—	1	—	—	—	—	3	5	2	3.63	2.43
	Phthisis - - -	2	3	2	—	—	—					
	Hæmoptysis - - -	1	1	—	—	—	—					

No. 18.—Bengal ; En Route, &c. &c. ; Cavalry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Two Years,* 1848 and 1849.			One Year,* 1855.			Total for 3 Years.*			Annual Ratio per 1000 of Mean Strength.							
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.						
III.	ORDER 1.																	
	Cephalitis - - -	4	7	—	2	2	—	51	32	24	61·82	29·09						
	Apoplexy - - -	35	12	23	—	—	—											
	Paralysis - - -	—	1	—	—	—	—											
	Insanity - - -	2	2	—	—	—	—											
	Epilepsy - - -	1	1	—	—	—	—											
	Otitis - - -	5	6	—	—	—	—											
	Brain Disease, &c. - -	1	—	1	—	—	—											
	Dysecœa - - -	1	1	—	—	—	—	4	5	1	4·85	1·21						
	Pericarditis - - -	3	5	—	—	—	—											
	Heart Disease, &c. - -	1	—	1	—	—	—											
	ORDER 3.																	
	Bronchitis - - -	1	1	—	—	—	—	11	11	1	13·33	1·21						
	Pleurisy - - -	3	4	—	2	3	—											
	Pneumonia - - -	2	2	1	1	1	—											
	Asthma - - -	2	—	—	—	—	—											
	ORDER 4.																	
	Dyspepsia - - -	17	20	—	—	—	—	107	116	4	129·7	4·86						
	Peritonitis - - -	1	1	—	—	—	—											
	Ileus and Colic - - -	10	8	—	—	—	—											
	Hæmorrhoids - - -	5	6	—	1	1	—											
	Fistula - - -	2	1	—	—	—	—											
	Obstipatio - - -	11	11	—	—	—	—											
	Hepatitis - - -	36	37	4	8	9	—											
	Jaundice - - -	10	14	—	1	1	—											
	Spleen Disease, &c. - -	3	4	—	2	3	—											
	ORDER 5.																	
	Nephritis - - -	1	1	—	—	—	—	3	2	1	3·64	1·21						
	Ischuria - - -	1	1	—	—	—	—											
	Hæmaturia - - -	1	—	1	—	—	—											
	ORDER 7.																	
	Arthritis - - -	—	—	—	1	1	—	1	1	—	1·21	—						
	ORDER 8.																	
	Phlegmon - - -	66	67	1	13	17	—	111	120	1	134·54	1·21						
	Abscess - - -																	
	Ulcer - - -												20	22	—	7	7	—
	Skin Disease, &c. - -												5	7	—	—	—	—
	V.																	
ORDER 1.— <i>Accident or Negligence.</i>																		
Burns or Scalds - - -	2	2	—	—	—	—	74	102	2	89·69	2·42							
Contusion - - -	32	49	—	11	12	—												
Sub-luxation - - -	8	9	—	6	8	—												
Luxation - - -	2	1	1	—	—	—												
Fracture - - -	1	5	—	1	1	—												
Wounds { Gunshot - - -	—	2	—	—	—	—												
{ Incised - - -	9	9	—	2	4	—												
Found dead - - -	—	—	1	—	—	—												
ORDER 5.																		
Punitus - - -	7	9	—	—	—	—	9	14	—	10·92	—							
Observatio - - -	1	2	—	1	3	—												

* No Cavalry separately accounted for under this Heading during the Years 1847, 1850, 1851, 1852, 1853, 1854, and 1856.

No. 19.

BENGAL.—WUZEERABAD STATION.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 4 Years - - - - 2,295
 Mean Annual Strength - - - - 574

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1849 to 1851.			One Year,* 1852.			Total for Four Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	2,258	2,152	96	564	552	11	2,822	2,704	107	1,229·6	46·62
	CLASSES.											
I.	ZYMOTIC DISEASES -	1,763	1,700	64	383	371	7	2,146	2,071	71	935·07	30·94
II.	CONSTITUTIONAL -	11	10	2	7	4	1	18	14	3	7·84	1·31
III.	LOCAL - - -	329	289	30	130	127	3	459	416	33	200·00	14·37
V.	VIOLENCE - - -	155	153	—	44	50	—	199	203	—	86·71	—
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small Pox - - -	1	1	—	1	—	1	1,634	1,553	65	711·98	28·32
	Vaccinia - - -	7	7	—	—	—	—					
	Quinsy - - -	8	8	—	3	3	—					
	Catarrh and Influenza -	26	25	—	8	7	—					
	Ophthalmia - - -	35	33	—	4	4	—					
	Fever (C. C.) - - -	642	629	26	94	89	3					
	Erysipelas - - -	2	2	—	—	—	—					
	Dysentery - - -	136	115	21	32	32	1					
	Diarrhœa - - -	56	50	5	16	16	—					
	Cholera - - -	4	3	1	5	5	—					
	Ague - - -	260	255	1	72	60	—					
	Remittent Fever - -	52	47	6	1	1	—					
	Rheumatism - - -	143	136	—	26	25	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	333	325	—	68	81	—	414	417	—	180·39	—
	Stricture of Urethra -	4	5	—	9	6	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy -	5	5	2	—	—	—	97	99	6	42·27	2·62
	Alcoholism { <i>a.</i> Del. Tremens	9	9	1	4	2	2					
	{ <i>b.</i> Intemperance	39	43	1	40	40	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	1	2	—	—	—	—	1	2	—	·43	—
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	3	4	—	4	3	—	9	8	—	3·92	—
	Dropsy - - -	1	1	—	1	—	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	4	4	—	1	1	—	9	6	3	3·92	1·31
	Phthisis - - -	2	—	2	1	—	1					
	Hæmoptysis - - -	1	1	—	—	—	—					
III.	ORDER 1.											
	Cephalitis - - -	4	4	—	—	—	—	23	15	9	10·02	3·92
	Apoplexy - - -	7	—	7	1	—	—					
	Insanity - - -	2	3	—	—	—	—					
	Epilepsy - - -	2	2	—	1	—	1					
	Odontalgia - - -	1	1	—	1	1	—					
	Otitis - - -	3	3	—	1	1	—					

No. 19.—Bengal ; Wuzeerabad Station ; Cavalry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1849 to 1851.			One Year,* 1852.			Total for 4 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 2.											
	Pericarditis - - -	1	1	—	—	—	—	1	1	—	·43	—
	ORDER 3.											
	Epistaxis - - -	1	1	—	—	—	—	21	20	2	9·15	·87
	Bronchitis - - -	4	4	—	—	—	—					
	Pleurisy - - -	3	2	1	—	—	—					
	Pneumonia - - -	2	2	1	6	6	—					
	Asthma - - -	4	4	—	1	1	—					
	ORDER 4.											
	Dyspepsia - - -	20	21	—	7	7	—	251	226	22	109·38	9·58
	Gastritis - - -	4	2	1	5	6	—					
	Enteritis - - -	—	—	—	1	1	—					
	Peritonitis - - -	2	1	2	—	—	—					
	Ascites - - -	1	1	—	—	—	—					
	Hernia - - -	1	1	—	1	1	—					
	Ileus and Colic - -	12	11	—	18	19	—					
	Hæmorrhoids - - -	8	6	1	2	3	—					
	Obstipatio - - -	6	5	—	11	11	—					
	Hepatitis - - -	98	81	17	21	19	1					
	Jaundice - - -	19	17	—	2	2	—					
	Spleen Disease, &c. -	9	8	—	3	3	—					
	ORDER 5.											
	Nephritis - - -	1	1	—	2	2	—	8	8	—	3·48	—
	Ischuria - - -	3	3	—	1	1	—					
	Hæmaturia - - -	1	1	—	—	—	—					
	ORDER 6.											
	Hydrocele - - -	2	1	—	3	—	—	5	1	—	2·18	—
	ORDER 7.											
	Hydrarthrus - - -	1	—	—	1	—	—	4	1	—	1·74	—
	Joint Disease, &c. - -	1	1	—	—	—	—					
	Contractura - - -	1	—	—	—	—	—					
	ORDER 8.											
	Phlegmon - - -	81	79	—	34	35	—	146	144	—	63·62	—
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Disease, &c. - -	4	2	—	3	5	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Contusion - - -	91	87	—	31	36	—	179	180	—	79·99	—
	Sub-luxation - - -	19	21	—	3	3	—					
	Luxation - - -	5	4	—	5	5	—					
	Fracture - - -	8	5	—	1	2	—					
	Wounds { Gunshot - - -	1	2	—	—	—	—					
	Incised - - -	14	14	—	1	1	—					
	ORDER 5.											
	Punitus - - -	5	6	—	1	1	—	20	23	—	8·72	—
	Observatio - - -	12	14	—	2	2	—					

* No Cavalry separately accounted for at this Station during the Years 1847, 1848, 1853, 1854, 1855, and 1856.

No. 20.

BENGAL.—SEALKOTE STATION.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS.—HER MAJESTY’S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Mean Annual Strength - - - - 158.

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1850.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	206	194	2	206	194	2	1,303·86	12·66
	CLASSES.								
I.	ZYMOTIC DISEASES - -	159	146	1	159	146	1	1,006·4	6·33
II.	CONSTITUTIONAL - -	2	1	—	2	1	—	12·66	—
III.	LOCAL - - - -	23	28	1	23	28	1	145·57	6·33
V.	VIOLENCE - - - -	22	19	—	22	19	—	139·24	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Ophthalmia - - - -	5	6	—	120	106	1	759·56	6·33
	Fever (C. C.) - - - -	38	38	1					
	Erysipelas - - - -	1	1	—					
	Dysentery - - - -	14	16	—					
	Diarrhœa - - - -	4	3	—					
	Cholera - - - -	1	1	—					
	Ague - - - -	48	26	—					
	Remittent Fever - - - -	4	11	—					
	Rheumatism - - - -	5	4	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	28	31	—	34	37	—	215·2	—
	Stricture of Urethra - - - -	6	6	—					
	ORDER 3.— <i>Dietic Dis.</i>								
	Alcoholism { a. Del. Tremens - -	1	—	—	4	2	—	25·31	—
	{ b. Intemperance - -	3	2	—					
	ORDER 4.— <i>Parasitic Dis.</i>								
	Vermes - - - -	1	1	—	1	1	—	6·33	—
II.	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	1	—	—	2	1	—	12·66	—
	Hæmoptysis - - - -	1	1	—					

No. 20.—Bengal ; Sealkote Station ; Cavalry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	One Year, 1850.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.								
	Paralysis - " - -	1	1	—	3	2	1	18.98	6.33
	Insanity - - - -	1	1	—					
	Hydrophobia - - - -	1	—	1					
	ORDER 4.								
	Illeus and Colic - - -	6	6	—	12	12	—	75.95	—
	Hæmorrhoids - - - -	1	1	—					
	Obstipatio - - - -	1	1	—					
	Hepatitis - - - -	3	3	—					
	Spleen Disease, &c. - -	1	1	—					
	ORDER 5.								
	Ischuria - - - -	1	1	—	1	1	—	6.33	—
	ORDER 8.								
	Phlegmon - - - -	5	11	—	7	13	—	44.3	—
	Ulcer - - - -	1	1	—					
	Skin Disease, &c. - - -	1	1	—					
	ORDER 1.— <i>Accident or Negligence.</i>								
	Burns or Scalds - - -	1	1	—	21	19	—	132.91	—
	Contusion - - - -	19	18	—					
	Sub-luxation - - - -	1	—	—					
	ORDER 5.								
	Observatio - - - -	1	—	—	1	—	—	6.33	—

* No Cavalry separately accounted for at this Station except during the Year 1850.

No. 21.

BENGAL.—ALLAHABAD STATION.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Mean Annual Strength - - - - - 148

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1856.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attaced.	Died.
	SPECIFIED CAUSES - -	72	70	1	72	70	1	486·49	6·76
	CLASSES.								
I.	ZYMOTIC - - - -	59	56	1	59	56	1	398·65	6·76
II.	CONSTITUTIONAL - - -	—	—	—	—	—	—	—	—
III.	LOCAL - - - -	10	10	—	10	10	—	67·57	—
V.	VIOLENCE - - - -	3	4	—	3	4	—	20·27	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Quinsy - - - -	1	1	—	41	39	1	277·03	6·76
	Fever (C.C.) - - - -	7	7	—					
	Dysentery - - - -	1	—	—					
	Diarrhœa - - - -	23	23	—					
	Cholera - - - -	4	3	1					
	Remittent Fever - - -	1	1	—					
	Rheumatism - - - -	4	4	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	12	12	—	12	12	—	81·08	—
	ORDER 3.— <i>Dietic Dis.</i>								
	Purpura and Scurvy - -	2	2	—	3	2	—	20·27	—
	Alcoholism, Intemperance -	1	—	—					
	ORDER 4.— <i>Parasitic Dis.</i>								
	Psora - - - -	3	3	—	3	3	—	20·27	—
III.	ORDER 7.								
	Joint Diseases, &c. - -	1	1	—	1	1	—	6·76	—
	ORDER 8.								
	Phlegmon - - - -	3	3	—	9	9	—	60·81	—
	Ulcer - - - -	6	6	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Sub-luxation - - - -	—	1	—	2	3	—	13 51	—
	Fracture - - - -	1	1	—					
	Wounds, Incised - - -	1	1	—					
	ORDER 5.								
	Observatio - - - -	1	1	—	1	1	—	6·76	—

* No Cavalry separately accounted for at this Station during the Years 1847 to 1855.

No. 22.

BENGAL.—KURRACHEE STATION.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Mean Annual Strength - - - - - 156

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and (F.) the Number of DEATHS by different Diseases.

Class.	Diseases.	One Year, 1853.*			Total for One Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.)	(E.)	(F.)	(C.)	(E.)	(F.)	Attacked.	Died.
		No. of Attacks.	No. discharged to Duty.	No. of Deaths.	No. of Attacks.	No. discharged to Duty.	No. of Deaths.		
	SPECIFIED CAUSES - -	101	88	1	101	88	1	647·43	6·41
	CLASSES.								
I.	ZYMOTIC DISEASES - -	86	74	—	86	74	—	551·28	—
II.	CONSTITUTIONAL - -	2	1	1	2	1	1	12·82	6·41
III.	LOCAL - - - -	12	12	—	12	12	—	76·92	—
V.	VIOLENCE - - - -	1	1	—	1	1	—	6·41	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Quinsy - - - -	3	3	—	69	53	—	442·31	—
	Catarrh and Influenza - - -	7	5	—					
	Fever (C.C.) - - - -	2	2	—					
	Dysentery - - - -	18	12	—					
	Diarrhœa - - - -	18	16	—					
	Cholera - - - -	1	1	—					
	Ague - - - -	15	10	—					
	Remittent Fever - - - -	1	—	—					
	Rheumatism - - - -	4	4	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	16	21	—	16	21	—	102·56	—
	ORDER 3.— <i>Dietic Dis.</i>								
	Purpura and Scurvy - - - -	1	—	—	1	—	—	6·41	—
II.	ORDER 1.— <i>Diathetic Dis.</i>								
	Dropsy - - - -	—	—	1	—	—	1	—	6·41
	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	1	—	—	2	1	—	12·82	—
	Phthisis - - - -	1	1	—					
III.	ORDER 1.								
	Epilepsy - - - -	1	1	—	1	1	—	6·41	—
	ORDER 3.								
	Pleurisy - - - -	1	1	—	4	2	—	25·64	—
	Pneumonia - - - -	3	1	—					
	ORDER 4.								
	Dyspepsia - - - -	2	1	—	7	9	—	44·87	—
	Hæmatemesis - - - -	1	1	—					
	Obstipatio - - - -	2	2	—					
	Hepatitis - - - -	2	5	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Contusion - - - -	1	1	—	1	1	—	6·41	—

* No Cavalry separately accounted for at this Station during the Years 1847 to 1852, and 1854 to 1856.

N.B.—Invalids are included in these Numbers, but the Returns do not enable them to be distinguished.

No 23.

BENGAL.—MEERUT STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 10 Years - - - - 8,156
 Mean Annual Strength - - - - 816

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years. 1847 to 1851.			Five Years. 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	8,759	8,381	199	7,314	7,090	169	16,073	15,471	368	1,970·65	45·12
	CLASSES.											
I.	ZYMOTIC DISEASES -	7,031	6,752	129	5,952	5,783	126	12,983	12,535	255	1,591·8	31·26
II.	CONSTITUTIONAL -	49	41	13	40	28	12	89	69	25	10·91	3·06
III.	LOCAL -	1,289	1,213	53	1,004	964	27	2,293	2,177	80	281·14	9·81
IV.	DEVELOPMENTAL -	2	1	1	—	—	—	2	1	1	·24	·12
V.	VIOLENCE -	388	374	3	318	315	4	706	689	7	86·56	·86
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox -	4	1	3	4	5	—	10,869	10,406	248	2,329·6	30·41
	Varicella -	—	—	—	2	2	—					
	Measles -	—	—	—	5	4	1					
	Quinsy -	62	62	—	63	63	—					
	Catarrh and Influenza -	212	205	4	285	279	5					
	Ophthalmia -	686	663	—	391	386	—					
	Fever (C.C.) -	1,471	1,392	40	1,804	1,745	29					
	Typhus -	1	1	—	—	—	—					
	Erysipelas -	6	5	—	4	4	—					
	Dysentery -	503	438	41	268	220	36					
	Diarrhœa -	374	363	8	539	532	18					
	Cholera -	12	12	—	64	29	35					
	Ague -	1,961	1,885	22	1,434	1,416	1					
	Remittent Fever -	106	91	4	15	15	—					
	Rheumatism -	382	369	1	211	219	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c -	1,098	1,111	1	827	830	—	1,942	1,957	1	241·11	·12
	Stricture of Urethra -	10	10	—	7	6	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy -	17	13	3	9	8	—	153	153	6	18·76	·73
	Alcoholism { <i>a.</i> Del. Tremens	79	80	1	9	9	1					
	{ <i>b.</i> Intemperance	38	42	1	1	1	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes -	5	4	—	10	10	—	19	19	—	2·33	—
	Psora -	4	5	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago -	14	15	—	1	1	—	20	20	1	2·45	·12
	Dropsy -	4	4	—	1	—	1					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius -	1	2	—	3	2	1	69	49	24	8·46	2·94
	Scrofula -	7	9	—	5	5	—					
	Phthisis -	18	7	12	14	7	8					
	Hæmoptysis -	5	4	1	16	13	2					
III.	ORDER 1.											
	Cephalitis -	27	27	1	9	9	—	232	188	48	28·45	5·88
	Apoplexy -	39	12	27	23	3	20					
	Paralysis -	4	4	—	3	3	—					
	Odontalgia -	—	—	—	1	1	—					
	Insanity -	5	7	—	6	6	—					
	Epilepsy -	14	14	—	14	16	—					
	Otitis -	32	31	—	51	51	—					
	Brain Disease, &c. -	1	1	—	—	—	—					
	Dysecœa -	1	1	—	2	2	—					

No. 23.—Bengal; Meerut Station; Infantry. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.							
		(C.) No. of Attacks.	(E.) No. di- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. di- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. di- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.						
III.	ORDER 2.																	
	Pericarditis - - -	3	3	—	16	16	—	}	24	23	—	2.94	—					
	Aneurism - - -	—	—	—	1	—	—											
	Heart Disease, &c. - -	4	4	—	—	—	—											
	ORDER 3.																	
	Epistaxis - - -	3	3	—	1	1	—	}	87	72	6	10.66	.86					
	Bronchitis - - -	7	6	1	5	4	—											
	Pleurisy - - -	21	17	—	6	4	—											
	Pneumonia - - -	22	15	4	13	13	1											
	Asthma - - -	5	4	—	4	5	—	}	961	928	26	117.83	3.08					
	ORDER 4.																	
	Dyspepsia - - -	49	49	—	86	87	—											
	Gastritis - - -	3	3	—	—	—	—											
	Enteritis - - -	—	—	—	2	1	1											
	Peritonitis - - -	1	2	—	4	4	—											
	Ascites - - -	1	2	1	1	1	—											
	Hernia - - -	3	2	—	4	3	—											
	Ileus and Colic - - -	158	158	1	74	73	—											
	Hæmorrhoids - - -	28	26	1	32	29	—											
	Hæmatemesis - - -	—	—	—	3	3	—											
	Fistula - - -	2	2	—	5	5	—											
	Obstipatio - - -	33	35	—	35	35	—											
	Hepatitis - - -	206	191	17	109	103	5											
	Jaundice - - -	21	21	—	25	18	—											
	Spleen Disease, &c. - -	45	44	—	31	31	—											
	ORDER 5.																	
	Nephritis - - -	2	1	—	5	3	—	}	9	6	—	1.10	—					
	Enuresis - - -	—	—	—	1	1	—											
	Cystitis - - -	1	1	—	—	—	—											
	ORDER 6.																	
	Hydrocele - - -	—	—	—	4	5	—	4	5	—	.49	—						
	ORDER 7.																	
	Hydrarthrus - - -	1	1	—	1	1	—	}	14	14	—	1.72	—					
	Arthritis - - -	4	4	—	4	4	—											
	Joint Disease, &c. - -	2	1	—	1	1	—											
	Contractura - - -	1	1	—	—	1	—											
	ORDER 8.																	
	Phlegmon } - - -	292	288	—	258	258	—	}	962	941	—	117.95	—					
	Abcess }	219	206	—	119	117	—											
	Ulcer - - -	3	1	—	18	19	—											
	Tumor - - -	26	25	—	27	27	—											
Skin Disease, &c. - -																		
IV.	ORDER 4.																	
	Atrophy - - -	2	1	1	—	—	—	2	1	1	.24	.12						
V.	ORDER 1.— <i>Accident or Negligence.</i>																	
	Burns or Scalds - - -	7	7	—	5	3	—	}	535	524	7	65.59	.86					
	Contusion - - -	155	156	—	114	113	—											
	Sub-luxation - - -	67	62	—	69	70	—											
	Luxation - - -	5	6	—	11	10	—											
	Fracture - - -	11	10	—	6	6	—											
	Wounds { Gunshot - - -	14	13	—	1	1	1											
	Incised - - -	50	48	1	17	17	—											
	Amputatio - - -	3	2	—	—	—	—											
	Found dead - - -	—	—	2	—	—	2											
	Drowned - - -	—	—	—	—	—	1											
	ORDER 5.																	
	Punitus - - -	40	41	—	9	9	—	}	171	165	—	20.97	—					
	Observatio - - -	36	29	—	86	86	—											

No. 24.

BENGAL.—UMBALLA STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 10 Years - - - - 7,003
 Mean Annual Strength - - - - 700

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (D.) the Number DISCHARGED to DUTY; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(D.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(D.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(D.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	6,411	6,192	201	4,992	4,895	186	11,4 0	11,087	387	1,628·24	55·24
	CLASSES.											
I.	ZYMOTIC DISEASES -	5,292	5,120	133	4,280	4,165	144	9,572	9,285	277	1,366·82	39·55
II.	CONSTITUTIONAL -	51	41	5	57	47	7	108	88	12	15·42	1·71
III.	LOCAL -	825	783	56	492	527	28	1,317	1,310	84	188·06	11·99
IV.	DEVELOPMENTAL -	7	5	1	1	—	1	8	5	2	1·14	·28
V.	VIOLENCE -	236	243	6	162	156	6	398	399	12	56·82	1·71
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox -	3	3	—	3	3	—	8,111	7,877	268	1,153·2	38·27
	Measles -	—	—	—	3	3	—					
	Quinsy -	32	31	—	49	55	—					
	Catarrh and Influenza -	150	150	6	164	175	2					
	Ophthalmia -	808	825	—	237	218	—					
	Fever (C. C.) -	1,998	1,933	62	880	837	38					
	Typhus -	2	1	1	—	—	—					
	Erysipelas -	4	4	—	4	4	—					
	Dysentery -	353	319	36	181	169	14					
	Diarrhœa -	404	401	13	702	703	29					
	Cholera -	16	16	2	70	29	41					
	Ague -	337	247	1	1,174	1,216	18					
	Remittent Fever -	16	17	1	7	7	—					
	Rheumatism -	266	255	3	248	256	1					
	ORDER 2.— <i>Enthetic Dis.</i>							1,348	1,302	2	192·49	·28
	Syphilis, &c. -	817	839	2	517	450	—					
	Stricture of Urethra -	3	3	—	11	10	—					
	ORDER 3.— <i>Dietic Dis.</i>							107	100	7	15·28	1·00
	Purpura and Scurvy -	43	42	1	2	3	—					
	Alcoholism { <i>a.</i> Del. Tremens <i>b.</i> Intemperance	18 19	14 17	3 2	14 11	12 12	1 —					
	ORDER 4.— <i>Parasitic Dis.</i>							6	6	—	·85	—
	Vermes -	1	1	—	—	—	—					
	Psora -	2	2	—	3	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>							18	15	—	2·57	—
	Lumbago -	5	2	—	6	6	—					
	Dropsy -	—	—	—	7	7	—					
	ORDER 2.— <i>Tubercular Dis.</i>							90	73	12	12·85	1·71
	Morbus Coxarius -	3	3	—	—	—	—					
	Scrofula -	24	24	—	8	8	—					
	Phthisis -	12	4	5	29	19	7					
	Hemoptysis -	7	8	—	7	7	—					
III.	ORDER 1.							155	111	50	22·13	7·14
	Cephalitis -	5	5	2	17	19	—					
	Apoplexy -	52	28	24	27	5	20					
	Paralysis -	2	2	—	4	5	—					
	Odontalgia -	—	—	—	4	4	—					
	Insanity -	11	9	1	3	5	—					
	Tetanus -	1	—	1	—	—	—					
	Epilepsy -	6	4	1	11	13	1					
	Otitis -	6	7	—	6	5	—					

No. 24.—Bengal ; Umballa Station ; Infantry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.								
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.							
III.	ORDER 2.																		
	Pericarditis - - -	5	4	—	9	23	—	}	36	53	—	5·14	—						
	Varix - - -	1	1	—	1	2	—												
	Heart Disease, &c. - -	8	7	—	12	16	—												
	ORDER 3.																		
	Epistaxis - - -	1	—	—	2	1	—	}	73	70	8	104·2	1·14						
	Bronchitis - - -	4	4	1	11	13	—												
	Pleurisy - - -	18	17	2	—	—	—												
	Hydrothorax - - -	1	—	—	—	—	—												
	Pneumonia - - -	24	23	3	9	9	2												
	Asthma - - -	3	3	—	—	—	—	}	544	553	23	77·68	3·28						
	ORDER 4.																		
	Dyspepsia - - -	28	35	—	54	60	—												
	Gastritis - - -	3	3	—	1	1	—												
	Enteritis - - -	1	—	1	1	1	—												
	Peritonitis - - -	6	5	1	1	1	—												
	Ascites - - -	—	—	—	2	1	—												
	Hæmatemesis - - -	1	1	—	—	—	—												
	Prolapsus Ani - - -	—	—	—	1	1	—												
	Hernia - - -	1	1	—	—	—	—												
	Ileus and Colic - - -	83	84	1	23	26	—												
	Hæmorrhoids - - -	32	31	—	7	9	—												
	Fistula - - -	—	—	—	4	4	—												
	Obstipatio - - -	17	17	—	3	3	—												
	Hepatitis - - -	132	118	12	72	79	3												
	Jaundice - - -	28	26	2	11	8	2												
	Spleen Disease, &c. - -	15	15	1	17	23	—												
	ORDER 5.																		
	Nephritis - - -	2	1	—	—	2	—	}	10	12	—	1·43	—						
	Ischuria - - -	1	1	—	5	6	—												
	Diabetes - - -	2	2	—	—	—	—												
	ORDER 6.																		
	Hydrocele - - -	3	3	—	2	1	—	}	5	4	—	·72	—						
	ORDER 7.																		
	Hydrarthrus - - -	2	2	—	5	8	—	}	13	16	—	1·86	—						
	Arthritis - - -	1	1	—	1	1	—												
	Joint Disease, &c. - -	1	—	—	1	1	—												
	Contractura - - -	2	3	—	—	—	—												
	ORDER 8.																		
	Phlegmon - - -	}	183	177	3	100	111	}	481	491	3	68·68	·43						
	Abscess - - -																		
	Ulcer - - -													113	120	—	45	40	—
	Tumor - - -													—	1	—	3	3	—
	Skin Disease, &c. - -	20	22	—	17	17	—												
IV.																			
ORDER 4.																			
Atrophy - - -	7	5	1	1	—	1	8	5	2	1·14	·28								
V.																			
ORDER 1.— <i>Accident or Negligence.</i>																			
Found dead - - -	—	—	1	—	—	1	}	299	301	3	42·69	·43							
Burns or Scalds - - -	9	8	1	1	—	—													
Contusion - - -	116	118	—	53	47	—													
Sub-luxation - - -	17	20	—	18	22	—													
Luxation - - -	2	3	—	4	3	—													
Fracture - - -	8	7	—	9	9	—													
Wounds { Gunshot - -	10	11	—	4	5	—													
Wounds { Incised - -	22	23	—	26	25	—													
ORDER 4.— <i>Suicide.</i>																			
Suspendium - - -	—	—	1	—	—	—	—	—	1	—	·14								
ORDER 5.																			
Punitus - - -	10	10	—	7	7	—	}	99	98	8	14·13	1·14							
Observatio - - -	42	43	3	40	38	5													

No. 25.

BENGAL.—FEROZEPORE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 10 Years - - - - 7,778
Mean Annual Strength - - - - 794

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 100 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	7,950	7,755	265	8,671	8,501	171	16,621	16,256	436	2,136·9	56·05
	CLASSES.											
I.	ZYMOTIC DISEASES -	6,579	6,469	164	7,044	6,911	134	13,623	13,380	298	1,751·5	38·31
II.	CONSTITUTIONAL -	87	71	17	100	106	14	187	177	31	24·04	3·98
III.	LOCAL - - -	1,009	923	82	1,204	1,163	22	2,213	2,086	104	284·52	13·37
V.	VIOLENCE - -	275	292	2	323	321	1	598	613	3	76·88	·38
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	1	—	—	—	—	—	11,326	11,034	286	1,456·2	36·77
	Measles - - -	2	2	1	—	—	—					
	Quinsy - - -	29	33	—	66	67	1					
	Catarrh and Influenza -	239	227	7	407	405	2					
	Ophthalmia - - -	494	512	—	218	214	—					
	Fever (C. C.) - - -	2,591	2,481	63	1,907	1,956	16					
	Erysipelas - - -	17	17	—	6	5	1					
	Dysentery - - -	665	624	55	306	286	14					
	Diarrhœa - - -	423	410	7	747	733	6					
	Cholera - - -	18	13	5	134	41	89					
	Ague - - -	333	339	5	1,533	1,495	—					
	Remittent Fever - - -	36	27	9	103	97	5					
	Rheumatism - - -	515	516	—	536	534	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	1,105	1,165	5	1,000	999	—	2,137	2,196	5	274·5	·64
	Stricture of Urethra - -	12	11	—	20	21	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	44	42	—	16	15	—	134	125	7	17·23	·9
	Alcoholism { <i>a.</i> Del. Tremens	23	18	7	7	7	—					
	{ <i>b.</i> Intemperance	18	17	—	26	26	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	13	14	—	12	10	—	26	25	—	3·34	—
	Psora - - -	1	1	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	21	32	—	33	53	—	68	88	1	8·74	·13
	Dropsy - - -	11	9	—	3	3	1					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	2	1	1	—	—	—	119	89	30	15·3	3·85
	Scrofula - - -	18	15	—	9	9	—					
	Phthisis - - -	22	11	15	31	19	11					
	Hæmoptysis - - -	13	12	1	24	22	2					

No. 25.—Bengal ; Ferozepore Station ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.)	(E.)	(F.)	(C.)	(E.)	(F.)	(C.)	(E.)	(F.)	Attacked.	Died.
		No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.	No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.	No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.		
III.	ORDER 1.											
	Cephalitis - - -	17	17	—	34	31	—	299	257	46	38·44	5·91
	Apoplexy - - -	38	10	35	19	16	7					
	Paralysis - - -	4	4	—	12	12	—					
	Insanity - - -	5	5	—	9	9	—					
	Epilepsy - - -	10	10	1	29	28	—					
	Odontalgia - - -	4	4	—	7	7	—					
	Otitis - - -	33	32	—	71	70	—					
	Brain Disease, &c. - -	4	—	2	2	1	1					
	Dysecœa - - -	—	—	—	1	1	—					
	ORDER 2.											
	Pericarditis - - -	21	16	3	36	36	1	75	67	4	9·64	·51
	Varix - - -	4	4	—	2	1	—					
	Heart Disease, &c. - -	1	1	—	11	9	—					
	ORDER 3.											
	Epistaxis - - -	7	6	—	6	5	—	152	133	19	19·54	2·45
	Bronchitis - - -	3	3	1	20	20	1					
	Pleurisy - - -	25	20	4	12	12	—					
	Hydrothorax - - -	2	—	2	—	—	—					
	Pneumonia - - -	19	14	6	16	12	4					
	Asthma - - -	8	8	1	34	33	—	1,007	948	31	129·47	3·98
	ORDER 4.											
	Dyspepsia - - -	64	63	2	70	69	—					
	Gastritis - - -	10	9	1	12	11	1					
	Enteritis - - -	6	5	1	4	4	—					
	Peritonitis - - -	5	3	2	6	5	1					
	Ascites - - -	1	1	1	2	2	—					
	Hæmatemesis - - -	1	1	—	1	1	—					
	Hernia - - -	3	3	—	5	5	—					
	Ileus and Colic - - -	48	50	—	129	127	—					
	Hæmorrhoids - - -	32	35	—	34	35	—					
	Fistula - - -	4	4	—	13	15	—					
	Obstipatio - - -	37	31	1	18	18	—					
	Hepatitis - - -	187	166	16	193	179	5					
	Jaundice - - -	13	13	—	12	10	—					
	Spleen Disease, &c. - -	33	21	—	64	62	—					
	ORDER 5.											
	Nephritis - - -	4	4	1	12	11	1	37	36	2	4·76	·26
	Hæmaturia - - -	—	—	—	1	1	—					
	Ischuria - - -	5	5	—	8	8	—					
	Diabetes - - -	—	—	—	1	1	—					
	Stone - - -	—	—	—	1	1	—					
	Cystitis - - -	1	1	—	4	4	—	7	8	—	·91	—
	ORDER 6.											
	Hydrocele - - -	5	5	—	2	3	—					
	ORDER 7.											
	Arthritis - - -	6	6	—	4	4	—	31	30	—	3·98	—
	Joint Disease, &c. - -	12	2	—	2	2	—					
	Contractura - - -	7	16	—	—	—	—					
	ORDER 8.											
	Phlegmon - - -	206	203	—	194	190	—	605	607	2	77·78	·26
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Diseases, &c. - -	16	16	—	30	30	—	487	505	3	62·61	·38
	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	6	7	—	9	9	—					
	Contusion - - -	82	92	—	152	153	—					
	Sub-luxation - - -	49	35	—	53	53	—					
	Luxation - - -	5	5	—	8	8	—					
	Fracture - - -	11	9	—	4	4	—					
	Wounds { Gunshot - - -	50	75	—	3	2	1					
	{ Incised - - -	23	21	—	31	31	—					
	Amputatio - - -	1	—	2	—	—	—					
	Otherwise - - -	—	1	—	—	—	—					
	ORDER 5.											
	Punitus - - -	13	13	—	5	5	—	111	108	—	14·27	—
	Observatio - - -	35	34	—	58	56	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	6	7	—	9	9	—	487	505	3	62·61	·38
	Contusion - - -	82	92	—	152	153	—					
	Sub-luxation - - -	49	35	—	53	53	—					
	Luxation - - -	5	5	—	8	8	—					
	Fracture - - -	11	9	—	4	4	—					
	Wounds { Gunshot - - -	50	75	—	3	2	1					
	{ Incised - - -	23	21	—	31	31	—					
	Amputatio - - -	1	—	2	—	—	—					
	Otherwise - - -	—	1	—	—	—	—					
	ORDER 5.											
	Punitus - - -	13	13	—	5	5	—	111	108	—	14·27	—
	Observatio - - -	35	34	—	58	56	—					

No. 26.

BENGAL.—LAHORE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 10 Years - - - - 8,155
 Mean Annual Strength - - - - 815

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	9,451	9,132	357	11,059	10,655	307	20,510	19,787	664	2,515·04	81·42
	CLASSES.											
I.	ZYMOTIC DISEASES -	7,996	7,836	236	9,268	8,948	249	17,264	16,784	485	2,117·	59·47
II.	CONSTITUTIONAL -	88	63	18	86	69	12	174	132	30	21·34	3·68
III.	LOCAL - - -	1,079	957	100	1,285	1,227	43	2,364	2,184	143	289·89	17·53
IV.	DEVELOPMENTAL -	3	2	—	1	1	—	4	3	—	·49	—
V.	VIOLENCE - -	285	274	3	419	410	3	704	684	6	86·32	·73
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	27	18	9	9	5	4	15,622	15,128	475	1,915·65	58·23
	Vaccinia - - -	3	3	—	—	—	—					
	Varicella - - -	—	—	—	1	1	—					
	Measles - - -	1	1	—	2	2	—					
	Quinsy - - -	28	23	—	46	48	—					
	Catarrh and Influenza -	204	194	12	396	408	—					
	Ophthalmia - - -	693	761	—	336	348	—					
	Fever (C. C.) - - -	2,776	2,812	49	2,104	2,041	31					
	Typhus - - -	1	—	—	—	—	—					
	Icterodes - - -	1	—	—	—	—	—					
	Erysipelas - - -	18	16	—	2	2	—					
	Dysentery - - -	1,052	913	103	584	561	53					
	Diarrhoea - - -	476	436	25	480	472	9					
	Cholera - - -	74	66	7	193	69	125					
	Ague - - -	885	869	1	3,431	3,322	—					
	Remittent Fever - - -	644	610	19	272	238	22					
	Rheumatism - - -	386	387	6	497	502	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	676	680	3	845	867	1	1,546	1,570	4	189·58	·49
	Stricture of Urethra - -	11	10	—	14	13	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	5	3	—	15	12	2	73	63	6	8·95	·73
	Alcoholism { <i>a. Del. Tremens</i>	21	18	2	14	12	2					
	{ <i>b. Intemperance</i>	10	12	—	8	6	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	4	4	—	17	17	—	23	23	—	2·82	—
	Psora - - -	—	—	—	2	2	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	18	16	—	9	9	—	50	44	2	6·13	·25
	Dropsy - - -	5	4	—	18	15	2					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	—	—	—	2	2	—	124	88	28	15·21	3·43
	Serofula - - -	3	31	—	17	17	—					
	Phthisis - - -	19	1	18	23	10	9					
	Hæmoptysis - - -	14	11	—	17	16	1					

No. 26.—Bengal ; Lahore Station ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	13	12	—	29	28	—	213	165	43	26·12	5·27
	Apoplexy - - -	27	3	22	29	15	14					
	Paralysis - - -	12	12	2	4	4	—					
	Insanity - - -	6	5	1	3	2	—					
	Hydrophobia - - -	1	—	1	—	—	—					
	Epilepsy - - -	11	8	—	15	14	1					
	Odontalgia - - -	2	2	—	4	3	—					
	Otitis - - -	22	22	—	21	22	—					
	Brain Disease, &c. - - -	5	6	—	4	1	2					
	Dysecœa - - -	1	1	—	4	5	—					
	ORDER 2.											
	Pericarditis - - -	3	—	—	26	25	2	43	38	2	5·27	·25
	Varix - - -	—	—	—	1	1	—					
	Heart Disease, &c. - - -	5	4	—	8	8	—					
	ORDER 3.											
	Epistaxis - - -	7	7	—	—	1	—	134	119	12	16·43	1·46
	Bronchitis - - -	12	10	2	—	12	2					
	Pleurisy - - -	21	19	1	—	31	—					
	Pneumonia - - -	14	10	3	32	22	4					
	Asthma - - -	8	7	—	—	—	—					
	ORDER 4.											
	Dyspepsia - - -	52	50	2	83	82	—	1,295	1,190	78	158·82	9·56
	Gastritis - - -	37	38	2	12	12	—					
	Enteritis - - -	4	—	4	2	1	1					
	Peritonitis - - -	7	5	2	11	10	1					
	Ascites - - -	1	—	1	3	2	—					
	Hæmatemesis - - -	1	1	—	3	2	2					
	Hernia - - -	—	—	—	4	4	—					
	Hæmorrhoids - - -	36	33	—	43	44	—					
	Ileus and Colic - - -	57	56	—	87	87	—					
	Fistula - - -	5	6	—	4	4	—					
	Obstipatio - - -	22	22	—	26	27	—					
	Hepatitis - - -	270	215	48	279	260	12					
	Jaundice - - -	79	70	2	28	27	—					
	Spleen Disease, &c. - - -	51	50	—	88	82	1					
	ORDER 5.											
	Nephritis - - -	4	3	—	2	1	1	17	15	1	2·08	·13
	Ischuria - - -	3	2	—	5	6	—					
	Enuresis - - -	3	3	—	—	—	—					
	ORDER 6.											
	Hydrocele - - -	1	—	—	4	3	—	5	3	—	·61	—
	ORDER 7.											
	Hydrarthrus - - -	2	2	—	1	1	—	13	11	1	1·59	·13
	Arthritis - - -	1	2	—	8	6	—					
	Joint Disease, &c. - - -	1	—	1	—	—	—					
	ORDER 8.											
	Phlegmon - - -	149	155	6	162	159	—	644	643	6	78·97	·73
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Disease, &c. - - -	16	14	—	21	22	—					
	IV.											
	ORDER 4.											
	Atrophy - - -	3	2	—	1	1	—	4	3	—	·49	—
	V.											
	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	6	5	—	4	5	—	493	486	4	60·45	·49
	Contusion - - -	142	139	1	157	156	1					
	Sub-luxation - - -	30	30	—	67	69	—					
	Luxation - - -	2	2	—	3	3	—					
	Fracture - - -	13	11	1	9	7	1					
	Wounds { Gunshot - - -	11	9	—	—	—	—					
	{ Incised - - -	24	25	—	25	25	—					
	ORDER 5.											
	Punitus - - -	34	35	—	6	6	—	211	198	2	25·87	·25
	Observatio - - -	23	18	1	148	139	1					

No. 27.

BENGAL.—FORT WILLIAM STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 10 Years - - - - 6,077
Average Annual Strength - - - - 608

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	7,275	7,027	347	5,921	5,622	275	13,196	12,649	622	2,171·45	102·35
	CLASSES.											
I.	ZYMOTIC DISEASES -	5,488	5,268	284	4,430	4,212	204	9,918	9,480	488	1,632·1	80·3
II.	CONSTITUTIONAL -	74	59	17	55	49	8	129	108	25	21·23	4·11
III.	LOCAL - - -	1,306	1,276	43	1,080	1,017	58	2,386	2,293	101	392·63	16·62
IV.	DEVELOPMENTAL -	1	3	—	—	—	—	1	3	—	·16	—
V.	VIOLENCE - - -	406	421	3	356	344	5	762	765	8	125·39	1·32
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	11	9	2	—	—	—	8,101	7,718	473	1,333·15	77·83
	Measles - - -	3	3	—	3	3	—					
	Quinsy - - -	23	29	—	20	21	—					
	Catarrh and Influenza -	256	260	9	138	139	3					
	Ophthalmia - - -	606	633	—	129	126	—					
	Fever (C. C.) - - -	1,366	1,287	42	1,510	1,505	17					
	Typhus - - -	1	—	—	—	—	—					
	Erysipelas - - -	4	4	—	3	1	1					
	Dysentery - - -	782	679	118	534	465	65					
	Diarrhoea - - -	709	707	14	414	434	20					
	Cholera - - -	126	54	83	171	78	86					
	Ague - - -	295	297	1	338	336	2					
	Remittent Fever - - -	86	85	6	91	83	2					
	Rheumatism - - -	259	262	2	223	218	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	805	800	2	671	632	—	1,496	1,451	2	246·07	·33
	Stricture of Urethra - -	6	6	—	14	13	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	29	29	4	12	7	1	301	290	13	49·53	2·14
	Alcoholism { <i>a. Del. Tremens</i>	45	46	1	66	64	7					
	<i>b. Intemperance</i>	67	68	—	82	76	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Verues - - -	7	7	—	6	6	—	20	21	—	3·29	—
	Psora - - -	2	3	—	5	5	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	9	9	—	16	19	—	32	34	1	5·26	·16
	Dropsy - - -	6	5	1	1	1	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	—	—	—	1	1	—	97	74	24	15·96	3·95
	Serofula - - -	4	5	—	7	8	—					
	Phthisis - - -	42	28	15	27	17	8					
	Hæmoptysis - - -	13	12	1	3	3	—					
	III. ORDER 1.											
	Cephalitis - - -	5	6	—	4	3	—	236	194	45	38·83	7·4
	Apoplexy - - -	12	2	10	36	9	32					
	Paralysis - - -	10	9	1	17	17	—					
	Tetanus - - -	1	—	1	—	—	—					
	Insanity - - -	29	25	—	19	19	—					
	Epilepsy - - -	19	19	—	19	20	—					
	Odontalgia - - -	7	6	—	1	1	—					
	Otitis - - -	23	23	—	29	31	—					
	Brain Disease, &c. - -	—	—	—	2	1	1					
	Dyseecæa - - -	—	—	—	3	3	—					

No. 27.—Bengal ; Fort William Station ; Infantry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.								
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.							
III.	ORDER 2.																		
	Pericarditis - - -	5	4	—	35	31	2	}	70	63	2	11·52	·33						
	Varix - - -	4	4	—	—	—	—												
	Heart Disease, &c. - -	3	2	—	23	22	—												
	ORDER 3.																		
	Epistaxis - - -	1	1	—	2	2	—	}	139	139	10	22·87	1·66						
	Bronchitis - - -	17	14	1	33	35	2												
	Pléurisy - - -	12	12	2	6	6	—												
	Pneumonia - - -	24	29	3	26	25	1												
	Asthma - - -	12	12	1	6	3	—	}	1,108	1,077	39	182·33	6·42						
	ORDER 4.																		
	Dyspepsia - - -	76	74	—	150	148	—												
	Gastritis - - -	3	2	1	6	6	—												
	Enteritis - - -	1	1	—	2	—	2												
	Peritonitis - - -	4	3	1	1	1	—												
	Ascites - - -	3	3	—	—	—	—												
	Hæmatemesis - - -	3	2	1	1	—	1												
	Hernia - - -	2	2	—	6	6	—												
	Ileus and Colic - - -	116	115	—	84	89	4												
	Prolapsus Ani - - -	2	1	—	—	—	—												
	Hæmorrhoids - - -	95	90	—	26	25	—												
	Fistula - - -	5	4	—	4	4	—												
	Obstipatio - - -	85	85	—	14	14	—												
	Hepatitis - - -	143	141	15	174	161	12												
	Jaundice - - -	43	39	1	13	13	—												
	Spleen Disease, &c. - -	21	23	1	25	25	—												
	ORDER 5.																		
	Nephritis - - -	8	8	—	1	1	—	}	33	33	1	5·43	·16						
	Ischuria - - -	11	11	—	4	5	—												
	Enuresis - - -	3	3	—	2	2	—												
	Diabetes - - -	—	—	—	3	3	—												
	Cystitis - - -	1	—	1	—	—	—	}	4	6	—	·66	—						
	ORDER 6.																		
	Hydrocele - - -	—	—	—	3	5	—												
	Testis Disease, &c. - -	—	—	—	1	1	—	}	13	11	1	2·14	·16						
	ORDER 7.																		
	Hydrarthrus - - -	1	1	—	—	—	—												
	Arthritis - - -	—	—	—	4	4	—												
	Joint Disease, &c. - -	2	1	1	3	2	—												
	Contractura - - -	2	2	—	1	1	—												
	ORDER 8.																		
	Phlegmon - - -	242	242	1	178	161	1	}	783	770	3	128·55	·49						
	Abscess - - -																		
	Ulcer - - -													203	216	1	91	90	—
	Tumor, - - -													6	4	—	—	—	—
	Skin Disease, &c. - -	41	35	—	22	22	—												
IV.	ORDER 4.																		
	Atrophy - - -	1	3	—	—	—	—	1	3	—	·16	—							
V.	ORDER 1.— <i>Accident or Negligence.</i>																		
	Burns or Scalds - - -	6	5	—	3	3	—	}	586	599	5	96·43	·83						
	Contusion - - -	174	179	—	152	153	—												
	Sub-luxation - - -	55	59	—	51	51	—												
	Luxation - - -	4	3	—	3	3	—												
	Fracture - - -	11	13	1	15	12	2												
	Wounds { Gunshot - - -	16	18	—	6	6	—												
	{ Incised - - -	55	61	—	34	32	—												
	Amputatio - - -	1	1	—	—	—	—												
	Found dead - - -	—	—	1	—	—	—												
	ORDER 3.— <i>Homicide.</i>																		
	Assassinated - - -	—	—	—	—	—	1	}	176	166	3	28·96	·49						
	ORDER 5.																		
	Punitus - - -	10	9	—	4	4	—												
	Observatio - - -	74	73	1	88	80	2												

N.B.—Invalids are included in these Numbers, but the Returns do not enable them to be distinguished.

No. 23.

BENGAL.—LANDOUR STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS,—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 10 Years - - - - 1,103
 Mean Annual Strength - - - - 110

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	648	572	43	1,501	1,453	24	2,149	2,025	67	1,948·3	60·71
	CLASSES.											
I.	ZYMOTIC DISEASES -	435	391	25	959	938	11	1,394	1,329	36	1,263·8	32·63
II.	CONSTITUTIONAL -	17	8	5	13	10	3	30	18	8	27·2	7·25
III.	LOCAL - - -	119	100	11	468	446	8	587	546	19	532·19	17·22
IV.	DEVELOPMENTAL -	—	—	—	1	—	1	1	—	1	·9	·9
V.	VIOLENCE - - -	77	73	2	60	59	1	137	132	3	124·21	2·71
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	—	—	—	4	4	—	1,242	1,196	32	1,126·	29·01
	Quinsy - - -	—	—	—	18	18	—					
	Catarrh and Influenza -	11	10	—	55	54	—					
	Ophthalmia - - -	56	49	—	48	49	—					
	Fever (C. C.) - - -	56	54	1	56	51	3					
	Icterodes - - -	—	—	—	1	1	—					
	Dysentery - - -	63	47	14	67	63	2					
	Diarrhœa - - -	25	26	1	67	60	3					
	Cholera - - -	—	—	—	1	1	—					
	Ague - - -	109	107	2	386	392	1					
	Remittent Fever - - -	8	8	—	10	10	—	136	116	4	123·3	3·62
	Rheumatism - - -	54	48	4	147	144	1					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	45	34	3	78	69	1	16	17	—	14·5	—
	Stricture of Urethra -	5	5	—	8	8	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	1	1	—	6	6	—	23	13	6	20·85	5·44
	Alcoholism { <i>a.</i> Del. Tremens	2	2	—	3	4	—					
	{ <i>b.</i> Intemperance	—	—	—	4	4	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	—	—	—	2	2	—	7	5	2	6·35	1·81
	Dropsy - - -	4	3	1	1	—	1					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	9	5	1	4	4	—	28	21	3	25·38	2·72
	Phthisis - - -	3	—	3	4	2	2					
	Hæmoptysis - - -	1	—	—	4	2	—					
III.	ORDER 1.											
	Cephalitis - - -	—	—	—	2	2	—	28	21	3	25·38	2·72
	Apoplexy - - -	—	—	—	3	1	1					
	Paralysis - - -	1	—	1	5	4	1					
	Insanity - - -	2	2	—	—	—	—					
	Epilepsy - - -	5	4	—	9	7	—					
	Otitis - - -	1	1	—	—	—	—					

No. 28.—Bengal; Landour Station; Infantry. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.		
		(C.) No. of Attacks.	(C.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.	
III.	ORDER 2.												
	Pericarditis - - -	1	—	—	39	38	1	}	45	43	1	40·8	·9
	Varix - - -	—	—	—	3	3	—						
	Heart Disease, &c. - -	1	1	—	1	1	—						
	ORDER 3.												
	Epistaxis - - -	—	—	—	2	1	—	}	57	52	2	51·68	1·81
	Bronchitis - - -	6	4	1	25	24	1						
	Pleurisy - - -	—	—	—	4	4	—						
	Pneumonia - - -	1	—	—	3	3	—						
	Asthma - - -	7	7	—	9	9	—						
	ORDER 4.												
	Dyspepsia - - -	4	5	—	25	26	—	}	383	355	13	347·24	11·79
	Gastritis - - -	—	—	—	1	—	—						
	Peritonitis - - -	1	1	—	—	—	—						
	Ascites - - -	2	2	—	—	—	—						
	Prolapsus Ani - - -	—	—	—	6	6	—						
	Ileus and Colic - - -	1	1	—	11	9	—						
	Hæmorrhoids - - -	1	1	—	7	7	—						
	Hæmatemesis - - -	—	—	—	1	—	1						
	Fistula - - -	2	2	—	3	3	—						
	Obstipatio - - -	—	—	—	10	10	—						
	Hepatitis - - -	65	52	8	176	167	3						
	Jaundice - - -	—	—	—	3	3	—						
	Spleen Disease, &c. - -	6	4	1	58	56	—						
	ORDER 5.												
	Nephritis - - -	—	—	—	16	16	—	}	21	21	—	19·04	—
	Ischuria - - -	—	—	—	3	3	—						
	Stone - - -	1	1	—	—	—	—						
	Cystitis - - -	1	1	—	—	—	—						
ORDER 7.													
Arthritis - - -	1	1	—	—	—	—	}	2	2	—	1·81	—	
Joint Disease, &c. - -	—	—	—	1	1	—							
ORDER 8.													
Phlegmon - - -	4	5	—	17	17	—	}	51	52	—	46·24	—	
Ulcer - - -	5	5	—	25	25	—							
IV.	ORDER 4.												
	Atrophy - - -	—	—	—	1	—	1	1	—	1	·9	·9	
V.	ORDER 1.— <i>Accident or Negligence.</i>												
	Contusion - - -	10	10	—	29	29	—	}	120	116	2	108·79	1·81
	Sub-luxation - - -	1	1	—	11	11	—						
	Fracture - - -	1	1	—	1	1	—						
	Wounds { Gunshot - - -	58	55	1	—	—	—						
	Incised - - -	4	3	1	5	5	—						
	ORDER 5.												
	Observatio - - -	3	3	—	14	13	1	17	16	1	15·42	·9	

No. 29.

BENGAL.—EN ROUTE, &c. &c.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 10 Years	-	-	-	24,601
Mean Annual Strength	-	-	-	2,460

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	20,672	20,192	816	15,014	15,186	455	35,686	35,378	1,261	1,450·6	51·24
	CLASSES.											
I.	ZYMOTIC DISEASES -	16,556	16,206	644	11,833	11,997	331	28,389	28,203	975	1,154·0	39·63
II.	CONSTITUTIONAL -	174	140	36	154	146	21	328	286	57	13·32	2·31
III.	LOCAL - - -	2,876	2,843	114	2,277	2,330	84	5,153	5,173	198	209·46	8·04
IV.	DEVELOPMENTAL -	10	7	—	1	—	1	11	7	1	·45	·04
V.	VIOLENCE - - -	1,056	996	22	749	713	8	1,805	1,709	30	73·37	1·21
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	31	24	7	4	3	—	23,886	23,621	949	970·95	38·58
	Measles - - -	—	—	—	3	2	1					
	Varicella - - -	1	1	—	—	—	—					
	Quinsy - - -	117	106	2	132	129	2					
	Catarrh and Influenza -	688	787	14	716	715	10					
	Ophthalmia - - -	1,571	1,580	1	515	547	—					
	Fever (C. C.) - - -	3,501	3,316	124	1,456	1,448	42					
	Typhus - - -	3	1	1	—	—	—					
	Typhoid - - -	1	1	—	—	—	—					
	Erysipelas - - -	18	19	—	5	5	1					
	Dysentery - - -	2,114	1,988	221	752	583	97					
	Diarrhœa - - -	1,967	1,887	57	1,627	1,563	76					
	Cholera - - -	277	125	145	144	55	69					
	Ague - - -	2,213	2,326	28	2,893	3,077	19					
	Remittent Fever - -	640	707	21	495	540	6					
	Rheumatism - - -	956	872	3	1,045	1,029	2					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	2,225	2,322	11	1,848	1,858	5	4,123	4,221	16	167·60	·65
	Stricture of Urethra -	14	13	—	36	28	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy -	77	75	2	52	40	—	333	314	10	13·5	·41
	Alcoholism { a. Del. Tremens	41	37	5	24	24	1					
	b. Intemperance	72	73	2	67	65	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	16	16	—	18	19	—	47	47	—	1·91	—
	Psora - - -	13	12	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	29	30	—	27	27	—	88	87	8	3·57	·32
	Dropsy - - -	21	17	4	11	13	4					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - -	—	1	—	2	2	—	240	199	49	9·75	1·99
	Scrofula - - -	47	45	2	34	37	—					
	Phthisis - - -	57	28	28	58	47	17					
	Hæmoptysis - - -	22	19	2	20	20	—					

No. 29.—Bengal ; En Route, &c. &c. ; Infantry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1,000 of Mean Strength.						
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.					
III.	ORDER 1.																
	Cephalitis - - -	34	33	—	56	61	—	502	517	43	20·4	1·75					
	Apoplexy - - -	19	10	21	17	6	12										
	Paralysis - - -	28	25	3	23	27	—										
	Odontalgia - - -	4	5	—	3	4	—										
	Insanity - - -	49	49	1	61	82	1										
	Tetanus - - -	1	—	1	—	—	—										
	Epilepsy - - -	44	47	1	42	45	1										
	Otitis - - -	58	62	—	51	48	—										
	Brain Disease, &c. - -	6	6	2	—	—	—										
	Dysecoea - - -	—	2	—	6	5	—										
	ORDER 2.							170	158	19	6·91	·77					
	Pericarditis - - -	48	49	6	63	60	10										
	Aneurism - - -	1	1	—	3	2	1										
	Varix - - -	10	6	—	5	4	—										
	Heart Disease, &c. - -	8	8	1	32	28	1										
	ORDER 3.							316	285	37	12·84	1·50					
	Epistaxis - - -	2	2	—	8	10	—										
	Bronchitis - - -	24	21	2	56	49	5										
	Pleurisy - - -	46	42	4	25	23	2										
	Pneumonia - - -	65	49	13	51	44	10										
	Asthma - - -	19	22	1	20	23	—										
	ORDER 4.							2,472	2,470	91	100·50	3·70					
	Dyspepsia - - -	227	223	—	122	129	1										
	Gastritis - - -	16	15	2	20	21	2										
	Enteritis - - -	11	4	2	6	4	1										
	Peritonitis - - -	11	8	3	3	1	2										
	Ascites - - -	7	4	1	8	6	1										
	Prolapsus Ani - - -	1	2	—	2	2	—										
	Hernia - - -	11	9	—	8	10	—										
	Ileus and Colic - - -	233	237	—	170	168	—										
	Hæmorrhoids - - -	135	131	1	83	97	1										
	Obstipatio - - -	110	104	—	50	40	—										
	Fistula - - -	11	12	—	13	14	—										
	Hæmatemesis - - -	1	1	—	2	2	—										
	Hepatitis - - -	469	469	45	452	466	26										
	Jaundice - - -	40	40	2	20	23	—										
	Spleen Disease, &c. - -	84	86	—	127	123	1										
	ORDER 5.							42	53	3	1·70	·12					
	Nephritis - - -	8	17	—	13	15	2										
	Ischuria - - -	6	7	—	10	9	—										
	Diabetes - - -	—	—	—	1	1	1										
	Cystitis - - -	2	2	—	2	2	—										
	ORDER 6.							10	10	—	·41	—					
	Hydrocele - - -	5	4	—	4	5	—										
	Testis Disease, &c. - -	—	—	—	1	1	—										
	ORDER 7.							40	35	—	1·62	—					
	Hydrarthrus - - -	2	2	—	4	2	—										
	Arthritis - - -	8	8	—	8	7	—										
	Joint Disease, &c. - -	3	5	—	8	6	—										
	Contractura - - -	4	4	—	3	1	—										
	ORDER 8.							1,601	1,645	5	65·08	·20					
	Phlegmon - - -	525	535	2	349	351	—										
	Abscess - - -																
	Ulcer - - -																
	Tumor - - -																
	Skin Disease, &c. - -	31	28	1	33	34	1										
IV.	ORDER 4.							11	7	1	·45	·04					
	Atrophy - - -	10	7	—	1	—	1										
V.	ORDER 1.— <i>Accident or Negligence.</i>							1,472	1,382	19	59·83	·77					
	Burns or Scalds - - -	24	23	—	21	17	—										
	Contusion - - -	409	397	1	352	349	—										
	Sub-luxation - - -	181	168	—	130	124	—										
	Luxation - - -	27	25	—	10	7	—										
	Fracture - - -	35	34	—	45	42	—										
	Wounds { Gunshot - - -	91	53	8	3	4	—										
	{ Incised - - -	70	78	—	67	59	—										
	Amputatio - - -	5	4	—	2	2	—										
	Drowned - - -	—	—	6	—	—	2										
	Found Dead - - -	—	—	1	—	—	1										
	ORDER 4.— <i>Suicide.</i>							—	—	3	—	·12					
	Gunshot - - -	—	—	2	—	—	1										
	ORDER 5.							333	327	8	13·54	·32					
	Punitus - - -	41	40	—	28	25	—										
	Observatio - - -	173	178	4	91	84	4										

N.B.—Invalids are included in these Numbers, but the Returns do not enable them to be distinguished.

No. 30.

BENGAL.—DINAPORE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 9 Years - - - - 7,018
 Mean Annual Strength - - - - 779

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Four Years,* 1852 to 1854, and 1856.			Total for 9 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	7,200	6,676	284	6,306	6,084	155	13,506	12,760	439	1,924.49	62.55
	CLASSES.											
I.	ZYMOTIC DISEASES -	5,582	5,111	227	4,499	4,345	116	10,081	9,456	343	1,436.46	48.83
II.	CONSTITUTIONAL -	44	34	9	36	29	5	80	63	14	11.4	1.99
III.	LOCAL - - -	1,254	1,191	48	1,472	1,410	32	2,726	2,601	80	388.43	11.40
IV.	DEVELOPMENTAL -	—	—	—	1	1	—	1	1	—	.14	—
V.	VIOLENCE - - -	320	340	—	298	299	2	618	639	2	88.06	.28
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	1	1	—	4	3	1	7,380	6,773	337	1,051.6	48.02
	Vaccina - - -	1	1	—	—	—	—					
	Measles - - -	3	2	1	2	2	—					
	Varicella - - -	1	1	—	—	—	—					
	Quinsy - - -	37	37	1	59	58	1					
	Catarrh and Influenza -	181	171	4	175	174	1					
	Ophthalmia - - -	312	287	—	204	203	—					
	Fever (C.C) - - -	933	912	11	651	648	2					
	Typhus - - -	—	—	—	1	—	1					
	Erysipelas - - -	2	2	—	1	1	—					
	Dysentery - - -	826	677	100	454	373	68					
	Diarrhœa - - -	377	373	17	328	323	3					
	Cholera - - -	220	145	76	66	33	33					
	Ague - - -	317	322	5	710	719	4					
	Remittent Fever - - -	636	420	8	135	131	—					
	Rheumatism - - -	317	321	—	426	433	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	1,286	1,311	2	1,198	1,168	—	2,521	2,514	3	359.22	.43
	Stricture of Urethra -	13	13	—	24	22	1					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	13	12	1	11	8	—	127	117	3	18.09	.43
	Alcoholism { <i>a.</i> Del. Tremens	68	66	1	9	6	1					
	{ <i>b.</i> Intemperance	25	24	—	1	1	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	6	6	—	38	37	—	53	52	—	7.55	—
	Psora - - -	7	7	—	2	2	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	5	5	—	6	6	—	13	12	1	1.85	.14
	Dropsy - - -	1	1	1	1	—	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	—	—	—	3	3	—	67	51	13	9.55	1.85
	Scrofula - - -	21	20	—	8	8	—					
	Phthisis - - -	14	6	7	12	6	5					
	Hæmoptysis - - -	3	2	1	6	6	—					

No. 30.—Bengal ; Dinapore Station ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Four Years,* 1852 to 1854, and 1856.			Total for 9 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	7	7	—	21	20	—	236	194	26	33·62	2·71
	Apoplexy - - -	19	4	14	13	6	7					
	Paralysis - - -	11	6	3	5	5	—					
	Odontalgia - - -	—	—	—	3	3	—					
	Insanity - - -	3	2	—	11	10	—					
	Epilepsy - - -	29	37	1	9	9	—					
	Otitis - - -	11	11	—	81	63	—					
	Brain Disease, &c. - -	2	2	—	8	6	1	2	1	—		
	Dysœcœa - - -	2	1	—	1	2	—					
	ORDER 2.											
	Pericarditis - - -	7	5	2	15	12	2	58	35	5	8·26	·72
	Aneurism - - -	—	—	—	1	1	1					
	Varix - - -	2	2	—	24	9	—					
	Heart Disease, &c. - -	1	1	—	8	5	—	128	125	4	18·24	·56
	ORDER 3.											
	Epistaxis - - -	5	5	—	2	2	—					
	Bronchitis - - -	1	—	—	6	5	—					
	Pleurisy - - -	20	21	—	29	30	1					
	Pneumonia - - -	17	16	2	16	14	1	1,264	1,188	44	180·11	6·27
	Asthma - - -	—	—	—	32	32	—					
	ORDER 4.											
	Dyspepsia - - -	44	45	—	118	116	—					
	Gastritis - - -	18	17	1	5	5	—					
	Enteritis - - -	7	7	—	2	2	—					
	Peritonitis - - -	—	—	—	4	4	—					
	Ascites - - -	2	1	1	3	2	—					
	Hæmatemesis - - -	3	3	—	1	1	—					
	Hernia - - -	4	4	—	8	8	—					
	Ileus and Colic - - -	81	68	1	34	34	—					
	Hæmorrhoids - - -	32	29	—	35	34	—					
	Prolapsus Ani - - -	—	—	—	1	1	—					
	Fistula - - -	12	9	—	6	6	—					
	Obstipatio - - -	16	15	—	101	100	—					
	Hepatitis - - -	322	292	23	266	242	18					
	Jaundice - - -	17	17	—	18	18	—					
	Spleen Disease, &c. - -	43	43	—	61	65	—					
	ORDER 5.											
	Nephritis - - -	1	1	—	10	9	1	30	28	1	4·27	·14
	Ischuria - - -	5	4	—	4	5	—					
	Enuresis - - -	1	1	—	4	4	—					
	Diabetes - - -	—	—	—	2	1	—					
	Cystitis - - -	—	—	—	3	3	—					
	ORDER 6.											
	Hydrocele - - -	3	3	—	5	5	—	8	8	—	1·14	—
	ORDER 7.											
	Hydrarthrus - - -	5	6	—	1	1	—	23	23	—	3·28	—
	Arthritis - - -	1	1	—	5	5	—					
	Joint Disease, &c. - -	6	5	—	4	4	—					
	Contractura - - -	1	1	—	—	—	—					
	ORDER 8.											
	Phlegmon - - -	324	321	—	274	291	—	979	1,000	—	139·51	—
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -	—	—	—	5	5	—					
	Skin Disease, &c. - -	24	24	—	59	59	—					
IV.	ORDER 4.											
	Atrophy - - -	—	—	—	1	1	—	1	1	—	·14	—
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	3	3	—	3	3	—	471	497	—	67·11	—
	Contusion - - -	146	163	—	109	108	—					
	Sub-luxation - - -	58	58	—	40	40	—					
	Luxation - - -	9	9	—	2	2	—					
	Fracture - - -	14	18	—	6	8	—					
	Wounds { Gunshot - - -	1	2	—	—	—	—	34	37	—		
	Incised - - -	46	46	—	—	—	—					
	ORDER 5.											
	Punitus - - -	18	18	—	6	6	—	147	142	2	21·05	·28
	Observatio - - -	25	23	—	98	95	2					

* No Troops separately accounted for at this Station during the Year 1855.

No. 31.

BENGAL.—JULLUNDUR STATION—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 9 Years - - - - 6,472
 Mean Annual Strength - - - - 712

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Four Years,* 1848 to 1851.			Five Years, 1852 to 1856.			Total for 9 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	4,872	4,755	113	8,479	8,249	124	13,351	13,004	237	2,062·89	36·62
	CLASSES.											
I.	ZYMOTIC DISEASES -	3,700	3,617	66	6,938	6,766	82	10,638	10,383	148	1,643·7	22·87
II.	CONSTITUTIONAL -	41	35	7	39	35	2	80	70	9	12·36	1·39
III.	LOCAL - - -	852	817	31	1,322	1,266	38	2,174	2,083	69	335·91	10·66
V.	VIOLENCE - - -	279	286	9	180	182	2	459	468	11	70·92	1·7
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	1	—	1	7	5	2	8,666	8,496	138	1,339·	21·33
	Measles - - -	—	—	—	2	2	—					
	Quinsy - - -	18	17	—	48	47	—					
	Catarrh and Influenza -	122	114	2	262	256	2					
	Ophthalmia - - -	298	298	—	346	367	—					
	Fever (C. C.) - - -	1,075	1,041	16	464	459	8					
	Erysipelas - - -	1	1	—	1	—	1					
	Dysentery - - -	473	436	27	127	102	24					
	Diarrhœa - - -	151	147	3	590	568	32					
	Cholera - - -	11	8	3	—	—	—					
	Ague - - -	322	338	1	3,590	3,546	9	1,822	1,751	3	281·52	·46
	Remittent Fever - - -	75	70	5	22	20	1					
	Rheumatism - - -	247	251	—	413	403	1					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	775	778	2	1,022	946	1	1,822	1,751	3	281·52	·46
	Stricture of Urethra - -	6	6	—	19	21	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	9	2	—	9	9	—	123	109	7	19·	1·08
	Alcoholism { <i>a.</i> Del. Tremens -	35	32	5	3	2	1					
	{ <i>b.</i> Intemperance -	65	62	1	2	2	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	15	15	—	10	10	—	27	27	—	4·18	—
	Psora - - -	1	1	—	1	1	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	4	5	—	9	9	—	21	21	—	3·24	—
	Dropsy - - -	7	7	—	1	—	—					
	ORDER 3.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	—	—	—	1	1	—	59	49	9	9·12	1·39
	Scrofula - - -	12	14	—	9	8	—					
	Phthisis - - -	14	5	7	13	11	2					
	Hæmoptysis - - -	4	4	—	6	6	—					

No. 31. Bengal ; Jullundur Station ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Four Years,* 1848 to 1851.			Five Years. 1852 to 1856.			Total for 9 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	37	36	—	35	31	—	201	166	22	31.06	3.4
	Apoplexy - - -	10	3	9	12	—	11					
	Paralysis - - -	11	10	1	5	4	1					
	Odontalgia - - -	4	3	—	—	—	—					
	Insanity - - -	5	4	—	4	3	—					
	Tetanus - - -	—	—	—	1	1	—					
	Epilepsy - - -	12	12	—	15	12	—					
	Otitis - - -	20	18	—	29	29	—					
	Brain Disease, &c. - -	1	—	—	—	—	—					
	ORDER 2.											
	Pericarditis - - -	—	—	—	113	110	3	147	141	6	22.71	.93
	Aneurism - - -	1	—	1	1	—	1					
	Varix - - -	1	1	—	2	2	—					
	Heart Disease, &c. - -	15	15	1	14	13	—					
	ORDER 3.											
	Epistaxis - - -	—	—	—	3	3	—	64	57	6	9.89	.93
	Bronchitis - - -	9	8	—	20	21	—					
	Pleurisy - - -	2	3	—	7	6	1					
	Pneumonia - - -	9	7	2	6	2	2					
	Asthma - - -	4	3	1	4	4	—					
	ORDER 4.											
	Dyspepsia - - -	16	15	—	206	202	—	1,258	1,223	34	194.38	5.25
	Gastritis - - -	2	2	—	3	2	1					
	Enteritis - - -	—	—	—	1	—	1					
	Peritonitis - - -	1	—	1	3	1	1					
	Prolapsus Ani - - -	1	1	—	1	1	—					
	Hæmatemesis - - -	1	—	1	1	—	1					
	Hernia - - -	2	2	—	—	—	—					
	Ileus and Colic - - -	163	162	—	70	69	—					
	Hæmorrhoids - - -	13	12	—	47	40	—					
	Fistula - - -	2	2	—	6	7	—					
	Obstipatio - - -	21	22	—	26	26	—					
	Hepatitis - - -	196	179	14	340	331	14					
	Jaundice - - -	18	22	—	15	15	—					
	Spleen Disease, &c. - -	15	15	—	88	95	—					
	ORDER 5.											
	Nephritis - - -	—	—	—	7	7	—	13	11	1	2.01	.15
	Ischuria - - -	1	1	—	3	2	—					
	Hæmaturia - - -	1	1	—	—	—	—					
	Diabetes - - -	—	—	—	1	—	1					
	ORDER 6.											
	Hydrocele - - -	3	3	—	5	5	—	8	8	—	1.23	—
	ORDER 7.											
	Arthritis - - -	—	—	—	4	4	—	6	6	—	.93	—
	Contractura - - -	2	2	—	—	—	—					
	ORDER 8.											
	Phlegmon - - -	162	159	—	111	108	—	477	471	—	73.7	—
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Disease, &c. - -	31	32	—	17	18	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Drowned - - -	—	—	2	—	—	—	395	405	9	61.03	1.39
	Burns or Scalds - - -	6	6	—	4	4	—					
	Contusion - - -	150	151	1	68	70	—					
	Sub-luxation - - -	42	44	—	61	62	—					
	Luxation - - -	5	3	—	1	1	—					
	Fracture - - -	9	10	—	7	6	—					
	Wounds { Gunshot - - -	14	21	—	3	2	1					
	{ Incised - - -	23	23	—	2	2	—					
	Found dead - - -	—	—	5	—	—	—					
	ORDER 4.— <i>Suicide.</i>											
	Gunshot Wound - - -	—	—	1	—	—	1	—	—	2	—	.31
	ORDER 5.											
	Punitus - - -	8	8	—	7	8	—	64	63	—	9.89	—
	Observatio - - -	22	20	—	27	27	—					

* No Troops separately accounted for at this Station during the Year 1847.

No. 32.

BENGAL.—DARJEELING STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 9 Years - - - - 642
 Mean Annual Strength - - - - 72

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Four Years,* 1848 to 1851.			Five Years, 1852 to 1856.			Total for 9 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	465	424	18	380	342	7	845	766	25	1,216.2	38.95
	CLASSES.											
I.	ZYMOTIC DISEASES -	276	254	10	210	195	5	486	449	15	757.01	23.37
II.	CONSTITUTIONAL -	16	12	3	10	8	2	26	20	5	40.5	7.79
III.	LOCAL - - -	131	120	4	135	114	—	266	234	4	414.33	6.23
V.	VIOLENCE - - -	42	38	1	25	25	—	67	63	1	104.36	1.56
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Quinsy - - -	4	3	—	5	4	1	389	350	15	605.92	23.37
	Catarrh and Influenza - -	9	9	—	18	14	1					
	Ophthalmia - - -	28	28	—	3	3	—					
	Fever (C. C.) - - -	13	14	—	19	19	—					
	Dysentery - - -	64	53	8	10	8	—					
	Diarrhœa - - -	16	16	—	23	24	2					
	Ague - - -	14	15	—	35	34	1					
	Remittent Fever - - -	23	16	2	1	1	—					
	Rheumatism - - -	51	45	—	53	44	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	39	40	—	29	29	—	70	71	—	109.04	—
	Stricture of Urethra - -	1	1	—	1	1	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	—	—	—	3	4	—	17	18	—	26.48	—
	Alcoholism { <i>a.</i> Del. Tremens <i>b.</i> Intemperance -	3 2	3 2	— —	2 7	2 7	— —					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	9	9	—	1	1	—	10	10	—	15.57	—
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Dropsy - - -	3	1	2	—	—	—	5	3	2	7.79	3.12
	Cancer - - -	2	2	—	—	—	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	—	—	—	1	1	—	21	17	3	32.71	4.67
	Scrofula - - -	7	6	—	5	5	—					
	Phthisis - - -	3	3	—	3	1	2					
	Hæmoptysis - - -	1	—	1	1	1	—					

No. 32.—Bengal ; Darjeeling Station ; Infantry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Four Years,* 1848 to 1851.			Five Years, 1852 to 1856.			Total for 9 Years.*			Annual Ratio per 1000 of Mean Strength.			
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.		
III.	ORDER 1.													
	Cephalitis - - -	3	3	—	3	4	—	}	19	19	—	29·59	—	
	Apoplexy - - -	1	1	—	—	—	—							
	Paralysis - - -	4	4	—	4	2	—							
	Epilepsy - - -	1	2	—	2	2	—							
	Brain Disease, &c. - -	1	1	—	—	—	—							
	ORDER 2.													
	Pericarditis - - -	4	4	—	1	1	—	}	9	9	—	14·02	—	
	Aneurism - - -	1	1	—	—	—	—							
	Heart Disease, &c. - -	—	—	—	3	3	—							
	ORDER 3.													
	Bronchitis - - -	5	3	1	1	1	—	}	18	13	1	28·04	1·56	
	Pleurisy - - -	5	5	—	—	—	—							
	Pneumonia - - -	1	—	—	6	4	—							
	ORDER 4.													
	Dyspepsia - - -	18	18	—	15	15	—	}	184	161	3	286·61	4·67	
	Gastritis - - -	4	3	—	1	1	—							
	Enteritis - - -	1	1	—	1	1	—							
	Peritonitis - - -	1	1	—	—	—	—							
	Ileus and Colic - - -	16	15	1	5	5	—							
	Hæmorrhoids - - -	4	3	—	11	9	—							
	Fistula - - -	—	—	—	4	4	—							
	Obstipatio - - -	3	3	—	1	1	—							
	Hepatitis - - -	31	28	2	51	35	—							
	Jaundice - - -	2	2	—	—	—	—							
	Spleen Disease, &c. - -	8	8	—	7	8	—							
	ORDER 5.													
	Nephritis - - -	—	—	—	3	3	—	}	4	4	—	6·23	—	
	Ischuria - - -	—	—	—	1	1	—							
	ORDER 6.													
	Hydrocele - - -	4	4	—	—	—	—	4	4	—	6·23	—		
	ORDER 7.													
	Arthritis - - -	1	1	—	3	2	—	}	6	4	—	9·34	—	
	Joint Disease, &c. - -	2	1	—	—	—	—							
	ORDER 8.													
	Phlegmon - - -	}	3	3	—	3	3	—	}	22	20	—	34·27	—
	Abscess - - -		—	—	—	—	—	—						
	Ulcer - - -		5	3	—	8	8	—						
	Skin Disease, &c. - -		2	2	—	1	1	—						
V.	ORDER 1.— <i>Accident or Negligence.</i>													
	Contusion - - -	29	28	—	7	8	—	}	52	50	—	80·99	—	
	Sub-luxation - - -	1	1	—	3	3	—							
	Fracture - - -	5	3	—	2	2	—							
	Wounds; Incised - -	4	4	—	1	1	—							
	ORDER 5.													
	Observatio - - -	3	2	1	12	11	—	15	13	1	23·37	1·56		

* No Troops separately accounted for at this Station during the Year 1847.

No. 33.

BENGAL.—WUZEERABAD STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 8 Years - - - - 8,615
 Mean Annual Strength - - - - 1,077

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1849 to 1851.			Five Years, 1852 to 1856.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	7,788	7,683	213	6,574	6,405	108	14,362	14,088	321	1,667·1	37·26
	CLASSES.											
I.	ZYMOTIC DISEASES -	6,533	6,406	149	4,935	4,813	61	11,468	11,219	210	1,331·2	24·37
II.	CONSTITUTIONAL -	56	59	5	70	54	10	126	113	15	14·62	1·74
III.	LOCAL - - -	959	919	59	1,193	1,165	34	2,152	2,084	93	249·79	10·79
IV.	DEVELOPMENTAL -	1	—	—	—	—	—	1	—	—	·12	—
V.	VIOLENCE - -	239	299	—	376	373	3	615	672	3	71·39	·35
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	3	2	—	2	1	—	9,214	8,958	202	1,069·57	23·45
	Varicella - - -	2	—	—	—	—	—					
	Quinsy - - -	30	31	—	48	50	—					
	Catarrh and Influenza -	126	127	1	357	359	3					
	Ophthalmia - - -	743	654	—	173	173	—					
	Fever (C. C.) - - -	838	952	16	1,698	1,624	20					
	Typhus - - -	6	3	3	—	—	—					
	Erysipelas - - -	5	4	1	3	3	—					
	Dysentery - - -	630	596	90	209	184	17					
	Diarrhœa - - -	191	198	11	422	418	14					
	Cholera - - -	17	14	3	8	10	—					
	Ague - - -	1,988	1,879	8	601	605	—					
	Remittent Fever - -	267	263	8	83	58	4					
	Rheumatism - - -	433	411	1	331	337	2					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	1,101	1,127	3	902	891	—	2,049	2,060	3	237·84	·35
	Stricture of Urethra -	18	15	—	28	27	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	57	53	1	17	17	1	163	157	5	18·92	·58
	Alcoholism { a. Del. Tremens	31	30	2	4	3	—					
	{ b. Intemperance	27	25	1	27	29	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	14	14	—	20	22	—	42	44	—	4·87	—
	Psora - - -	6	6	—	2	2	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	15	17	—	35	33	—	56	55	—	6·5	—
	Dropsy - - -	3	3	—	3	2	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	25	31	—	6	6	—	70	58	15	8·12	1·74
	Phthisis - - -	6	3	4	16	5	8					
	Hæmoptysis - - -	7	5	1	10	8	2					
III.	ORDER 1.											
	Cephalitis - - -	28	26	1	32	31	—	233	193	38	27·05	4·41
	Apoplexy - - -	38	19	26	13	6	7					
	Paralysis - - -	9	9	—	10	8	2					
	Odontalgia - - -	3	3	—	8	7	—					
	Insanity - - -	14	13	1	6	3	—					
	Epilepsy - - -	8	9	—	13	14	—					
	Otitis - - -	12	10	—	30	29	—					
	Brain Disease, &c. - -	—	—	—	4	2	1					
	Dyseccœa - - -	—	—	—	5	4	—					

No. 33.—Bengal ; Wuzeerabad Station ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1849 to 1851.			Five Years, 1852 to 1856.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 2.											
	Pericarditis - - -	16	15	1	25	25	1	92	95	5	10.68	.58
	Aneurism - - -	—	—	1	1	—	1					
	Varix - - -	1	2	—	7	7	—					
	Heart Disease, &c. - -	4	4	—	38	42	1					
	ORDER 3.							168	162	12	19.5	2.39
	Epistaxis - - -	2	—	2	8	8	—					
	Bronchitis - - -	39	38	1	13	11	—					
	Pleurisy - - -	43	42	2	19	19	—					
	Pneumonia - - -	29	24	5	9	10	2					
	Asthma - - -	5	9	—	1	1	—	1,050	1,012	35	121.88	4.06
	ORDER 4.											
	Dyspepsia - - -	42	43	—	98	98	—					
	Gastritis - - -	10	9	—	9	10	—					
	Enteritis - - -	6	5	1	6	5	1					
	Peritonitis - - -	6	5	1	2	2	—					
	Ascites - - -	1	—	1	2	1	1					
	Hæmatemesis - - -	1	2	—	4	4	—					
	Hernia - - -	7	5	—	3	4	—					
	Ileus and Colic - - -	31	29	—	85	84	—					
	Hæmorrhoids - - -	12	15	—	40	37	2					
	Fistula - - -	3	3	—	3	3	—					
	Obstipatio - - -	16	12	—	50	46	—					
	Hepatitis - - -	246	234	13	241	230	12					
	Jaundice - - -	38	40	1	2	3	—					
	Spleen Disease, &c. - -	51	47	2	35	36	—					
	ORDER 5.							38	37	—	4.41	—
	Nephritis - - -	7	7	—	15	14	—					
	Ischuria - - -	2	2	—	7	7	—					
	Enuresis - - -	3	3	—	—	—	—					
	Diabetes - - -	—	—	—	2	2	—					
	Cystitis - - -	2	2	—	—	—	—					
	ORDER 6.							6	6	—	.69	—
	Hydrocele - - -	2	2	—	4	4	—					
	ORDER 7.							29	32	—	3.37	—
	Hydrarthrus - - -	1	1	—	6	4	—					
	Arthritis - - -	14	16	—	4	6	—					
	Joint Disease, &c. - -	—	—	—	2	2	—					
	Contractura - - -	2	3	—	—	—	—	536	547	3	62.21	.35
	ORDER 8.											
	Phlegmon - - -	110	111	—	202	209	2					
	Ulcer - - -	71	75	—	95	93	1					
	Tumor - - -	1	1	—	1	1	—					
	Skin Disease, &c. - -	23	24	—	33	33	—					
	ORDER 1.							1	—	—	.12	—
	Atrophy - - -	1	—	—	—	—	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>							434	492	3	50.38	.35
	Burns or Scalds - - -	6	7	—	4	4	—					
	Contusion - - -	53	58	—	135	136	—					
	Sub-luxation - - -	37	35	—	81	81	—					
	Luxation - - -	—	—	—	4	4	—					
	Fracture - - -	4	8	—	9	9	—					
	Wounds - { Gunshot - - -	56	111	—	1	—	2					
	{ Incised - - -	16	12	—	26	26	—					
	Amputatio - - -	1	1	—	1	—	—					
	Found dead - - -	—	—	—	—	—	1					
	ORDER 5.							181	180	—	21.01	—
	Punitus - - -	3	3	—	3	3	—					
	Observatio - - -	63	64	—	112	110	—					

* No Troops separately accounted for at this Station during the Years 1847 and 1848.

No. 34.

BENGAL.—RAWUL PINDI STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 8 Years - - - - 7,136
 Mean Annual Strength - - - - 892

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1849 to 1851.			Five Years, 1852 to 1856.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	4,210	3,903	89	13,383	13,255	117	17,593	17,158	206	2,465·4	28·86
	CLASSES.											
I.	ZYMOTIC DISEASES -	3,395	3,143	33	11,474	11,395	80	14,869	14,538	113	2,083·7	15·83
II.	CONSTITUTIONAL -	49	44	7	63	59	6	112	103	13	15·69	1·82
III.	LOCAL - - -	543	506	37	1,290	1,255	29	1,833	1,761	66	256·87	9·25
IV.	DEVELOPMENTAL -	8	1	7	—	—	—	8	1	7	1·13	·98
V.	VIOLENCE - - -	215	209	5	556	546	2	771	755	7	108·	·98
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	2	—	2	—	—	—	13,579	13,238	102	1,902·9	14·29
	Measles - - -	—	—	—	5	5	—					
	Quinsy - - -	26	24	1	54	54	—					
	Catarrh and Influenza -	110	111	—	348	345	2					
	Ophthalmia - - -	207	210	—	138	155	—					
	Fever (C. C.) - - -	237	228	8	1,820	1,853	10					
	Icterodes - - -	1	1	—	—	—	—					
	Erysipelas - - -	3	3	—	—	—	—					
	Dysentery - - -	148	143	15	245	206	28					
	Diarrhœa - - -	197	201	—	665	663	12					
	Cholera - - -	15	14	1	5	3	1					
	Ague - - -	1,619	1,580	1	6,730	6,661	14					
	Remittent Fever - -	216	9	1	128	117	6					
	Rheumatism - - -	238	234	—	422	418	—					
	ORDER 2.— <i>Enthetic Dis.</i>							1,126	1,144	1	157·81	·14
	Syphilis, &c. - - -	298	313	—	817	823	1					
	Stricture of Urethra -	6	3	—	5	5	—					
	ORDER 3.— <i>Dietic Dis.</i>							135	127	10	18·92	1·4
	Purpura and Scurvy -	21	21	1	34	36	1					
	Alcoholism { a. Del. Tremens -	28	27	2	24	17	5					
	{ b. Intemperance -	17	15	1	11	11	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	6	6	—	23	23	—	29	29	—	4·07	—
II.	ORDER 1.— <i>Diathetic Dis.</i>							63	56	5	8·82	7·0
	Lumbago - - -	22	23	—	24	23	—					
	Dropsy - - -	13	7	5	4	3	—					
	ORDER 2.— <i>Tubercular Dis.</i>							49	47	8	6·87	1·12
	Scrofula - - -	8	10	—	11	11	—					
	Phthisis - - -	6	4	2	12	10	6					
	Hæmoptysis - - -	—	—	—	12	12	—					
III.	ORDER 1.							205	207	22	28·73	3·09
	Cephalitis - - -	24	24	—	40	38	4					
	Apoplexy - - -	12	4	8	27	22	6					
	Paralysis - - -	1	17	—	6	3	—					
	Odontalgia - - -	—	—	—	1	—	—					
	Insanity - - -	7	6	—	12	13	1					
	Tetanus - - -	1	—	1	—	—	—					
	Epilepsy - - -	9	8	1	15	21	1					
	Otitis - - -	13	12	—	36	37	—					
	Brain Disease, &c. -	—	—	—	1	1	—					
	Dysœcœa - - -	—	—	—	—	1	—					

No. 34.—Bengal; Rawul Pindi Station; Infantry. Stational Returns. European Troops; H.M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1849 to 1851.			Five Years, 1852 to 1856.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 2.											
	Pericarditis - - -	6	4	3	15	11	2	69	62	5	9.67	.7
	Aneurism - - -	1	1	—	4	3	—					
	Varix - - -	3	3	—	11	9	—					
	Heart Disease, &c. - -	3	4	—	26	27	—					
	ORDER 3.											
	Epistaxis - - -	—	—	—	4	5	—	143	116	13	20.04	1.82
	Bronchitis - - -	16	12	3	19	17	—					
	Pleurisy - - -	8	6	2	16	13	—					
	Pneumonia - - -	11	8	3	32	22	5					
	Asthma - - -	10	10	—	27	23	—					
	ORDER 4.											
	Dyspepsia - - -	92	75	—	72	73	—	818	772	25	114.63	3.5
	Gastritis - - -	5	4	1	5	3	—					
	Enteritis - - -	2	—	2	1	1	—					
	Peritonitis - - -	4	—	4	6	3	3					
	Ascites - - -	1	—	1	4	2	2					
	Prolapsus Ani - - -	—	—	—	1	1	—					
	Hernia - - -	—	—	—	8	6	—					
	Ileus and Colic - - -	21	22	—	38	39	—					
	Hæmorrhoids - - -	18	18	—	60	60	—					
	Fistula - - -	5	5	—	11	11	—					
	Obstipatio - - -	7	7	—	17	17	—					
	Hepatitis - - -	66	61	7	231	224	5					
	Jaundice - - -	20	20	—	7	7	—					
	Spleen Disease, &c. - -	24	22	—	92	91	—					
	ORDER 5.											
	Nephritis - - -	2	1	—	6	4	—	31	28	—	4.34	—
	Ischuria - - -	3	3	—	4	4	—					
	Enuresis - - -	4	4	—	12	12	—					
	ORDER 6.											
	Hydrocele - - -	3	2	—	—	—	—	3	2	—	4.20	—
	ORDER 7.											
	Hydrarthrus - - -	3	3	—	—	—	—	8	8	—	1.13	—
	Arthritis - - -	1	2	—	1	1	—					
	Joint Disease, &c. - -	—	—	—	1	1	—					
	Contractura - - -	—	—	—	2	2	—					
	ORDER 8.											
	Phlegmon - - -	67	64	1	202	209	—	556	566	1	77.91	.14
	Ulcer - - -	43	54	—	153	147	—					
	Tumor - - -	—	—	—	22	23	—					
	Skin Disease, &c. - -	27	20	—	42	48	—					
—												
IV.	ORDER 4.											
	Atrophy - - -	8	1	7	—	—	—	8	1	7	1.13	.98
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	8	9	—	7	7	—	484	484	4	67.8	.56
	Contusion - - -	76	76	1	226	219	—					
	Sub-luxation - - -	21	21	—	57	67	—					
	Luxation - - -	2	2	—	1	1	—					
	Fracture - - -	12	11	—	19	20	—					
	Wounds — { Gunshot - - -	—	—	—	10	9	—					
	{ Incised - - -	19	19	—	23	21	—					
	Amputatio - - -	2	1	—	1	1	1					
	Drowned - - -	—	—	2	—	—	—					
	ORDER 4.— <i>Suicide (attempted or accomplished).</i>											
	Wound, Gunshot - - -	1	—	2	—	—	—	1	—	2	.14	.28
	ORDER 5.											
	Punitus - - -	19	19	—	6	4	—	286	271	1	40.06	.14
	Observatio - - -	55	51	—	206	197	1					

* No Troops separately accounted for at this Station during the Years 1847 and 1848.

No. 35.

BENGAL.—PESHAWUR STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 8 Years - - - - 13,393
 Mean Annual Strength - - - - 1,674

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1849 to 1851.			Five Years, 1852 to 1856.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	12,904	12,330	331	38,491	38,093	489	51,395	50,423	820	3,837.5	61.23
	CLASSES.											
I.	ZYMOTIC DISEASES -	11,622	11,132	267	34,226	34,115	314	45,848	45,247	581	3,423.31	43.38
II.	CONSTITUTIONAL -	44	32	12	159	143	19	203	175	31	15.16	2.32
III.	LOCAL - - -	944	882	50	3,140	2,882	142	4,084	3,764	192	304.94	14.33
IV.	DEVELOPMENTAL -	—	—	—	3	—	2	3	—	2	.23	.15
V.	VIOLENCE - - -	294	284	2	963	953	12	1,257	1,237	14	93.86	1.05
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	6	4	2	12	10	2	42,876	42,340	560	3,201.4	41.81
	Measles - - -	—	—	—	20	18	2					
	Varicella - - -	1	1	—	—	—	—					
	Quinsy - - -	32	32	—	111	102	6					
	Catarrh and Influenza -	220	212	4	948	927	5					
	Ophthalmia - - -	520	495	—	457	444	—					
	Fever (C. C.) - - -	2,626	2,609	65	4,488	4,307	50					
	Erysipelas - - -	3	3	—	8	7	1					
	Dysentery - - -	770	653	113	1,185	972	113					
	Diarrhoea - - -	556	539	16	1,334	1,241	21					
	Cholera - - -	23	14	9	27	18	10					
	Ague - - -	5,600	5,386	30	22,205	22,680	71					
	Remittent Fever - - -	161	150	12	306	280	23					
	Rheumatism - - -	311	289	4	946	947	1					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	641	607	—	1,978	1,974	4	2,655	2,616	4	198.23	.3
	Stricture of Urethra -	4	3	—	32	32	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	4	2	—	42	35	1	272	249	17	20.32	1.27
	Alcoholism { a. Del. Tremens -	41	35	6	26	24	3					
	b. Intemperance - - -	93	89	6	66	64	1					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	8	7	—	32	30	—	45	42	—	3.36	—
	Psora - - -	2	2	—	3	3	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	10	10	—	74	75	—	109	107	5	8.14	.37
	Dropsy - - -	4	4	—	21	18	5					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	1	1	—	1	1	—	94	68	26	7.02	1.94
	Scrofula - - -	8	7	—	21	21	—					
	Phthisis - - -	16	5	12	29	16	13					
	Hæmoptysis - - -	5	5	—	13	12	1					
III.	ORDER I.											
	Cephalitis - - -	7	7	—	187	170	—	511	394	38.15	5.82	
	Apoplexy - - -	24	12	12	95	32	59					
	Paralysis - - -	4	3	1	14	12	—					
	Insanity - - -	13	10	—	30	21	—					
	Tetanus - - -	—	—	—	1	—	1					
	Epilepsy - - -	7	6	1	21	18	2					
	Odontalgia - - -	1	1	—	5	5	—					
	Otitis - - -	16	16	—	80	78	1					
	Brain Disease, &c. - -	—	—	—	1	—	1					
	Dyscœa - - -	1	1	—	4	2	—					

No. 35.—Bengal ; Peshawur Station ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1849 to 1851.			Five Years, 1852 to 1856.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 2.											
	Pericarditis - - -	6	6	1	37	29	6	94	81	8	7.02	.6
	Aneurism - - -	—	—	—	1	1	—					
	Varix - - -	—	—	—	13	8	—					
	Heart Disease, &c. - -	7	8	—	30	29	1					
	ORDER 3.											
	Epistaxis - - -	—	—	—	3	3	—	283	247	37	21.31	2.76
	Bronchitis - - -	5	5	4	73	67	6					
	Pleurisy - - -	14	14	—	28	28	1					
	Pneumonia - - -	53	42	9	84	67	16					
	Asthma - - -	1	1	—	22	20	1					
	ORDER 4.											
	Dyspepsia - - -	44	44	—	196	178	1	2,309	2,178	66	172.04	4.92
	Gastritis - - -	7	7	—	22	20	1					
	Enteritis - - -	7	5	2	5	3	2					
	Peritonitis - - -	3	1	1	10	8	2					
	Ascites - - -	1	—	1	9	6	2					
	Hæmatemesis - - -	2	—	—	3	2	—					
	Hernia - - -	—	—	—	31	26	—					
	Ileus and Colic - - -	124	123	—	294	292	1					
	Hæmorrhoids - - -	42	41	—	93	93	—					
	Prolapsus Ani - - -	—	—	—	8	8	—					
	Fistula - - -	2	1	—	18	15	1					
	Obstipatio - - -	30	30	—	62	63	—					
	Hepatitis - - -	227	211	16	633	570	30					
	Jaundice - - -	44	44	—	26	25	2					
	Spleen Disease, &c. - -	94	91	1	272	271	3					
	ORDER 5.											
	Nephritis - - -	5	5	—	5	5	—	34	33	2	2.54	15
	Ischuria - - -	2	1	—	16	16	1					
	Hæmaturia - - -	1	1	—	—	—	—					
	Enuresis - - -	—	—	—	2	2	—					
	Diabetes - - -	—	—	—	1	1	1					
	Cystitis - - -	2	2	—	—	—	—					
	ORDER 6.											
	Hydrocele - - -	—	—	—	10	10	—	10	10	—	.75	—
	ORDER 7.											
	Hydrarthrus - - -	—	—	—	2	2	—	10	9	—	.75	—
	Arthritis - - -	1	1	—	2	2	—					
	Joint Disease, &c. - -	2	2	—	3	2	—					
	ORDER 8.											
	Phlegmon - - -	77	75	1	472	465	—	833	812	1	62.2	.07
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Disease, &c. - -	3	2	—	39	39	—					
IV.	ORDER 4.											
	Atrophy - - -	—	—	—	3	—	2	3	—	2	.23	.15
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Drowned - - -	—	—	—	—	—	1	773	767	5	57.72	.37
	Burns or Scalds - - -	8	8	—	18	17	—					
	Contusion - - -	174	171	—	276	279	—					
	Sub-luxation - - -	26	25	—	119	114	—					
	Luxation - - -	—	—	—	13	16	—					
	Fracture - - -	7	6	1	18	18	—					
	Wounds { Gunshot - - -	18	18	—	12	11	1					
	{ Incised - - -	32	30	—	51	52	1					
	Amputation - - -	—	—	—	1	2	—					
	Found dead - - -	—	—	—	—	—	1					
	ORDER 5.											
	Punitus - - -	6	6	—	13	15	—	484	470	9	36.14	.68
	Observatio - - -	23	20	1	442	429	8					

* No Troops separately accounted for at this Station during the Years 1847 and 1848.

No. 36.

BENGAL.—KUSSOWLIE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 8 Years - - - - 3,521
 Mean Annual Strength - - - - 440

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1847, 1848, and 1850.			Five Years, 1852 to 1856.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	1,881	1,846	75	4,044	3,973	57	5,925	5,819	132	1,682·75	37·48
	CLASSES.											
I.	ZYMOTIC DISEASES -	1,527	1,501	62	3,274	3,217	48	4,801	4,718	110	1,363·53	31·24
II.	CONSTITUTIONAL -	12	8	2	23	21	2	35	29	4	9·93	1·13
III.	LOCAL - - -	255	241	10	600	586	5	855	827	15	242·83	4·26
V.	VIOLENCE - -	87	96	1	147	149	2	234	245	3	66·46	·85
	ORDERS.											
I.	ORDER I.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	3	3	—	—	—	—	4,322	4,217	108	1,227·5	30·68
	Measles - - -	—	—	—	1	1	—					
	Quinsy - - -	34	34	—	54	53	—					
	Catarrh and Influenza -	80	78	2	168	167	2					
	Ophthalmia - - -	253	243	—	61	68	—					
	Fever (C. C.) - - -	278	267	3	290	292	1					
	Erysipelas - - -	—	—	—	1	1	—					
	Dysentery - - -	324	352	50	143	137	12					
	Diarrhœa - - -	183	187	6	672	591	25					
	Cholera - - -	2	1	1	4	3	1					
	Ague - - -	2	2	—	1,273	1,285	3					
	Remittent Fever - - -	171	139	—	1	—	1					
	Rheumatism - - -	43	38	—	281	275	1					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	132	137	—	300	316	1	437	457	1	124·11	·28
	Stricture of Urethra -	2	1	—	3	3	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	17	17	—	5	9	—	41	43	1	11·64	·28
	Alcoholism { <i>a.</i> Del. Tremens <i>b.</i> Intemperance	2 —	1 —	— —	1 16	— 16	1 —					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	1	1	—	—	—	—	1	1	—	·28	—
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	2	1	—	4	4	—	9	6	1	2·55	·28
	Dropsy - - -	2	1	1	1	—	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	6	6	—	8	8	—	26	23	3	7·38	·85
	Phthisis - - -	2	—	1	7	5	2					
	Hæmoptysis - - -	—	—	—	3	4	—					

No. 36.—Bengal; Kussowlie Station; Infantry. Stational Returns. European Troops; H.M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1847, 1848, and 1850.			Five Years, 1852 to 1856.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	1	1	—	37	41	—	93	85	7	26·41	1·99
	Apoplexy - - -	5	2	3	1	—	2					
	Paralysis - - -	4	3	1	8	7	—					
	Insanity - - -	3	1	—	8	9	—					
	Epilepsy - - -	4	2	1	12	12	—					
	Otitis - - -	1	1	—	6	5	—					
	Brain Disease, &c. - - -	2	1	—	—	—	—					
	Dysœcœa - - -	1	—	—	—	—	—					
	ORDER 2.											
	Pericarditis - - -	7	2	1	16	17	—	32	27	1	9·09	·28
	Heart Disease, &c. - - -	—	—	—	—	8	—					
	ORDER 3.											
	Epistaxis - - -	—	1	—	2	1	—	35	29	2	12·51	·57
	Bronchitis - - -	1	—	—	7	5	2					
	Pleurisy - - -	4	4	—	4	4	—					
	Pneumonia - - -	4	3	—	12	10	—					
	Asthma - - -	—	—	—	1	1	—					
	ORDER 4.											
	Dyspepsia - - -	30	31	—	43	44	—	488	477	5	138·6	1·42
	Gastritis - - -	—	—	—	2	2	—					
	Peritonitis - - -	2	1	—	1	—	1					
	Ascites - - -	—	—	—	1	1	—					
	Hernia - - -	—	—	—	1	—	—					
	Ileus and Colic - - -	13	13	—	83	83	—					
	Hæmorrhoids - - -	4	4	—	18	17	—					
	Fistula - - -	—	—	—	1	2	—					
	Obstipatio - - -	3	2	—	7	7	—					
	Hepatitis - - -	53	51	4	162	158	—					
	Jaundice - - -	3	2	—	4	4	—					
	Spleen Disease, &c. - - -	11	10	—	46	45	—					
	ORDER 5.											
	Nephritis - - -	—	—	—	3	4	—	6	7	—	1·7	—
	Ischuria - - -	—	1	—	2	1	—					
	Hæmaturia - - -	—	—	—	1	1	—					
	ORDER 6.											
	Hydrocele - - -	1	1	—	—	—	—	1	1	—	·28	—
	ORDER 8.											
	Phlegmon - - -	59	60	—	62	58	—	200	201	—	56·8	—
	Ulcer - - -	34	39	—	29	27	—					
	Tumor - - -	1	1	—	—	—	—					
	Skin Disease, &c. - - -	4	4	—	11	12	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	4	4	—	1	2	—	216	226	3	61·34	·85
	Contusion - - -	27	29	—	74	77	1					
	Sub-luxation - - -	24	28	—	37	35	—					
	Luxation - - -	—	—	—	8	7	—					
	Fracture - - -	5	4	1	6	7	—					
	Wounds { Gunshot - - -	1	2	—	2	1	—					
	{ Incised - - -	18	20	—	9	10	—					
	Found dead - - -	—	—	—	—	—	1					
	ORDER 5.											
	Punitus - - -	8	9	—	3	3	—	18	19	—	5·12	—
	Observatio - - -	—	—	—	7	7	—					

* No Troops separately accounted for at this Station during the Years 1849 and 1851.

No. 37.

BENGAL.—SEALKOTE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 7 Years - - - - 4,404
 Mean Annual Strength - - - - 652

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS from different DISEASES.

Class.	Diseases.	Two Years,* 1850 and 1851.			Five Years, 1852 to 1856.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	913	890	11	6,827	6,583	107	7,740	7,473	118	1,757.54	26.79
	CLASSES.											
I.	ZYMOTIC DISEASES -	791	766	9	5,326	5,178	57	6,117	5,944	66	1,389.01	14.98
II.	CONSTITUTIONAL -	8	7	—	92	69	12	100	76	12	22.71	2.72
III.	LOCAL - - -	92	95	2	1,003	935	35	1,095	1,030	37	248.64	8.4
V.	VIOLENCE - - -	22	22	—	406	401	3	428	423	3	97.18	.68
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	—	—	—	4	1	3	4,949	4,797	58	1,123.8	13.17
	Measles - - -	—	—	—	1	1	—					
	Quinsy - - -	—	1	—	37	36	—					
	Catarrh and Influenza -	8	7	—	174	169	1					
	Ophthalmia - - -	61	60	—	234	236	—					
	Fever (C. C.) - - -	156	154	1	1,596	1,534	17					
	Erysipelas - - -	—	—	—	1	1	—					
	Dysentery - - -	39	37	1	315	288	18					
	Diarrhœa - - -	9	9	—	218	221	—					
	Cholera - - -	2	2	—	3	2	1					
	Ague - - -	348	346	4	1,261	1,227	3					
	Remittent Fever - - -	6	2	1	54	47	6					
	Rheumatism - - -	33	27	2	389	389	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	117	114	—	964	955	3	1,112	1,093	5	252.5	1.13
	Stricture of Urethra -	7	2	—	24	22	2					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	1	1	—	12	13	—	44	42	3	9.99	.68
	Alcoholism { <i>a.</i> Del. Tremens -	2	2	—	11	9	2					
	{ <i>b.</i> Intemperance -	2	2	—	16	15	1					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	—	—	—	11	11	—	12	12	—	2.72	—
	Psora - - -	—	—	—	1	1	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	1	1	—	28	27	—	31	30	—	7.04	—
	Dropsy - - -	—	—	—	2	2	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - -	—	—	—	1	1	—	69	46	12	15.67	2.72
	Scrofula - - -	3	2	—	23	22	1					
	Phthisis - - -	2	2	—	29	8	11					
	Hæmoptysis - - -	2	2	—	9	9	—					

No. 37.—Bengal; Sealkote Station; Infantry. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.	Two Years,* 1850 and 1851.			Five Years, 1852 to 1856.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.		
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.	
III.	ORDER 1.												
	Cephalitis - - -	—	—	—	35	36	—	100	82	14	22·72	3·18	
	Apoplexy - - -	—	—	—	18	5	13						
	Paralysis - - -	—	—	—	3	2	—						
	Odontalgia - - -	—	—	—	1	1	—						
	Insanity - - -	—	—	—	13	7	—						
	Epilepsy - - -	1	2	—	18	17	1						
	Otitis - - -	—	—	—	9	10	—						
	Dysecœa - - -	—	—	—	2	2	—						
	ORDER 2.												
	Pericarditis - - -	2	2	—	23	21	1	57	55	2	12·94	·45	
	Aneurism - - -	—	—	—	2	1	1						
	Varix - - -	—	—	—	3	3	—						
	Heart Disease, &c. - - -	—	—	—	27	28	—						
	ORDER 3.												
	Epistaxis - - -	1	1	—	7	7	—	105	104	3	23·84	·68	
	Bronchitis - - -	1	2	—	31	30	1						
	Pleurisy - - -	18	20	—	32	31	—						
	Pneumonia - - -	1	—	1	13	12	1						
	Asthma - - -	—	—	—	1	1	—						
	ORDER 4.												
	Dyspepsia - - -	2	3	—	62	52	—	559	518	17	126·93	3·86	
	Gastritis - - -	—	—	—	8	8	—						
	Peritonitis - - -	3	2	1	2	1	1						
	Ascites - - -	—	—	—	2	1	1						
	Prolapsus Ani - - -	—	—	—	1	1	—						
	Hernia - - -	—	—	—	3	3	—						
	Ileus and Colic - - -	11	11	—	107	108	—						
	Hæmorrhoids - - -	1	1	—	36	37	—						
	Obstipatio - - -	2	2	—	35	35	—						
	Hepatitis - - -	25	25	—	208	179	14						
	Jaundice - - -	2	2	—	4	3	—						
	Spleen Disease, &c. - - -	1	1	—	44	43	—						
	ORDER 5.												
	Nephritis - - -	—	—	—	9	9	—	12	12	—	2·72	—	
	Hæmaturia - - -	—	—	—	3	3	—						
	ORDER 6.												
	Hydrocele - - -	—	—	—	1	1	—	1	1	—	·23	—	
	ORDER 7.												
	Hydrarthrus - - -	3	3	—	—	—	—	8	8	—	1·81	—	
	Arthritis - - -	3	3	—	2	2	—						
	ORDER 8.												
	Phlegmon - - -	5	5	—	133	135	1	253	250	1	57·45	·23	
	Ulcer - - -	4	4	—	79	74	—						
	Skin Disease, &c. - - -	6	6	—	26	26	—						
V.	ORDER 1.— <i>Accident or Negligence.</i>												
	Burns or Scalds - - -	1	1	—	5	5	—	214	212	1	48·59	·23	
	Contusion - - -	4	4	—	101	102	—						
	Sub-luxation - - -	6	6	—	54	54	—						
	Luxation - - -	—	—	—	2	2	—						
	Fracture - - -	1	1	—	15	15	—						
	Wounds - { Gunshot - - -	1	1	—	1	1	—						
	Incised - - -	3	3	—	20	17	—						
	Found dead - - -	—	—	—	—	—	1						
	ORDER 4.— <i>Suicide.</i>												
	Gunshot - - -	—	—	—	—	—	1	—	—	1	—	·23	
	ORDER 5.												
	Punitus - - -	—	—	—	1	1	—	214	211	1	48·59	·23	
	Observatio - - -	6	6	—	207	204	1						

* No Troops separately accounted for at this Station during the Years 1847, 1848, and 1849.

No. 38.

BENGAL.—AGRA STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 7 Years - - - - 3,790
Mean Annual Strength - - - - 541

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1847 to 1849.			Four Years,* 1852 to 1855.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	3,306	3,198	111	4,631	4,355	50	7,937	7,553	161	2,094·2	42·48
	CLASSES.											
I.	ZYMOTIC DISEASES -	2,719	2,658	62	3,528	3,319	20	6,247	5,977	82	1,648·3	21·63
II.	CONSTITUTIONAL -	41	31	10	49	37	8	90	68	18	23·75	4·75
III.	LOCAL - - -	444	412	39	952	899	21	1,396	1,311	60	368·34	15·83
V.	VIOLENCE - - -	102	97	—	102	100	1	204	197	1	53·82	·26
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	30	23	7	5	5	—	5,386	5,127	78	1,421·12	20·58
	Quinsy - - -	20	22	—	25	25	—					
	Catarrh and Influenza -	12	12	—	143	138	—					
	Ophthalmia - - -	144	144	—	127	118	—					
	Fever (C. C.) - - -	1,540	1,489	33	275	267	2					
	Erysipelas - - -	4	3	1	—	—	—					
	Dysentery - - -	322	317	12	68	64	4					
	Diarrhoea - - -	37	43	1	194	181	6					
	Cholera - - -	27	22	5	—	—	—					
	Ague - - -	45	46	—	2,003	1,863	4					
	Remittent Fever - - -	5	5	—	22	17	3					
	Rheumatism - - -	94	91	—	244	232	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	368	372	—	389	378	1	783	774	1	206·6	·26
	Stricture of Urethra - -	15	15	—	11	9	—					
	ORDER 3.— <i>Dietic Diseases.</i>											
	Purpura and Scurvy - -	6	7	—	9	9	—	65	63	3	17·15	·79
	Alcoholism { <i>a.</i> Del. Tremens	27	24	3	2	2	—					
	{ <i>b.</i> Intemperance	20	20	—	1	1	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	1	1	—	10	10	—	13	13	—	3·43	—
	Psora - - -	2	2	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	—	—	—	15	15	—	17	16	1	4·48	·26
	Dropsy - - -	—	—	—	2	1	1					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	11	11	—	5	4	1	73	52	17	19·27	4·49
	Phthisis - - -	23	13	10	23	14	5					
	Hæmoptysis - - -	7	7	—	4	3	1					

No. 38.—Bengal; Agra Station; Infantry. Stational Return. European Troops; H.M. Regiments—*cont.*

Class.	Diseases.	Three Years,* 1847 to 1847.			Four Years,* 1852 to 1855.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	2	2	—	14	14	—	119	89	28	31·55	7·39
	Apoplexy - - -	28	3	23	7	6	1					
	Paralysis - - -	1	1	—	8	5	3					
	Insanity - - -	1	1	—	3	2	1					
	Epilepsy - - -	18	18	—	2	2	—					
	Odontalgia - - -	1	1	—	—	—	—					
	Otitis - - -	8	8	—	23	23	—					
	Brain Disease, &c. - - -	1	1	—	—	—	—					
	Dyseecœa - - -	—	—	—	2	2	—					
	ORDER 2.											
	Pericarditis - - -	7	6	1	37	34	3	48	44	5	12·65	1·33
	Aneurism - - -	1	—	1	—	—	—					
	Varix - - -	—	—	—	1	1	—					
	Heart Disease, &c. - - -	—	1	—	2	2	—					
	ORDER 3.											
	Epistaxis - - -	3	4	—	—	—	—	42	37	4	11·08	1·04
	Bronchitis - - -	1	1	—	12	10	1					
	Pleurisy - - -	1	1	—	3	1	1					
	Hydrothorax - - -	—	—	—	1	—	1					
	Pneumonia - - -	7	6	1	2	2	—					
	Asthma - - -	8	8	—	4	4	—					
	ORDER 4.											
	Dyspepsia - - -	1	1	—	260	252	—	824	783	23	217·3	6·07
	Gastritis - - -	1	1	1	1	1	—					
	Enteritis - - -	—	—	—	7	6	1					
	Peritonitis - - -	3	1	2	4	3	1					
	Ascites - - -	1	1	1	—	—	—					
	Hæmorrhoids - - -	6	6	—	23	23	—					
	Ileus and Colic - - -	47	50	—	60	60	—					
	Hæmatemesis - - -	—	—	—	1	1	—					
	Fistula - - -	1	1	—	2	2	—					
	Obstipatio - - -	4	4	—	16	16	—					
	Hepatitis - - -	94	84	9	234	213	8					
	Jaundice - - -	8	8	—	3	3	—					
	Spleen Disease, &c. - - -	11	12	—	36	34	—					
	ORDER 5.											
	Nephritis - - -	11	11	—	9	8	—	25	24	—	6·09	—
	Ischuria - - -	4	4	—	1	1	—					
	ORDER 6.											
	Hydrocele - - -	—	—	—	2	2	—	2	2	—	·52	—
	ORDER 7.											
	Arthritis - - -	—	—	—	1	1	—	1	1	—	·26	—
	ORDER 8.											
	Phlegmon - - -	74	75	—	117	114	—	335	331	—	88·39	—
	Abscess - - -											
	Ulcer - - -											
	Skin Diseases, &c. - - -												17	16	—	9	8	—
V.	ORDER 1.											
	<i>Accident or Negligence.</i>											
	Burns or Scalds - - -	4	4	—	1	1	—	180	172	1	47·49	·26
	Contusion - - -	37	36	—	54	52	1					
	Sub-luxation - - -	28	28	—	27	27	—					
	Luxation - - -	5	3	—	—	—	—					
	Fracture - - -	7	7	—	5	4	—					
	Wounds { Gunshot - - -	5	5	—	—	—	—					
	{ Incised - - -	6	4	—	1	1	—					
	ORDER 5.											
	Punitus - - -	4	4	—	—	—	—	24	25	—	6·33	—
	Observatio - - -	6	6	—	14	15	—					

* No Troops separately accounted for at this Station during the Years 1850, 1851, and 1856...

No. 39.

BENGAL.—DUM DUM STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 7 Years - - - - 1,528
 Mean Annual Strength - - - - 218

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Two Years,* 1848 and 1849.			Five Years, 1852 to 1856.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	743	559	43	1,959	1,839	74	2,702	2,398	117	1,768·3	76·57
	CLASSES.											
I.	ZYMOTIC DISEASES -	640	475	42	1,456	1,370	58	2,096	1,845	100	1,371·74	65·44
II.	CONSTITUTIONAL -	1	1	—	18	15	2	19	16	2	12·43	1·31
III.	LOCAL - - -	87	70	1	357	336	13	444	406	14	290·57	9·16
IV.	DEVELOPMENTAL -	1	1	—	—	—	1	1	1	—	·65	—
V.	VIOLENCE - - -	14	12	—	128	118	—	142	130	1	92·93	·65
	ORDERS.											
	ORDER 1.— <i>Miasmatic Dis.</i>											
	Measles - - -	—	—	—	1	1	—	1,818	1,594	99	1,189·8	64·79
	Quinsy - - -	3	2	—	11	10	—					
	Catarrh and Influenza -	37	5	—	34	36	—					
	Ophthalmia - - -	42	25	—	49	44	—					
	Fever (C. C.) - - -	160	154	1	238	218	6					
	Dysentery - - -	24	10	6	147	123	27					
	Diarrhœa - - -	201	161	—	235	214	10					
	Cholera - - -	99	63	35	16	3	13					
	Ague - - -	1	1	—	307	308	—					
	Remittent Fever - - -	—	—	—	110	120	—					
	Rheumatism - - -	27	26	—	76	70	1					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	40	26	—	195	186	—	237	214	—	155·11	—
	Stricture of Urethra - -	1	1	—	1	1	—					
	ORDER 3.— <i>Dietic Diseases.</i>											
	Purpura and Scurvy - -	4	—	—	—	—	—	39	35	1	25·52	·65
	Alcoholism { <i>a.</i> Del. Tremens	—	—	—	4	4	1					
	{ <i>b.</i> Intemperance	1	1	—	30	30	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	—	—	—	2	2	—	2	2	—	1·31	—
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	1	1	—	5	5	—	8	8	—	5·23	—
	Dropsy - - -	—	—	—	2	2	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	—	—	—	2	1	—	11	8	2	7·2	1·31
	Phthisis - - -	—	—	—	9	7	2					
III.	ORDER 1.											
	Cephalitis - - -	—	—	—	11	11	—	42	34	7	27·40	65·44
	Apoplexy - - -	1	—	1	6	—	6					
	Paralysis - - -	—	—	—	4	5	—					
	Odontalgia - - -	—	—	—	1	1	—					
	Insanity - - -	—	—	—	1	1	—					
	Epilepsy - - -	—	—	—	2	2	—					
	Otitis - - -	7	6	—	9	8	—					

No. 39.—Bengal ; Dum Dum Station ; Infantry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Two Years,* 1848 and 1849.			Five Years, 1852 to 1856.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.		
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.	
III.	ORDER 2.												
	Pericarditis - - -	—	—	—	7	7	—	}	12	12	—	7·85	—
	Varix - - -	—	—	—	1	1	—						
	Heart Disease, &c. - -	—	—	—	4	4	—						
	ORDER 3.												
	Bronchitis - - -	—	—	—	25	20	1	}	31	24	1	20·29	·65
	Pleurisy - - -	—	—	—	1	1	—						
	Pneumonia - - -	2	1	—	2	1	—						
	Asthma - - -	—	—	—	1	1	—						
	ORDER 4.												
	Dyspepsia - - -	4	4	—	36	34	—	}	203	193	4	132·85	2·63
	Gastritis - - -	—	—	—	7	7	—						
	Ascites - - -	—	—	—	1	—	—						
	Hæmorrhoids - - -	7	7	—	12	12	—						
	Hernia - - -	2	—	—	—	—	—						
	Ileus and Colic - - -	6	6	—	36	34	—						
	Prolapsus Ani - - -	—	—	—	1	1	—						
	Fistula - - -	—	—	—	2	3	—						
	Obstipatio - - -	2	2	—	10	10	—						
	Hepatitis - - -	2	1	—	54	52	4						
	Jaundice - - -	—	—	—	5	4	—						
	Spleen Disease, &c. - -	—	—	—	16	16	—						
	ORDER 5.												
	Ischuria - - -	—	—	—	2	3	—	2	3	—	1·31	—	
	ORDER 6.												
	Hydrocele - - -	—	—	—	1	1	1	1	1	1	·65	·65	
	ORDER 7.												
	Arthritis - - -	—	—	—	2	2	—	}	3	4	—	1·96	—
	Joint Disease, &c. - -	—	—	—	1	2	—						
	ORDER 8.												
	Phlegmon - - -	30	26	—	56	54	1	}	150	135	1	98·17	·65
	Ulcer - - -	23	17	—	34	32	—						
	Skin Disease, &c. - -	1	—	—	6	6	—						
IV.	ORDER 4.												
	Atrophy - - -	1	1	—	—	—	—	1	1	—	·65	—	
V.	ORDER 1.— <i>Accident or Negligence.</i>												
	Burns or Scalds - - -	—	—	—	1	—	—	}	100	92	1	65·44	·65
	Contusion - - -	9	8	—	52	46	1						
	Sub-luxation - - -	—	—	—	22	23	—						
	Luxation - - -	—	—	—	2	2	—						
	Fracture - - -	—	—	—	4	4	—						
	Wounds, Incised - - -	4	3	—	6	6	—						
	ORDER 5.												
	Punitus - - -	—	—	—	2	1	—	}	42	38	—	27·49	—
	Observatio - - -	1	1	—	39	36	—						

* No Troops separately accounted for at this Station during the Years 1847, 1850, and 1851.

No. 40.

BENGAL.—CAWNPORE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 7 Years - - - - 4,973
 Mean Annual Strength - - - - 710

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1847, 1850, and 1851.			Four Years,* 1852 to 1854, and 1856.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	7,502	7,232	173	5,378	5,126	282	12,950	12,358	455	2,604.03	91.48
	CLASSES.											
I.	ZYMOTIC DISEASES -	5,971	5,778	110	4,506	4,239	252	10,477	10,017	362	2,106.74	72.79
II.	CONSTITUTIONAL -	74	50	20	49	34	12	123	84	32	24.73	6.43
III.	LOCAL - - -	1,191	1,147	42	716	674	17	1,907	1,821	59	383.48	11.86
V.	VIOLENCE - - -	266	257	1	177	179	1	443	436	2	89.08	.4
	ORDERS.											
I.	ORDER I.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	4	3	1	7	5	2	8,873	8,364	356	1,784.2	71.58
	Vaccinia - - -	2	2	—	—	—	—					
	Measles - - -	1	1	—	—	—	—					
	Quinsy - - -	30	31	—	23	20	2					
	Catarrh and Influenza -	243	238	3	226	196	3					
	Ophthalmia - - -	380	379	—	117	121	—					
	Fever (C. C.) - - -	1,136	1,113	18	1,161	1,145	16					
	Dysentery - - -	515	479	35	270	251	18					
	Diarrhœa - - -	552	537	14	503	493	4					
	Cholera - - -	39	9	24	266	80	187					
	Ague - - -	1,353	1,349	3	1,170	1,152	16					
	Remittent Fever - - -	305	294	6	36	34	2					
	Rheumatism - - -	297	194	2	237	238	1					
	ORDER 2.— <i>Enthetic Dis.</i>							1,291	1,337	2	259.6	.4
	Syphilis, &c. - - -	958	991	2	326	340	—					
	Stricture of Urethra -	4	4	—	3	2	—					
	ORDER 3.— <i>Dietic Dis.</i>							268	270	4	53.89	.81
	Purpura and Scurvy - -	2	2	—	4	4	—					
	Alcoholism { <i>a.</i> Del. Tremens <i>b.</i> Intemperance	57 70	59 70	3 —	17 118	17 118	— 1					
	ORDER 4.— <i>Parasitic Dis.</i>							45	46	—	9.05	—
	Vermes - - -	12	12	—	19	20	—					
	Psora - - -	11	11	—	3	3	—					
II.	ORDER I.— <i>Diathetic Dis.</i>							39	34	1	7.84	.2
	Lumbago - - -	20	19	—	10	9	—					
	Dropsy - - -	3	2	1	6	4	—					
	ORDER 2.— <i>Tubercular Dis.</i>							84	50	31	16.89	.23
	Scrofula - - -	15	12	—	6	6	—					
	Phthisis - - -	31	13	18	16	7	10					
	Hæmoptysis - - -	5	4	1	11	8	2					

No. 40.—Bengal ; Cawnpore Station ; Infantry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1847, 1850, and 1851.			Four Years,* 1852 to 1854, and 1855.			Total for 7 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	1	1	—	4	3	—	173	141	32	34.79	6.43
	Apoplexy - - -	29	12	21	12	6	6					
	Paralysis - - -	4	3	1	4	2	1					
	Insanity - - -	5	3	2	2	2	—					
	Epilepsy - - -	7	7	—	13	13	—					
	Odontalgia - - -	10	10	—	7	7	—					
	Otitis - - -	51	50	—	18	18	—					
	Brain Disease, &c. - -	1	—	1	4	4	—	41	36	1	8.24	.2
	Dyseccœa - - -	—	—	—	1	—	—					
	ORDER 2.											
	Pericarditis - - -	5	5	—	28	24	—					
	Aneurism - - -	1	—	1	—	—	—					
	Varix - - -	—	—	—	4	4	—					
	Heart Disease, &c. - -	3	3	—	—	—	—					
	ORDER 3.											
	Epistaxis - - -	—	—	—	2	2	—	91	81	5	18.3	1.
	Bronchitis - - -	21	19	—	8	6	1					
	Pleurisy - - -	6	6	—	—	—	—					
	Pneumonia - - -	22	19	2	26	23	2					
	Asthma - - -	2	1	—	4	5	—					
	ORDER 4.											
	Dyspepsia - - -	46	44	—	36	35	—	895	872	20	179.97	4.03
	Gastritis - - -	2	3	—	13	13	—					
	Enteritis - - -	1	1	—	6	6	—					
	Peritonitis - - -	1	1	—	1	1	—					
	Ascites - - -	2	1	1	4	2	2					
	Hæmatemesis - - -	1	1	—	3	3	—					
	Hernia - - -	—	—	—	2	1	—					
	Ileus and Colic - - -	220	221	—	91	92	—					
	Prolapsus Ani - - -	—	—	—	2	2	—					
	Hæmorrhoids - - -	31	30	—	32	26	—					
	Fistula - - -	4	4	—	15	13	—					
	Obstipatio - - -	85	90	—	34	34	—					
	Hepatitis - - -	133	121	11	76	71	5					
	Jaundice - - -	6	5	1	7	8	—					
	Spleen Disease, &c. - -	23	25	—	18	18	—					
	ORDER 5.											
	Nephritis - - -	6	5	—	—	—	—	17	15	—	3.42	—
	Ischuria - - -	6	6	—	2	2	—					
	Diabetes - - -	2	2	—	—	—	—					
	Cystitis - - -	1	—	—	—	—	—					
	ORDER 6.											
	Hydrocele - - -	4	4	—	2	2	—	6	6	1	1.2	—
	ORDER 7.											
	Joint Disease, &c. - -	1	1	—	—	—	—	1	1	—	.22	—
	ORDER 8.											
	Phlegmon - - -	303	296	—	153	148	—	683	669	1	137.34	.2
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Disease, &c. - -	34	36	—	11	11	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	4	4	—	1	1	—	403	397	2	81.04	.4
	Contusion - - -	143	139	—	127	128	—					
	Sub-luxation - - -	49	49	—	20	20	—					
	Fracture - - -	13	12	—	1	1	—					
	Wounds { Gunshot - - -	5	4	—	—	—	—					
	Incised - - -	21	19	—	19	20	1					
	Drowned - - -	—	—	1	—	—	—	40	39	—	8.04	—
	ORDER 5.											
	Punitus - - -	3	2	—	4	4	—					
	Observatio - - -	28	28	—	5	5	—					

* No Troops separately accounted for at this Station during the Years 1848, 1849, and 1855.

No. 41.

BENGAL.—ALLAHABAD STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 7 Years - - - - - 668.
Mean Annual Strength - - - - - 95

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Four Years,* 1847 to 1850.			Three Years,* 1854 to 1856.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	838	768	74	163	184	8	1,001	952	82	1,498·54	122·75
	CLASSES.											
I.	ZYMOTIC DISEASES -	658	609	50	127	143	6	785	752	56	1,175·2	83·83
II.	CONSTITUTIONAL -	6	3	3	1	—	2	7	3	5	10·47	7·48
III.	LOCAL - - -	138	117	21	24	25	—	162	142	21	242·52	31·44
IV.	DEVELOPMENTAL -	1	1	—	—	—	—	1	1	—	1·49	—
V.	VIOLENCE - - -	35	38	—	11	16	—	46	54	—	68·86	—
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	1	—	1	1	1	—	719	688	55	1,076·4	82·34
	Quinsy - - -	4	4	—	3	3	—					
	Catarrh and Influenza -	10	10	—	5	6	—					
	Ophthalmia - - -	96	97	—	6	8	—					
	Fever (C. C.) - - -	292	264	28	4	4	—					
	Erysipelas - - -	—	—	—	1	1	—					
	Dysentery - - -	115	101	14	7	5	—					
	Diarrhoea - - -	51	47	2	44	60	6					
	Cholera - - -	7	5	2	1	2	—					
	Ague - - -	14	15	—	17	18	—					
	Remittent Fever - -	14	7	2	—	—	—					
	Rheumatism - - -	20	23	—	6	7	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	23	24	—	31	28	—	54	52	—	80·84	—
	ORDER 3.— <i>Dietic Dis.</i>											
	Alcoholism { <i>a.</i> Del. Tremens	10	11	1	—	—	—	12	12	1	17·96	1·49
	<i>b.</i> Intemperance	1	1	—	1	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Dropsy - - -	1	1	—	—	—	—	1	1	—	1·49	—
	ORDER 2.— <i>Tubercular Dis.</i>											
	Phthisis - - -	5	2	3	—	—	1	6	2	5	8·98	7·48
	Hæmoptysis - - -	—	—	—	1	—	1					
III.	ORDER 1.											
	Cephalitis - - -	3	3	—	2	2	—	30	17	12	44·91	17·97
	Apoplexy - - -	12	—	12	—	—	—					
	Insanity - - -	2	2	—	1	1	—					
	Epilepsy - - -	3	3	—	—	—	—					
	Otitis - - -	7	6	—	—	—	—					

No. 41.—Bengal ; Allahabad Station ; Infantry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Four Years,* 1847 to 1850.			Three Years,* 1854 to 1856.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 2.											
	Heart Disease, &c. " "	—	—	—	—	1	—	—	1	—	—	—
	ORDER 3.											
	Bronchitis " " "	5	5	—	—	—	—	}	16	14	2	23·95
	Pleurisy " " "	—	—	—	1	1	—					
	Pneumonia " " "	6	4	2	4	4	—					
	ORDER 4.											
	Dyspepsia " " "	22	22	—	1	—	—	}	78	73	6	116·77
	Enteritis " " "	1	—	1	—	—	—					
	Ascites " " "	—	—	—	1	1	—					
	Hæmatemesis " " "	2	2	—	—	—	—					
	Hernia " " "	2	2	—	—	—	—					
	Ileus and Colic " " "	—	—	—	1	1	—					
	Hæmorrhoids " " "	2	2	—	1	1	—					
	Obstipatio " " "	—	—	—	1	1	—					
	Hepatitis " " "	29	25	5	3	3	—					
	Jaundice " " "	1	1	—	—	—	—					
	Spleen Disease, &c. " "	11	12	—	—	—	—					
	ORDER 5.											
	Nephritis " " "	2	2	—	—	—	—	}	4	4	—	5·99
	Ischuria " " "	—	—	—	2	1	—					
	Cystitis " " "	—	1	—	—	—	—					
	ORDER 7.											
	Arthritis " " "	—	—	—	1	1	—	1	1	—	1·49	—
	ORDER 8.											
	Phlegmon " " "	18	17	1	3	3	—	}	33	32	1	49·41
	Ulcer " " "	10	8	—	1	4	—					
	Skin Disease, &c. " "	—	—	—	1	—	—					
IV.	ORDER 4.											
	Atrophy " " "	1	1	—	—	—	—	1	1	—	1·49	—
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds " " "	—	—	—	2	2	—	}	38	42	—	56·88
	Contusion " " "	28	29	—	5	6	—					
	Sub-luxation " " "	—	—	—	1	1	—					
	Fracture " " "	1	1	—	—	1	—					
	Wounds, Incised " " "	—	1	—	1	1	—					
	ORDER 5.											
	Punitus " " "	2	2	—	—	—	—	}	8	12	—	11·98
	Observatio " " "	4	5	—	2	5	—					

* No Troops separately accounted for at this Station during the Years 1851 to 1853.

No. 42.

BENGAL.—CHINSURAH STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 6 Years - - - - 692
 Mean Annual Strength - - - - 115

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by Different DISEASES.

Class.	Diseases.	Three Years,* 1847, 1849, and 1851.			Three Years,* 1852 to 1854.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	297	231	18	536	553	11	833	784	29	1,203·76	41·91
	CLASSES.											
I.	ZYMOTIC DISEASES -	229	175	15	382	398	5	611	573	20	882·95	28·90
II.	CONSTITUTIONAL -	6	2	2	14	12	3	20	14	5	28·90	7·22
III.	LOCAL - - -	46	41	—	99	100	3	145	141	3	209·54	4·34
V.	VIOLENCE - - -	16	13	1	41	43	—	57	56	1	82·37	1·45
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Quinsy - - -	—	—	—	3	3	—	492	461	20	710·98	28·90
	Catarrh and Influenza - -	17	15	—	23	23	—					
	Ophthalmia - - -	41	28	—	13	16	—					
	Fever (C. C.) - - -	37	41	1	16	15	1					
	Dysentery - - -	20	16	1	39	38	2					
	Diarrhœa - - -	40	34	—	49	42	1					
	Cholera - - -	16	4	11	3	1	1					
	Ague - - -	4	4	—	45	47	—					
	Remittent Fever - - -	1	1	2	49	55	—					
	Rheumatism - - -	12	9	—	64	69	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	37	20	—	51	62	—	89	82	—	128·62	—
	Stricture of Urethra - -	1	—	—	—	—	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	1	1	—	16	17	—	27	28	—	39·02	—
	Alcoholism { <i>a.</i> Del. Tremens	1	1	—	4	4	—					
	{ <i>b.</i> Intemperance	1	1	—	4	4	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	—	—	—	3	2	—	3	2	—	4·33	—
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	—	—	—	1	—	—	2	1	—	2·89	—
	Dropsy - - -	1	1	—	—	—	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	—	—	—	1	2	—	18	13	5	26·01	7·22
	Phthisis - - -	4	1	2	9	8	2					
	Hæmoptysis - - -	1	—	—	3	2	1					
III.	ORDER 1.											
	Cephalitis - - -	1	1	—	2	2	—	9	9	—	13·	—
	Insanity - - -	1	1	—	1	1	—					
	Epilepsy - - -	—	—	—	2	2	—					
	Otitis - - -	2	2	—	—	—	—					

No. 42.—Bengal ; Chinsurah Station ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1847, 1849, and 1851.			Three Years,* 1852 to 1854.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.		
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.	
III.	ORDER 2.												
	Pericarditis - - -	—	—	—	2	1	2	}	3	1	2	4·33	2·89
	Aneurism - - -	—	—	—	1	—	—						
	ORDER 3.												
	Bronchitis - - -	1	1	—	—	—	—	}	4	6	—	5·79	—
	Pneumonia - - -	—	—	—	2	3	—						
	Asthma - - -	—	1	—	1	1	—						
	ORDER 4.												
	Dyspepsia - - -	10	7	—	6	5	—	}	67	66	—	96·83	—
	Enteritis - - -	1	1	—	—	—	—						
	Illeus and Colic - - -	2	2	—	14	16	—						
	Hæmorrhoids - - -	3	4	—	5	4	—						
	Fistula - - -	—	—	—	2	2	—						
	Obstipatis - - -	—	—	—	4	4	—						
	Hepatitis - - -	3	3	—	15	16	—						
	Jaundice - - -	1	1	—	—	—	—						
	Spleen Disease, &c. - - -	—	—	—	1	1	—						
	ORDER 5.												
	Nephritis - - -	—	—	—	1	1	—	}	3	2	1	4·33	1·45
	Ischuria - - -	—	—	—	2	1	1						
	ORDER 6.												
	Hydrocele - - -	1	—	—	—	—	—	1	—	—	1·45	—	
	ORDER 7.												
	Joint Disease, &c. - - -	—	—	—	—	1	—	—	1	—	—	—	
	ORDER 8.												
	Phlegmon - - -	11	9	—	29	34	—	}	58	56	—	83·81	—
	Ulcer - - -	8	7	—	9	4	—						
	Skin Disease, &c. - - -	1	1	—	—	1	—						
V.	ORDER 1.— <i>Accident or Negligence.</i>												
	Contusion - - -	8	6	—	25	25	—	}	46	45	1	66·47	1·45
	Sub-luxation - - -	3	2	—	2	3	—						
	Fracture - - -	—	—	—	5	5	—						
	Wounds { Gunshot - - -	1	1	—	—	—	—						
	{ Incised - - -	1	1	—	1	2	—						
	Drowned - - -	—	—	1	—	—	—						
	ORDER 5.												
	Observatio - - -	3	3	—	8	8	—	11	11	—	15·90	—	

* No Troops separately accounted for at this Station during the Years 1848, 1850, 1855, and 1856.

No. 43.

BENGAL.—DUGSHAI STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 6 Years - - - - 4,311
 Mean Annual Strength - - - - 719

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Two Years,* 1850 and 1851.			Four Years,* 1852 to 1855.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	2,227	2,266	34	5,232	4,992	121	7,459	7,258	155	1,730·29	35·95
	CLASSES.											
I.	ZYMOTIC DISEASES -	1,452	1,477	18	4,055	3,880	94	5,507	5,357	112	1,277·5	25·98
II.	CONSTITUTIONAL -	18	18	2	38	34	4	56	52	6	12·99	1·39
III.	LOCAL - - -	602	606	10	841	788	17	1,443	1,394	27	334·72	6·26
V.	VIOLENCE - - -	155	165	4	298	290	6	453	455	10	105·08	2·32
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Quinsy - - -	26	27	—	47	41	—	4,841	4,667	107	1,122·91	24·83
	Catarrh and Influenza - -	77	86	—	291	285	3					
	Ophthalmia - - -	42	44	—	164	158	—					
	Fever (C. C.) - - -	354	362	—	477	303	13					
	Erysipelas - - -	6	2	—	3	2	1					
	Dysentery - - -	82	82	10	107	86	17					
	Diarrhoea - - -	244	245	3	1,173	1,168	50					
	Cholera - - -	—	—	—	14	12	1					
	Ague - - -	185	190	1	903	927	5					
	Remittent Fever - - -	6	7	—	19	20	2					
	Rheumatism - - -	187	183	1	434	437	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	231	238	1	366	393	1	615	643	2	142·76	·46
	Stricture of Urethra - -	1	1	—	17	11	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	1	—	1	5	4	1	39	35	3	9·05	69
	Alcoholism { <i>a.</i> Del. Tremens <i>b.</i> Intemperance	4 —	4 —	— 1	3 26	2 25	— —					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	6	6	—	5	5	—	12	12	—	2·78	—
	Psora - - -	—	—	—	1	1	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	14	15	—	15	16	—	36	37	1	8·35	·23
	Dropsy - - -	2	2	—	5	4	1					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	—	—	—	6	6	—	20	15	5	4·64	1·16
	Phthisis - - -	1	—	2	7	5	1					
	Hæmoptysis - - -	1	1	—	5	3	2					
III.	ORDER 1.											
	Cephalitis - - -	15	15	—	42	43	—	132	127	3	30·62	·69
	Apoplexy - - -	2	2	—	1	1	—					
	Paralysis - - -	13	11	1	4	3	1					
	Insanity - - -	5	3	1	2	—	—					
	Odontalgia - - -	—	—	—	1	1	—					
	Epilepsy - - -	14	16	—	13	13	—					
	Otitis - - -	10	9	—	9	9	—					
	Brain Disease, &c. - -	—	—	—	1	1	—					

No. 43.—Bengal; Dugshai Station; Infantry. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.	Two Years,* 1850 and 1851.			Four Years,* 1852 to 1855.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.									
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.								
III.	ORDER 2.																			
	Pericarditis - - -	6	4	1	10	7	—	}	39	32	1	9·05	·23							
	Varix - - -	3	3	—	3	2	—													
	Heart Disease, &c. - -	—	—	—	17	16	—													
	ORDER 3.																			
	Bronchitis - - -	3	3	—	17	13	1	}	87	67	7	20·18	1·62							
	Pleurisy - - -	—	—	—	17	8	1													
	Pneumonia - - -	2	2	—	12	7	4													
	Asthma - - -	33	33	—	3	1	1													
	ORDER 4.																			
	Dyspepsia - - -	51	54	—	89	92	1	}	857	847	16	198·8	3·72							
	Gastritis - - -	1	1	—	12	11	1													
	Enteritis - - -	1	1	—	—	—	—													
	Peritonitis - - -	—	—	—	4	1	3													
	Ascites - - -	—	—	—	1	2	—													
	Hæmatemesis - - -	—	—	—	2	2	—													
	Hernia - - -	1	1	—	4	4	—													
	Ileus and Colic - - -	36	36	—	105	106	—													
	Hæmorrhoids - - -	60	62	—	26	24	—													
	Prolapsus Ani - - -	1	1	—	—	—	—													
	Fistula - - -	—	—	—	3	3	—													
	Obstipatio - - -	6	6	—	16	16	—													
	Hepatitis - - -	171	169	7	119	115	3													
	Jaundice - - -	6	6	—	7	4	—													
	Spleen Disease, &c. - -	48	49	—	87	81	1													
	ORDER 5.																			
	Nephritis - - -	—	1	—	9	8	—	}	21	22	—	4·87	—							
	Ischuria - - -	8	8	—	2	3	—													
	Enuresis - - -	—	—	—	2	2	—													
	ORDER 6																			
	Hydrocele - - -	—	—	—	1	1	—	}	2	2	—	·46	—							
	Testis Disease, &c. - -	—	—	—	1	1	—													
	ORDER 7.																			
	Contractura - - -	3	3	—	—	—	—	3	3	—	·69	—								
	ORDER 8.																			
	Phlegmon - - -	}	48	48	—	101	91	—	}	302	294	—	70·05	—						
	Abscess - - -																			
	Ulcer - - -														49	53	—	83	82	—
	Tumor - - -														—	—	—	1	1	—
	Skin Disease, &c. - -														7	7	—	13	12	—
V.	ORDER 1.— <i>Accident or Negligence.</i>																			
	Burns or Scalds - - -	3	3	—	1	2	—	}	376	382	4	87·22	·93							
	Contusion - - -	88	97	—	179	176	—													
	Sub-luxation - - -	38	38	—	24	22	—													
	Luxation - - -	2	3	—	1	1	—													
	Fracture - - -	1	1	—	6	6	—													
	Wounds { Gunshot - - -	2	1	1	2	2	—													
	{ Incised - - -	16	17	—	13	13	—													
	Drowned - - -	—	—	2	—	—	—													
	Found dead - - -	—	—	1	—	—	—													
	ORDER 4.— <i>Suicide.</i>																			
	Gunshot Wound - - -	—	—	—	—	—	1	—	—	1	—	·23								
	ORDER 5.																			
	Punitus - - -	5	5	—	3	3	—	}	77	73	5	17·86	1·16							
	Observatio - - -	—	—	—	69	65	5													

* No Troops separately accounted for at this Station during the Years 1847, 1848, 1849, and 1856.

No. 44.

BENGAL.—MURREE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 6 Years - - - - 425
Mean Annual Strength - - - - 71

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year,* 1851.			Five Years, 1852 to 1856.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	92	89	3	872	822	36	964	911	39	2,268·3	91·76
	CLASSES.											
I.	ZYMOTIC DISEASES -	59	58	1	585	568	21	644	626	22	1,515·31	51·76
II.	CONSTITUTIONAL -	4	4	—	13	9	3	17	13	3	40·0	7·06
III.	LOCAL - - -	26	24	2	241	213	12	267	237	14	628·24	32·94
V.	VIOLENCE - - -	3	3	—	33	32	—	36	35	—	84·7	—
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Quinsy - - -	—	—	—	8	8	—	589	576	20	1,385·9	47·06
	Catarrh and Influenza -	5	5	—	27	26	1					
	Ophthalmia - - -	8	8	—	20	20	—					
	Fever (C. C.) - - -	—	—	—	10	10	—					
	Erysipelas - - -	—	—	—	1	1	—					
	Dysentery - - -	4	4	—	71	61	12					
	Diarrhœa - - -	4	3	1	113	107	2					
	Ague - - -	6	9	—	211	210	1					
	Remittent Fever - -	21	18	—	13	11	2					
	Rheumatism - - -	6	6	—	61	69	1					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	3	3	—	33	31	2	38	36	2	89·41	4·7
	Stricture of Urethra -	—	—	—	2	2	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy -	—	—	—	6	4	—	17	14	—	40·0	—
	Alcoholism { a. Del. Tremens	1	1	—	4	4	—					
	{ b. Intemperance	1	1	—	5	4	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	—	—	—	1	1	—	7	6	—	16·47	—
	Dropsy - - -	1	1	—	5	4	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	2	2	—	2	2	—	10	7	3	23·53	7·06
	Phthisis - - -	1	1	—	3	—	3					
	Hæmoptysis - - -	—	—	—	2	2	—					

No. 44.—Bengal; Murree Station; Infantry. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.	One Year,* 1851.			Five Years, 1852 to 1856.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	—	—	—	5	5	—	21	20	1	49·41	2·35
	Apoplexy - - -	—	—	—	1	—	1					
	Paralysis - - -	—	—	—	2	2	—					
	Epilepsy - - -	1	1	—	11	11	—					
	Otitis - - -	—	—	—	1	1	—					
	ORDER 2.											
	Pericarditis - - -	—	—	—	1	1	—	3	2	1	7·06	2·35
	Hydrothorax - - -	1	—	1	—	—	—					
	Heart Disease, &c. - - -	—	—	—	1	1	—					
	ORDER 3.											
	Bronchitis - - -	—	—	—	1	1	—	6	6	1	14·12	2·35
	Pleurisy - - -	1	1	—	1	1	—					
	Pneumonia - - -	—	—	—	3	3	1					
	ORDER 4.											
	Dyspepsia - - -	1	1	—	15	5	—	218	191	11	512·94	25·89
	Gastritis - - -	1	—	1	1	1	—					
	Enteritis - - -	1	1	—	1	1	—					
	Peritonitis - - -	—	—	—	1	—	1					
	Hæmorrhoids - - -	1	1	—	1	1	—					
	Ileus and Colic - - -	—	—	—	8	8	—					
	Fistula - - -	3	3	—	—	—	—					
	Obstipatio - - -	2	2	—	1	1	—					
	Hepatitis - - -	8	8	—	137	110	9					
	Jaundice - - -	—	—	—	2	2	—					
	Spleen Disease - - -	5	5	—	29	31	—					
	ORDER 8.											
	Phlegmon - - -	—	—	—	6	6	—	19	18	—	44·71	—
	Ulcer - - -	1	1	—	9	9	—					
	Skin Disease, &c. - - -	—	—	—	3	2	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	—	—	—	2	2	—	19	19	—	44·71	—
	Contusion - - -	2	2	—	8	8	—					
	Sub-luxation - - -	—	—	—	3	3	—					
	Fracture - - -	—	—	—	1	1	—					
	Wounds { Gunshot - - -	1	1	—	—	—	—					
	{ Incised - - -	—	—	—	2	2	—					
	ORDER 5.											
	Observatio - - -	—	—	—	17	16	—	17	16	—	40·	—

* No Troops separately accounted for at this Station during the Years 1847 to 1850.

No. 45.

BENGAL.—KURRACHEE.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 4 Years	-	-	-	-	416
Mean Annual Strength	-	-	-	-	104

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Four Years,* 1853 to 1856.			Total for 4 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	573	591	17	573	591	17	1,377·5	40·86
	CLASSES.								
I.	ZYMOTIC DISEASES - -	432	448	15	432	448	15	1,038·56	36·06
II.	CONSTITUTIONAL - -	9	9	1	9	9	1	21·63	2·4
III.	LOCAL - - - -	107	108	1	107	108	1	257·22	2·4
V.	VIOLENCE - - - -	25	26	—	25	26	—	60·09	—
	ORDERS.								
I.	ORDER I.— <i>Miasmatic Dis.</i>								
	Quinsy - - - -	4	4	—	366	376	15	879·81	36·06
	Catarrh and Influenza - -	47	48	—					
	Ophthalmia - - - -	12	12	—					
	Fever (C. C.) - - - -	12	13	—					
	Dysentery - - - -	33	35	4					
	Diarrhœa - - - -	176	175	8					
	Ague - - - -	29	37	—					
	Remittent Fever - - - -	6	5	2					
	Rheumatism - - - -	47	47	1					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	57	62	—	57	62	—	137·02	—
	ORDER 3.— <i>Dietic Dis.</i>								
	Purpura and Scurvy - - - -	8	9	—	8	9	—	19·23	—
	ORDER 4.— <i>Parasitic Dis.</i>								
	Psora - - - -	1	1	—	1	1	—	2·4	—
II.	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	4	5	—	9	9	1	21·63	2·4
	Hæmoptysis - - - -	5	4	1					

No. 45.—Bengal ; Kurrachee Station ; Infantry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Four Years,* 1853 to 1856.			Total for 4 Years.*			Annual Ratio per 1000 of Mean Strength.		
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.	
III.	ORDER 1.									
	Cephalitis - - - -	4	4	—	}	28	28	—	67·31	—
	Paralysis - - - -	3	3	—						
	Insanity - - - -	15	15	—						
	Epilepsy - - - -	5	5	—						
	Otitis - - - -	1	1	—						
	ORDER 2.									
	Pericarditis - - - -	12	11	1	12	11	1	28·84	2·4	
	ORDER 3.									
	Bronchitis - - - -	3	3	—	}	4	6	—	9·62	—
	Pneumonia - - - -	1	3	—						
	ORDER 4.									
	Dyspepsia - - - -	8	8	—	}	30	30	—	72·12	—
	Ascites - - - -	1	1	—						
	Hæmorrhoids - - - -	2	2	—						
	Fistula - - - -	1	1	—						
	Hepatitis - - - -	17	17	—						
	Spleen Disease, &c. - - - -	1	1	—						
	ORDER 5.									
	Hydrocele - - - -	1	1	—	}	2	2	—	4·81	—
	Testis Disease, &c. - - - -	1	1	—						
	ORDER 8.									
	Phlegmon - - - -	15	15	—	}	31	31	—	74·52	—
	Ulcer - - - -	15	15	—						
	Skin Disease, &c. - - - -	1	1	—						
V.	ORDER 1.— <i>Accident or Negligence.</i>									
	Burns or Scalds - - - -	1	1	—	}	24	24	—	57·68	—
	Contusion - - - -	16	16	—						
	Sub-luxation - - - -	2	2	—						
	Fracture - - - -	1	1	—						
	Wounds, Incised - - - -	4	4	—						
	ORDER 5.									
	Punitas - - - -	1	1	—	}	1	2	—	2·41	—
	Observatio - - - -	—	1	—						

* No Troops separately accounted for at this Station during the Years 1847 to 1852.

N.B.—Invalids are included in these Numbers, but the Returns do not enable them to be distinguished.

No. 46.

BENGAL.—SUBATHOO STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 3 Years	-	-	-	-	439
Mean Annual Strength	-	-	-	-	146

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1853 to 1855.			Total for 3 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	674	640	23	674	640	23	1,535·3	52·39
	CLASSES.								
I.	ZYMOTIC DISEASES - -	520	491	20	520	491	20	1,184·5	45·55
II.	CONSTITUTIONAL - -	5	4	2	5	4	2	11·39	4·56
III.	LOCAL - - - -	126	122	1	126	122	1	287·02	2·28
V.	VIOLENCE - - - -	23	23	—	23	23	—	52·39	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Quinsy - - - -	12	12	1	446	418	20	1,015·93	45·55
	Catarrh and Influenza - -	34	33	1					
	Ophthalmia - - - -	57	61	—					
	Fever (C. C.) - - - -	100	87	3					
	Erysipelas - - - -	2	2	—					
	Dysentery - - - -	12	12	2					
	Diarrhœa - - - -	80	67	12					
	Ague - - - -	107	103	—					
	Remittent Fever - - - -	2	1	1	71	70	—	161·73	—
	Rheumatism - - - -	40	40	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	71	70	—					
	ORDER 3.— <i>Dietic Dis.</i>								
	Purpura and Scurvy - - - -	1	1	—					
	ORDER 4.— <i>Parasitic Dis.</i>								
	Vermes - - - -	1	1	—	2	2	—	4·56	—
	Psora - - - -	1	1	—					

No. 46.—Bengal ; Subathoo Station ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1853 to 1855.			Total for 3 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
II.	ORDER 2.— <i>Tubercular Dis.</i>								
	Phthisis - - - -	5	4	2	5	4	2	11.39	4.56
III.	ORDER 1.								
	Cephalitis - - - -	2	2	—	16	19	—	36.45	—
	Paralysis - - - -	5	5	—					
	Epilepsy - - - -	6	9	—					
	Otitis - - - -	3	3	—					
	ORDER 2.								
	Pericarditis - - - -	3	2	—	4	3	—	9.11	—
	Heart Disease, &c. - - - -	1	1	—					
	ORDER 3.								
	Bronchitis - - - -	3	3	—	6	6	—	13.67	—
	Pneumonia - - - -	3	3	—					
	ORDER 4.								
	Dyspepsia - - - -	29	25	—	58	52	1	132.12	2.28
	Ileus and Colic - - - -	8	7	—					
	Obstipatio - - - -	2	2	—					
	Hepatitis - - - -	13	12	1					
	Spleen Disease, &c. - - - -	6	6	—					
	ORDER 8.								
	Phlegmon - - - -	29	29	—	42	42	—	95.67	—
	Ulcer - - - -	11	11	—					
	Tumor - - - -	2	2	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Contusion - - - -	5	5	—	20	20	—	45.55	—
	Sub-luxation - - - -	13	13	—					
	Wound, Incised - - - -	2	2	—					
	ORDER 5.								
	Observatio - - - -	3	3	—	3	3	—	6.84	—

* No Troops separately accounted for at this Station during the Years 1847 to 1853 and 1856.

No. 47.

BENGAL.—GOVINGHUR STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS,—NON-COMMISSIONED OFFICERS AND MEN,

Aggregate Strength for 2 Years - - - - 107
 Mean Annual Strength - - - - 54

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1851.*			One Year, 1852.*			Total for 2 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	185	181	—	2	5	—	187	186	—	1,747·7	—
	CLASSES.											
I.	ZYMOTIC DISEASES -	158	157	—	2	3	—	160	160	—	1,495·3	—
II.	CONSTITUTIONAL -	—	—	—	—	—	—	—	—	—	—	—
III.	LOCAL - - -	14	11	—	—	2	—	14	13	—	130·84	—
V.	VIOLENCE - - -	13	13	—	—	—	—	13	13	—	121·49	—
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Ophthalmia - - -	4	4	—	—	—	—	152	152	—	1,420·53	—
	Fever (C. C.) - - -	1	1	—	1	1	—					
	Dysentery - - -	1	1	—	—	—	—					
	Diarrhœa - - -	2	2	—	—	—	—					
	Ague - - -	138	136	—	1	2	—					
	Remittent Fever - - -	1	2	—	—	—	—					
	Rheumatism - - -	3	3	—	—	—	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	7	7	—	—	—	—	7	7	—	65·42	—
	ORDER 3.— <i>Dietic Dis.</i>											
	Alcoholism, Intemperance -	1	1	—	—	—	—	1	1	—	9·35	—
III.	ORDER 1.											
	Cephalitis - - -	1	—	—	—	1	—	4	4	—	37·38	—
	Odontalgia - - -	2	2	—	—	—	—					
	Otitis - - -	1	1	—	—	—	—					
	ORDER 4.											
	Dyspepsia - - -	1	1	—	—	—	—	8	7	—	74·76	—
	Hæmorrhoids - - -	1	—	—	—	—	—					
	Hepatitis - - -	4	4	—	—	—	—					
	Jaundice - - -	1	1	—	—	—	—					
	Spleen Disease, &c. - - -	1	1	—	—	—	—					
	ORDER 6.											
	Hydrocele - - -	1	1	—	—	—	—	1	1	—	9·35	—
	ORDER 8.											
	Ulcer - - -	1	—	—	—	1	—	1	1	—	9·35	—
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Contusion - - -	13	13	—	—	—	—	13	13	—	121·94	—

* No Troops separately accounted for at this Station during the Years 1847 to 1850, and 1853 to 1856.

No. 48.

BENGAL.—BERHAMPORE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 2 Years - - - - 146
 Mean Annual Strength - - - - 73

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year,* 1849.			One Year,* 1855.			Total for 2 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	62	31	9	78	86	—	140	117	9	958·91	61·66
	CLASSES.											
I.	ZYMOTIC DISEASES -	51	22	8	63	68	—	114	90	8	780·83	54·81
II.	CONSTITUTIONAL -	—	—	—	—	—	—	—	—	—	—	—
III.	LOCAL - - -	10	8	1	10	13	—	20	21	1	136·99	6·85
V.	VIOLENCE - - -	1	1	—	5	5	—	6	6	—	41·09	—
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Ophthalmia - - -	1	1	—	—	—	—	100	73	8	684·94	54·81
	Fever (C. C.) - - -	2	—	—	4	4	—					
	Dysentery - - -	19	6	3	10	10	—					
	Diarrhœa - - -	9	6	—	1	1	—					
	Cholera - - -	16	5	5	1	1	—					
	Ague - - -	—	—	—	1	3	—					
	Remittent Fever - - -	—	—	—	29	29	—					
	Rheumatism - - -	—	—	—	7	7	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	2	2	—	9	12	—	11	14	—	75·34	—
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - - -	1	1	—	—	—	—	2	2	—	13·7	—
	Alcoholism—Intemperance - - -	—	—	—	1	1	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Psora - - -	1	1	—	—	—	—	1	1	—	6·85	—
III.	ORDER 1.											
	Cephalitis - - -	1	1	—	—	—	—	4	3	1	27·41	6·85
	Apoplexy - - -	1	—	1	—	—	—					
	Otitis - - -	—	—	—	2	2	—					
	ORDER 4.											
	Dyspepsia - - -	1	—	—	1	1	—	10	12	—	68·49	—
	Ileus and Colic - - -	—	1	—	—	—	—					
	Hæmorrhoids - - -	—	—	—	1	2	—					
	Obstipatio - - -	5	4	—	—	—	—					
	Hepatitis - - -	—	—	—	1	2	—					
	Spleen Disease, &c. - - -	—	—	—	1	2	—					
	ORDER 8.											
	Phlegmon - - -	2	2	—	1	1	—	6	6	—	41·09	—
	Ulcer - - -	—	—	—	3	3	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	1	1	—	—	—	—	5	5	—	34·24	—
	Contusion - - -	—	—	—	2	2	—					
	Sub-luxation - - -	—	—	—	1	1	—					
	Luxation - - -	—	—	—	1	1	—					
	ORDER 5.											
	Punitus - - -	—	—	—	1	1	—	1	1	—	6·85	—

* No Troops separately accounted for at this Station during the Years 1847, 1848, 1850, 1851, 1852, 1853, 1854, and 1856.

No. 49.

BENGAL.—BAZID KHAIL STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Mean Annual Strength	-	-	-	-	43
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RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1854.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	8	10	—	8	10	—	186·05	—
	CLASSES.								
I.	ZYMOTIC DISEASES - -	7	9	—	7	9	—	162·79	—
II.	CONSTITUTIONAL - -	—	—	—	—	—	—	—	—
III.	LOCAL - - - -	1	1	—	1	1	—	23·26	—
V.	VIOLENCE - - - -	—	—	—	—	—	—	—	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Catarrh and Influenza - -	1	2	—	6	7	—	139·53	—
	Fever (C. C.) - - - -	2	2	—					
	Dysentery - - - -	1	1	—					
	Ague - - - -	2	2	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	1	2	—	1	2	—	23·26	—
III.	ORDER 6.								
	Hydrocele - - - -	1	1	—	1	1	—	23·26	—

* No Troops separately accounted for at this Station except during the Year 1854.

No. 50.

BENGAL.—GHAZEEPORE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Mean Annual Strength - - - - - 404

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1849.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	722	666	19	722	666	19	1,787·12	47·03
	CLASSES.								
I.	ZYMOTIC DISEASES - -	592	537	18	592	537	18	1,465·35	44·55
II.	CONSTITUTIONAL - -	1	3	—	1	3	—	2·47	—
III.	LOCAL - - - - -	112	110	1	112	110	1	277·23	2·47
IV.	DEVELOPMENTAL - -	1	1	—	1	1	—	2·47	—
V.	VIOLENCE - - - -	16	15	—	16	15	—	39·6	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Quinsy - - - -	3	3	—	356	344	17	881·19	42·08
	Catarrh and Influenza - - -	10	11	—					
	Ophthalmia - - - -	63	65	—					
	Fever - - - - -	77	71	3					
	Erysipelas - - - -	3	3	—					
	Dysentery - - - -	63	61	2					
	Diarrhœa - - - -	32	32	2					
	Cholera - - - - -	10	7	4					
	Ague - - - - -	18	18	—					
	Remittent Fever - - - -	56	51	5					
	Rheumatism - - - -	21	22	1					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	235	192	—	236	193	1	584·16	2·47
	Stricture of Urethra - - -	1	1	1					
II.	ORDER 1.— <i>Diathetic Dis.</i>								
	Lumbago - - - - -	1	1	—	1	1	—	2·47	—
	ORDER 2.— <i>Tubercular Dis.</i>								
	Phthisis - - - - -	—	1	—	—	2	—	—	—
	Hæmoptysis - - - - -	—	1	—					

No. 50.—Bengal; Ghazepore Station; Infantry. Stational Returns. European Troops; H.M. Regts.—*cont.*

Class.	Diseases.	One Year, 1849.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.								
	Apoplexy - - - -	1	—	1	13	12	1	32·18	2·47
	Paralysis - - - -	2	2	—					
	Otitis - - - -	10	10	—					
	ORDER 3.								
	Bronchitis - - - -	4	4	—	6	6	—	14·85	—
	Pneumonia - - - -	2	2	—					
	ORDER 4.								
	Dyspepsia - - - -	8	8	—	32	31	—	79·21	—
	Peritonitis - - - -	1	1	—					
	Ascites - - - -	1	—	—					
	Heus and Colic - - - -	15	15	—					
	Obstipatio - - - -	4	4	—					
	Hepatitis - - - -	3	3	—					
	ORDER 5.								
	Ischuria - - - -	2	2	—	2	2	—	4·94	—
	ORDER 6.								
	Hydrocele - - - -	—	2	—	—	2	—	—	—
	ORDER 8.								
	Phlegmon - - - -	19	20	—	59	57	—	146·05	—
	Ulcer - - - -	24	23	—					
	Skin Disease, &c. - - - -	16	14	—					
IV.	ORDER 4.								
	Atrophy - - - -	1	1	—	1	1	—	2·47	—
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Contusion - - - -	14	13	—	15	14	—	37·13	—
	Fracture - - - -	1	1	—					
	ORDER 5.								
	Punitus - - - -	1	1	—	1	1	—	2·47	—

* No Troops separately accounted for at this Station except during the Year 1849.

No. 51.

BENGAL.—LUCKNOW.—INFANTRY.

STATIONAL RETURNS—EUROPEAN TROOPS—HER MAJESTY’S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Mean Annual Strength - - - - - 629

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1856.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	736	740	81	836	741	81	1,329·08	128·78
	CLASSES.								
I.	ZYMOTIC DISEASES - -	716	635	71	716	635	71	1,138·3	112·88
II.	CONSTITUTIONAL - -	5	4	1	5	4	1	7·95	1·59
III.	LOCAL - - - -	107	95	8	107	95	8	170·11	12·72
V.	VIOLENCE - - - -	8	6	1	8	6	1	12·72	1·59
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Small pox - - - -	7	6	1	605	528	71	961·84	112·88
	Quinsy - - - -	12	12	—					
	Catarrh and Influenza - -	50	51	1					
	Ophthalmia - - - -	70	66	—					
	Fever (C. C.) - - - -	94	86	7					
	Dysentery - - - -	16	11	6					
	Diarrhœa - - - -	81	62	10					
	Cholera - - - -	66	21	45					
	Ague - - - -	171	178	1					
	Remittent Fever - - - -	2	2	—					
	Rheumatism - - - -	36	33	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	108	105	—	108	105	—	171·70	—
	ORDER 3.— <i>Dietic Dis.</i>								
	Purpura and Scurvy - - -	2	2	—	2	2	—	3·18	—
	ORDER 4.— <i>Parasitic Dis.</i>								
	Vermes - - - -	1	—	—	1	—	—	1·59	—
II.	ORDER 1.— <i>Diathetic Dis.</i>								
	Lumbago - - - -	1	1	—	1	1	—	1·59	—

No. 51.—Bengal ; Lucknow ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	One Year, 1856.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
II.	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	—	1	—	4	3	1	6·36	1·59
	Phthisis - - - -	2	—	1					
	Hæmoptysis - - - -	2	2	—					
III.	ORDER 1.								
	Apoplexy - - - -	9	4	5	15	9	5	23·85	7·95
	Paralysis - - - -	1	—	—					
	Insanity - - - -	1	1	—					
	Epilepsy - - - -	4	4	—					
	ORDER 2.								
	Pericarditis - - - -	5	4	—	7	6	—	11·13	—
	Heart Disease, &c. - - - -	2	2	—					
	ORDER 3.								
	Epistaxis - - - -	2	1	—	9	9	—	14·31	—
	Bronchitis - - - -	—	1	—					
	Pleurisy - - - -	3	3	—					
	Pneumonia - - - -	4	4	—					
	ORDER 4.								
	Dyspepsia - - - -	6	6	—	48	41	3	76·31	4·77
	Hæmorrhoids - - - -	2	1	—					
	Fistula - - - -	1	—	—					
	Hepatitis - - - -	22	17	3					
	Jaundice - - - -	10	10	—					
	Spleen Disease, &c. - - - -	7	7	—					
	ORDER 5.								
	Nephritis - - - -	2	4	—	2	4	—	3·18	—
	ORDER 8.								
	Phlegmon - - - -	22	21	—	26	26	—	41·33	—
	Ulcer - - - -	4	5	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Burns or Scalds - - - -	1	2	—	7	6	—	11·13	—
	Contusion - - - -	2	2	—					
	Sub-luxation - - - -	3	1	—					
	Wounds, incised - - - -	1	1	—					
	ORDER 4.— <i>Suicide.</i>								
	Suspendium - - - -	—	—	1	—	—	1	—	1·59
	ORDER 5.								
	Observatio - - - -	1	—	—	1	—	—	1·59	—

* No Troops separately accounted for at this Station except during the Year 1856.

No. 52.

BENGAL.—MEERUT.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly
SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1847	9th Lancers - -	694·75	2,701	42·25	664	659	12
1847	32nd Foot - -	1,037·75		75·25	2,039	1,970	61
1847	80th Foot - -	811·50		69·75	1,295	1,283	14
1847	Detachments - -	157·25		3·5	83	103	1
1848	9th Lancers - -	360·25	366	20	308	291	2
1848	Detachments - -	5·5		·25	3	4	—
1849	Detachments - -	84	84	9·75	277	234	14
1850	18th Foot - -	804·25	1,613	56·50	901	751	25
1850	29th Foot - -	807·25		100·25	1,567	1,513	49
1850	Detachments - -	1·5		1	4	2	2
1851	14th Dragoons - -	653·5	1,616	62	1,103	1,110	26
1851	29th Foot - -	940·5		118·75	2,512	2,448	39
1851	Detachments - -	22·25		5	77	81	1
1852	14th Dragoons - -	668·25	673	48·5	908	878	13
1852	Detachments - -	5		·25	7	7	—
1853	14th Dragoons - -	709·25	712	39·5	790	801	11
1853	Detachments - -	2·75		·25	5	4	1
1854	14th Dragoons - -	695·25	1,786	41·25	789	777	11
1854	81st Foot - -	1,011·25		96·25	2,297	2,194	75
1854	Detachments - -	70·5		5·25	162	162	1
1855	52nd Foot - -	670·5	1,403	55·5	1,280	1,253	22
1855	81st Foot - -	728·75		64·75	1,284	1,234	16
1855	Detachments - -	4		·25	11	11	—
1856	52nd Foot - -	110·25	982	18·5	358	311	11
1856	60th Foot - -	872·5		68·25	1,950	1,908	43
	Total - - -	11,937·5	11,936	1,002·75	20,674	19,989	450
	Mean - - -	—	1,194	100·27	2,067	1,999	45

No. 53.

BENGAL.—UMBALLA STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B).—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSION, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1847	3rd Dragoons - -	658	2,188	78·25	981	951	18
1847	14th Dragoons - -	570		54·75	829	795	34
1847	61st Foot - -	959		91	1,496	1,472	47
1847	Detachment - -	1·25		—	5	3	2
1848	3rd Dragoons - -	334·25	1,071	28·5	380	359	5
1848	98th Foot - -	731·75		93·25	1,588	1,551	44
1848	Detachment - -	5·25		·75	7	7	—
1849	3rd Dragoons - -	294·25	808	15·5	236	237	9
1849	18th Foot - -	461·5		51	822	844	30
1849	Detachment - -	51·75		15	83	63	9
1850	3rd Dragoons - -	475·25	1,399	28	538	477	7
1850	75th Foot - -	917·25		73·25	1,418	1,395	43
1850	Detachments - -	6·25		1·25	13	13	1
1851	9th Lancers - -	637·75	1,635	46·75	872	839	10
1851	75th Foot - -	988·75		54·75	979	957	27
1851	Detachments - -	8·25		·25	13	13	1
1852	9th Lancers - -	615·75	1,555	47·5	928	904	23
1852	75th Foot - -	939·25		68·25	1,575	1,468	111
1853	9th Lancers - -	600·25	1,032	28·25	739	745	12
1853	75th Foot - -	425		27·75	976	680	5
1853	Detachment - -	7·25		2·5	38	25	1
1854	9th Lancers - -	579·5		29·75	840	826	9
1854	32nd Foot - -	218·75	2,066	17·5	422	427	9
1854	52nd Foot - -	750·75		53·75	1,080	1,048	39
1854	53rd Foot - -	217·25		20	474	523	17
1854	60th Foot - -	205·5		20	625	692	3
1854	Detachments - -	93·75	719	6·5	95	128	—
1855	9th Lancers - -	716		32·5	796	786	11
1855	Detachments - -	3·5		·75	6	5	1
1856	9th Lancers - -	619·5	627	43·25	1,344	1,331	5
1856	Detachments - -	7·75		·50	17	17	—
Total - -		13,100·25	13,100	1,021	20,215	19,581	533
Mean - -		—	1,310	102	2,021	1,958	53

No. 54.

BENGAL.—FEROZEPORE STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.			Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.	
	Names.	Strength.							
1847	53rd Foot	-	-	923	923	90·25	1,648	1,602	59
1848	14th Dragoons	-	-	163·50	} 464 {	24	379	313	12
1848	32nd Foot	-	-	301		25·5	912	841	18
1849	10th Foot	-	-	726·5	} 791 {	69·5	1,161	1,198	41
1849	Detachments	-	-	64·5		8·	133	122	11
1850	87th Foot	-	-	575	575	68	1,872	1,827	62
1851	87th Foot	-	-	890·25	} 1,044 {	95	1,779	1,616	61
1851	Recruits	-	-	153·25		12·25	446	456	10
1852	87th Foot	-	-	944·75	} 952 {	62·5	1,291	1,254	24
1852	Detachments	-	-	7·25		—	14	14	—
1853	87th Foot	-	-	716	716	48	808	785	12
1854	70th Foot	-	-	748	748	66	1,665	1,417	17
1855	70th Foot	-	-	843·75	} 860 {	74·75	1,479	1,630	7
1855	Detachments	-	-	16·		11·75	53	53	—
1856	61st Foot	-	-	234·5	} 868 {	30·75	1,504	1,551	12
1856	70th Foot	-	-	633·75		77	1,683	1,576	100
Total - - -				7,941	7,941	763·25	16,827	16,255	446
Mean - - -				—	794	76·32	1,682	1,625	44·6

No. 55.—BENGAL.—LAHORE STATION.

1847	10th Foot - -	894		894	86	1,884	1,795	77
1848	10th Foot - -	480	} 1,260 {		47·5	733	693	22
1848	53rd Foot - -	780			66·25	1,340	1,290	71
1849	14th Dragoons - -	437	} 1,227 {		49·5	772	761	24
1849	98th Foot - -	701·25			67·25	1,659	1,542	59
1849	Detachments - -	89	} 632 {		16·5	271	223	19
1850	14th Dragoons - -	622			73·75	1,285	1,238	30
1850	98th Foot - -	9·5			5·	12	32	2
1851	Detachments - -	902		902	99·25	3,652	3,535	113
1852	96th Foot - -	836		836	89·5	3,611	3,562	58
1853	96th Foot - -	643		643	48	1,517	1,459	38
1854	10th Foot - -	919		919	83·25	1,621	1,607	27
1855	10th Foot - -	677·75	} 935 {		48·75	884	854	15
1855	81st Foot - -	243·75			14·	370	407	—
1855	Detachments - -	14	} 966 {		4·50	69	56	3
1856	81st Foot - -	956·25			102·5	2,887	2,650	162
1856	Detachments - -	9·75			4	64	66	5
	Total - - -	9,214·25		9,214	905·50	22,631	21,770	725
	Mean - - -	—		921	91·55	2,263	2,177	72

No. 56.

BENGAL.—FORT WILLIAM STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1847	9th Foot - -	118	805	7.25	150	180	16
1847	39th Foot - -	75.5		3.75	15	29	2
1847	94th Foot - -	117		10	145	199	1
1847	50th Foot - -	247.5		28.25	418	422	17
1847	General Hospital	233.75		10.5	366	301	18
1847	Detachments - -	13.75	489	—	22	61	3
1848	18th Foot - -	375.5		50.75	988	897	24
1848	21st Foot - -	—		—	—	23	—
1848	50th Foot - -	—		—	—	38	—
1848	General Hospital	113.5		6.25	223	261	9
1849	96th Foot - -	29.25	769	.25	15	15	—
1849	70th Foot - -	463.75		55.5	1,381	1,296	86
1849	General Hospital	276.25		10.5	428	377	25
1850	70th Foot - -	664.75	690	70.75	1,481	1,441	36
1850	Detachments - -	5.25		2.25	14	12	2
1850	General Hospitals	20.25		6.25	69	85	8
1851	18th Foot - -	991.5	1,004	107.5	1,456	1,378	97
1851	General Hospital	13		1.75	77	77	1
1852	29th Foot - -	100	402	11	296	254	3
1852	80th Foot - -	190.75		21.75	318	290	29
1852	General Hospital	101.5		6.75	232	227	9
1853	General Hospital	86	86	5	179	152	14
1854	98th Foot - -	832	904	56.75	1,339	1,230	71
1854	Detachments - -	37		—	81	75	6
1854	General Hospital	35		5.75	132	126	15
1855	35th Foot - -	96.75	355	9.25	167	216	4
1855	98th Foot - -	165.50		15.5	86	158	4
1855	General Hospital	92.75		4.5	165	155	13
1856	53rd Foot - -	557.25	573	35.25	1,179	1,103	57
1856	General Hospital	15.5		1	37	27	8
	Total - - -	6,077.5	6,077	543.80	11,453	11,105	577
	Mean - - -	—	608	54.	1,145	1,110	58

No. 57.

BENGAL.—LANDOUR.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly
SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1847	H. M. Troops (Invalids) -	115	115	11·75	202	187	13
1848	Sanitary Dépôt -	10	10	1·5	29	16	—
1849	" " -	115	115	21·25	162	147	13
1850	" " -	84	84	10·	98	90	8
1851	" " -	87	87	27·75	201	187	14
1852	" " -	97	97	31·75	245	243	4
1853	" " -	157	157	12·5	370	359	10
1854	" " -	128	128	14·	322	316	5
1855	" " -	144	144	14·25	293	290	6
1856	" " -	166	166	10·	266	258	7
	Total -	1,103	1,103	154·75	2,188	2,093	80
	Mean -	—	110	15·47	219	209	8

No. 58.

BENGAL.—TROOPS EN ROUTE, &c.

1847	Sundry -	1,385	1,385	124·75	2,179	2,208	60
1848	" -	3,763	3,763	276·75	6,704	6,823	240
1849	" -	2,918	2,198	234·25	5,742	5,236	360
1850	" -	3,106	3,106	269·25	4,930	5,027	145
1851	" -	2,614	2,614	137	3,133	3,183	76
1852	" -	2,531	2,531	139	3,493	3,475	72
1853	" -	2,856	2,856	189·25	4,588	4,591	105
1854	" -	1,561	1,561	113	3,682	3,814	79
1855	" -	3,393	3,393	240	5,052	5,044	154
1856	" -	1,200	1,200	92	2,111	2,086	108
	Total -	25,426	25,426	1,815·25	41,614	41,498	1,399
	Mean -	—	2,542	181·52	4,161	4,149	140

No. 59.

BENGAL.—DINAPORE STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the Regiments at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1847	80th Foot - -	257·75	} 951 {	14	361	366	5
1847	98th Foot - -	693·25		91·75	2,264	2,070	124
1848	80th Foot - -	792	792	85·75	1,318	1,190	37
1849	80th Foot - -	696	696	46·5	878	849	42
1850	80th Foot - -	849	849	68·5	1,075	1,025	28
1851	80th Foot - -	814	814	67·25	1,242	1,214	52
1852	29th Foot - -	530·75	} 554 {	44·	1,268	1,202	32
1852	80th Foot - -	22·75		·75	20	18	2
1852	Detachments - -	1		—	4	3	1
1853	29th Foot - -	869	} 870 {	97·	1,918	1,895	62
1853	Detachments - -	1·25		—	6	6	—
1854	96th Foot - -	600	} 601 {	56	1,281	1,207	31
1854	Detachments - -	1		·25	4	4	—
1856	10th Foot - -	891	891	76·75	1,767	1,724	30
	Total - -	7,018·75	7,018	648·5	13,406	12,773	446
	Mean - -	- -	779	72·	1,601	1,419	49

No. 60.

BENGAL.—JULLUNDUR STATION.

1848	68th Foot - -	257	257	22·25	488	437	10
1849	32nd Foot - -	716·5	} 774 {	50·25	1,162	1,042	36
1849	Detachments - -	57		13·5	263	229	7
1850	32nd Foot - -	786	786	57	1,187	1,156	28
1851	32nd Foot - -	723	723	53	1,236	1,205	22
1852	60th Foot - -	899	899	95	1,781	1,719	45
1853	60th Foot - -	825	825	60·25	1,578	1,571	26
1854	60th Foot - -	649	649	52·25	1,132	1,380	15
1855	8th Foot - -	213	} 664 {	18	484	531	3
1855	60th Foot - -	451·5		36·25	1,004	979	2
1856	8th Foot - -	895	895	94·25	2,473	2,435	36
	Total - -	6,472	6,472	555	12,788	12,684	230
	Mean - -	—	719	61·77	1,421	1,409	25

No. 61.

BENGAL.—DARJEELING STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY’S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Stations.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1848	Convalescent Dépôt -	21	21	3.5	32	21	1
1849	Convalescent Dépôt -	34	34	5	75	66	7
1850	80th Foot -	103.5	} 146 {	4	104	99	4
1850	Convalescent Dépôt -	42.5		3.75	52	51	2
1851	80th Foot -	91.25	} 173 {	3.5	90	86	1
1851	Convalescent Dépôt -	82		5.75	109	103	3
1852	Convalescent Dépôt -	67	67	4.25	69	66	3
1853	Convalescent Dépôt -	51	51	5.75	79	74	2
1854	Convalescent Dépôt -	100	100	10.25	113	113	3
1855	Convalescent Dépôt -	17	17	1.75	33	38	—
1856	Convalescent Dépôt -	33	33	2.75	81	81	—
	Total - - -	642.25	642	50.25	837	798	26
	Mean - - -	—	71	5.58	93	88	3

No. 62.

BENGAL.—WUZEERABAD STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1849	9th Lancers - -	485·25	1,655	41	529	474	55
1849	24th Foot - -	567·25		34·5	1,026	1,045	24
1849	29th Foot - -	599·5		111	980	1,033	60
1849	Detachments - -	3·5		1	15	14	3
1850	9th Lancers - -	617	2,033	44·25	935	931	23
1850	24th Foot - -	666·25		60	1,417	1,384	38
1850	29th Foot - -	746·25		77	2,069	2,029	52
1850	Detachments - -	3·25		·75	11	9	2
1851	3rd Dragoons - -	685	2,059	50·25	795	752	21
1851	10th Foot - -	667·75		57·25	1,125	1,126	26
1851	24th Foot - -	706		75·5	1,262	1,252	5
1851	Detachments - -	1·5		·25	5	1	2
1852	3rd Dragoons - -	507·75	1,573	32·5	560	553	11
1852	10th Foot - -	919·5		78·75	1,305	1,242	35
1852	24th Foot - -	146		9	243	250	—
1853	10th Foot - -	719·75	912	54·75	941	862	18
1853	61st Foot - -	192·5		8·75	306	310	4
1854	61st Foot - -	945	945	56·5	1,158	1,278	30
1855	61st Foot - -	990	990	48	1,092	1,082	11
1856	61st Foot - -	741	741	41·75	1,575	1,457	8
Total - - -		10,910	10,908	882·75	17,349	17,084	428
Mean - - -		—	1,363	110·32	2,169	2,136	53

No. 63.

BENGAL.—RAWUL PINDI STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, Number constantly
SICK, ADMISSIONS, DISCHARGES, AND DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1849	53rd Foot - -	690	690	62·25	1,699	1,676	51
1850	53rd Foot - -	863	863	51	1,381	1,373	28
1851	10th Foot - -	20·75	698	2	8	8	—
1851	53rd Foot - -	676		33·25	890	846	11
1851	Detachments - -	1·5		·5	6	3	1
1852	22nd Foot - -	991·75	995	79·25	1,855	1,802	29
1852	Detachments - -	3·75		25	4	5	—
1853	22nd Foot - -	554	786	50·25	821	741	15
1853	87th Foot - -	232·5		14·25	227	239	4
1854	87th Foot - -	959	959	60·25	1,777	1,692	18
1855	75th Foot - -	316·25	1,027	32·75	1,683	1,766	10
1855	87th Foot - -	710·75		38·25	1,316	1,312	1
1856	24th Foot - -	243·25	1,118	55·25	3,137	3,057	24
1856	75th Foot - -	873		58·5	2,507	2,526	22
1856	Detachments - -	2		·75	6	7	1
Total - - -		7,137·5	7,136	563·5	17,317	17,073	215
Mean - - -		—	892	70·	2,164	2,134	27

No. 64.

BENGAL.—PESHAWUR STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.			Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.		Strength.					
1849	60th Foot	- -	207·75	} 829 {	30·50	782	637	11
1849	61st Foot	- -	621·25		36·	874	861	37
1850	61st Foot	- -	1,008·5	} 1,864 {	109·5	3,348	3,160	97
1850	98th Foot	- -	855·5		112·25	3,056	2,861	89
1851	61st Foot	- -	957·25	} 1,668 {	103·5	2,831	2,831	51
1851	98th Foot	- -	711·25		81·75	2,059	2,098	57
1852	32nd Foot	- -	1,002	} 1,815 {	128	3,882	3,761	78
1852	53rd Foot	- -	813·5		115	3,301	3,199	60
1853	22nd Foot	- -	159·25	} 1,916 {	15·75	785	704	10
1853	32nd Foot	- -	846		104·50	3,697	3,746	25
1853	53rd Foot	- -	911·25	} 1,544 {	106·25	3,505	3,481	58
1854	22nd Foot	- -	639·5		69·25	1,894	1,787	33
1854	75th Foot	- -	848·5	} 1,820 {	122·75	3,727	3,598	81
1854	Detachments	- -	56·25		1·25	23	23	—
1855	24th Foot	- -	960·25	} 1,937 {	98	3,158	3,106	24
1855	75th Foot	- -	616·75		71·25	2,503	2,497	37
1855	87th Foot	- -	243	} 458 {	14·25	972	912	5
1856	24th Foot	- -	753·75		65	3,306	3,219	32
1856	27th Foot	- -	219	} 1,937 {	18·75	793	807	9
1856	87th Foot	- -	961·75		137·25	6,475	6,471	48
1856	Detachments	- -	3	} 1,937 {	·50	15	14	1
Total - - -			13,395·25		1,541·25	50,986	49,773	843
Mean - - -			—	1,674	193·	6,373	6,221	105

No. 65.

BENGAL.—KUSSOWLIE STATION.

1847	29th Foot	- -	881	881	57·5	871	833	47
1848	29th Foot	- -	534	534	30·5	483	424	30
1850	61st Foot	- -	208	208	37·75	534	503	—
1852	61st Foot	- -	252	252	13·5	284	313	5
1853	61st Foot	- -	246	246	10·75	437	460	4
1854	32nd Foot	- -	598·25	} 715 {	61·5	2,123	2,073	15
1854	Detachments	- -	116·75		7·75	157	156	1
1855	32nd Foot	- -	227	227	17·85	341	326	14
1856	32nd Foot	- -	446·75	} 458 {	37·75	691	644	19
1856	Detachments	- -	11		1·25	7	7	—
Total - - -			3,520·75	3,521	276·1	5,928	5,739	135
Mean - - -			—	440	34·5	741	717	17

No. 66.

BENGAL.—SEALKOTE STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly
SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1850	3rd Dragoons - -	158·25	} 462 {	9·25	165	214	2
1850	24th Foot - -	304		17·75	464	446	4
1851	24th Foot - -	240	240	14·75	454	444	8
1852	24th Foot - -	847	847	66·25	1,455	1,405	16
1853	24th Foot - -	874	874	77·75	1,527	1,546	22
1854	24th Foot - -	716	716	45·75	906	846	15
1855	27th Foot - -	679	} 731 {	44·25	1,351	1,300	37
1855	Detachment - -	51·75		6	184	188	3
1856	27th Foot - -	692	692	48·25	1,375	1,317	13
	Total - - -	4,562	4,562	330	7,881	7,706	120
	Mean - - -	—	652	47·14	1,126	1,101	17

No. 67.

BENGAL.—AGRA STATION.

1847	24th Foot - -	953	953	65·75	2,316	2,267	84
1848	24th Foot - -	872	872	26·75	916	877	26
1849	Depôt - - -	23	23	3·75	61	57	—
1852	75th Foot - -	85	85	7·25	184	162	1
1853	75th Foot - -	252	252	24·5	575	549	14
1854	8th Foot - -	907	} 918 {	77·25	1,928	1,865	19
1854	Detachments - -	11·25		2·75	29	27	2
1855	8th Foot - -	687	687	70·5	1,827	1,755	14
	Total - - -	3,790·25	3,790	278·5	7,836	7,559	160
	Mean - - -	—	541	39·78	1,119	1,079	23

No. 68.

BENGAL.—DUM DUM STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.			Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.	
	Names.	Strength.							
1848	18th Foot	-	-	91	91	4.25	69	46	—
1849	70th Foot	-	-	246.25	} 415 {	11	412	312	29
1849	Detachment	-	-	169		12.25	228	214	14
1852	Detachment	-	-	11	11	2.75	43	40	2
1853	Detachment	-	-	4	4	.25	1	2	—
1854	80th Foot	-	-	164	} 396 {	12.75	181	230	2
1854	35th Foot	-	-	174.5		12.25	275	266	1
1854	Detachment	-	-	57		—	9	9	—
1855	35th Foot	-	-	99	99	11.75	156	137	5
1856	53rd Foot	-	-	512	} 512 {	51.50	1,295	1,201	66
1856	Detachment	-	-	.25		—	2	15	1
	Total	-	-	1,528	1,528	118.75	2,671	2,412	120
	Mean	-	-	—	218	16.96	381	344	17

No. 69.

BENGAL.—CAWNPORE STATION.

1847	21st Foot - -	775.75	} 800 {	67.25	2,882	2,814	52
1847	62nd Foot - -	24.25		.5	1	—	1
1850	10th Foot - -	114.75	} 1,159 {	12.5	263	271	—
1850	96th Foot - -	935.25		82	1,712	1,699	50
1850	Detachments - -	109	} 1,030 {	.5	41	29	2
1851	70th Foot - -	918		114	2,090	2,031	57
1851	Detachments - -	112	} 942 {	17.5	526	499	13
1852	70th Foot - -	937.75		110	2,386	2,300	46
1852	Detachments - -	4.5	} 942 {	.5	13	12	1
1853	70th Foot - -	833		96.5	2,670	2,502	230
1854	Detachments - -	177	177	10.75	323	306	3
1856	Depôt - - -	22	22	3.75	25	10	—
	Total - - -	4,973.25	4,973	514.75	12,932	12,473	455
	Mean - - -	—	710	73.53	1,847	1,782	65

No. 70.

BENGAL.—ALLAHABAD STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(a.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1847	H. M. Troops (Det.) -	41	41	—	23	39	1
1848	H. M. Troops -	38	38	1·25	35	21	2
1849	Recruit Depôt -	18	18	4·75	63	57	8
1850	Recruit Depôt -	288	288	34	761	701	63
1854	96th Foot -	41	41	2·25	25	25	—
1855	53rd Foot -	242	242	6·25	138	159	8
1856	6th Dragoon Guards -	148	148	2·25	72	76	1
	Total -	816	816	50·75	1,122	1,078	83
	Mean -	—	102	7·25	160	154	12

No. 71.

BENGAL.—CHINSURAH STATION.

1847	H. M. Troops, Depôt -	143	143	·75	43	43	—
1849	96th Foot -	184·5	184	6·25	185	133	13
1851	Recruits ; Detachments -	103	103	2	63	58	1
1852	29th Foot -	77	161	6·25	176	203	3
1852	Detachment -	84·25		4	138	145	2
1853	Recruits ; Detachment -	72	72	7·75	189	181	6
1854	Detachments -	29	29	1·5	35	42	—
	Total -	692·75	692	28·50	829	805	25
	Mean -	—	115	4·6	138	134	4

No. 72.

BENGAL.—DUGSHAI STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(3.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1850	22nd Foot - -	688	688	49·75	1,281	1,286	19
1851	22nd Foot - -	762·25	} 763 {	42·25	953	967	11
1851	60th Foot - -	·75		—	3	3	—
1852	98th Foot - -	908	} 960 {	82·75	1,580	1,540	30
1852	Detachments - -	52·5		11·5	129	126	3
1853	98th Foot - -	725·5	} 758 {	50·25	885	772	20
1853	Detachments - -	32·5		6	74	70	4
1854	53rd Foot - -	518·75	} 575 {	59·75	1,810	1,309	31
1854	Detachments - -	56·25		4	111	86	2
1855	53rd Foot - -	840·5	} 567 {	39·5	760	759	35
1855	Detachments - -	27		4·5	34	42	10
Total - - -		4,312	4,311	350·25	7,620	6,960	165
Mean - - -		—	719	58	1,270	1,160	27

No. 73.

BENGAL.—MURREE STATION.

1851	Convalescent Dépôt - -	60	60	9·25	92	89	3
1852	Invalid Dépôt - -	47	47	10·75	127	123	6
1853	Invalid Dépôt - -	53	53	9·5	181	177	4
1854	Invalid Dépôt - -	99·25	99	12	142	129	8
1855	Invalid Dépôt - -	100	100	35·5	245	236	9
1856	Invalid Dépôt - -	66	66	12·5	171	168	8
Total - - -		425·25	425	78·5	958	922	38
Mean - - -		—	71	13	159	154	5

No. 74.

BENGAL.—KURRACHEE STATION.

1853	3rd Dragoons - -	156·5	} 321 {	3·25	29	43	—
1853	Recruits' Detachment - -	165		3	74	45	
1854	Detachments - -	85·75	86	7	133	145	2
1855	Detachments - -	94·	94	10·25	257	253	9
1856	Dépôt - - -	71·	71	10·25	187	190	7
Total - - -		571·75	572	33·75	680	676	19
Mean - - -		—	143	8·43	170	169	5

No. 75.

BENGAL.—SUBATHOO STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.			Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admission into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.		Strength.					
1853	Detachments	- -	4	4	·5	10	5	—
1854	Detachments	- -	318	318	23·25	458	427	4
1855	Detachments	- -	117	117	18·25	213	210	18
	Total	- - -	439	439	42	681	642	22
	Mean	- - -	—	146	14	227	214	7

No. 76.

BENGAL.—GOVINDGHUR STATION.

1851	Detachments	- -	81	81	3·75	185	181	—
1852	Detachments	- -	26	26	·5	2	5	1
	Total	- - -	107	107	4·25	187	186	1
	Mean	- - -	—	53	2·12	93	93	·5

No. 77.

BENGAL.—BERHAMPORE STATION.

1849	87th Foot	- -	105	105	5	62	30	9
1855	Detachments	- -	41	41	2·75	78	86	—
	Total	- - -	146	146	7·75	140	116	9
	Mean	- - -	—	73	3·87	75	58	4·5

No. 78.

BENGAL.—BASID KHAIL STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1854	75th Foot - -	43	43	·25	8	10	—
	Total and Mean -	—	43	·25	8	10	—

No. 79.

BENGAL.—GHAZEEPORE STATION.

1849	96th Foot - -	404	404	31·25	722	668	19
	Total and Mean -	—	404	31·25	722	668	19

No. 80.

BENGAL.—LUCKNOW.

1856	52nd Foot - -	628·75	628·75	39·25	836	840	81
	Total and Mean -	—	628	39·25	836	840	81

No. 81.

BOMBAY.—KIRKEE STATION.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 10 Years - - - - 6,559
Mean Annual Strength - - - - 656

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	7,660	7,580	86	6,060	5,947	40	13,720	13,527	126	2,091.78	19.20
	CLASSES.											
I.	ZYMOTIC DISEASES -	4,905	4,879	56	4,165	4,084	27	9,070	8,963	83	1,382.84	12.65
II.	CONSTITUTIONAL -	27	18	11	31	29	3	58	47	14	8.84	2.13
III.	LOCAL - - -	2,079	2,033	19	1,367	1,346	10	3,446	3,379	29	525.38	4.42
V.	VIOLENCE - - -	649	650	—	497	488	—	1,146	1,138	—	174.72	—
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	—	—	—	3	5	—	7,107	7,028	82	1,083.56	12.5
	Measles - - -	—	—	—	3	3	—					
	Quinsy - - -	57	50	1	73	72	—					
	Catarrh and Influenza -	424	426	—	174	177	1					
	Ophthalmia - - -	125	125	—	68	61	—					
	Fever (C. C.) - - -	1,285	1,287	16	388	378	6					
	Erysipelas - - -	10	10	—	8	7	—					
	Dysentery - - -	171	179	14	68	63	3					
	Diarrhœa - - -	727	727	—	290	289	—					
	Cholera - - -	59	39	20	24	11	13					
	Ague - - -	418	409	—	1,682	1,670	1					
	Remittent Fever - - -	32	28	4	198	195	2					
	Rheumatism - - -	550	552	—	270	265	1					
	ORDER 2.— <i>Enthetic Dis.</i>							1,848	1,826	1	281.75	.15
	Syphilis, &c. - - -	984	985	1	829	810	—					
	Stricture of Urethra -	13	12	—	22	19	—					
	ORDER 3.— <i>Dietic Dis.</i>							25	25	—	3.81	—
	Alcoholism { <i>a.</i> Del. Tremens <i>b.</i> Intemperance	7	7	—	9	9	—					
	ORDER 4.— <i>Parasitic Dis.</i>							90	84	—	13.72	—
	Vermes - - -	19	19	—	47	41	—					
	Psora - - -	5	5	—	—	—	—					
	Dracunculus - - -	19	19	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>							18	18	3	2.74	.46
	Lumbago - - -	2	2	—	6	6	—					
	Gout - - -	—	—	—	2	2	—					
	Dropsy - - -	2	2	1	6	6	1					
	Cancer - - -	—	—	1	—	—	—					
	ORDER 2.— <i>Tubercular Dis.</i>							40	29	11	6.1	1.68
	Scrofula - - -	6	6	—	11	11	—					
	Phthisis - - -	9	1	8	3	1	2					
	Hæmoptysis - - -	8	7	1	3	3	—					

No. 81.—Bombay ; Kirkee Station ; Cavalry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	49	—	1	20	18	—	135	79	6	20.58	.92
	Apoplexy - - -	4	2	4	—	—	—					
	Paralysis - - -	8	8	—	8	7	—					
	Odontalgia - - -	9	6	—	2	2	—					
	Insanity - - -	—	1	—	2	2	—					
	Neuralgia - - -	—	—	—	3	3	—					
	Epilepsy - - -	3	3	—	6	5	1					
	Otitis - - -	5	5	—	8	8	—					
	Dyseœœa - - -	4	5	—	3	3	—					
	Brain Disease, &c. - -	—	—	—	1	1	—					
	ORDER 2.											
	Pericarditis - - -	12	10	—	23	24	—	116	114	1	17.68	.15
	Aneurism - - -	—	—	—	6	5	1					
	Varix - - -	6	6	—	8	8	—					
	Heart Disease, &c. - -	60	60	—	1	1	—					
	ORDER 3.											
	Bronchitis - - -	7	7	—	11	11	—	61	58	3	9.31	.46
	Pleurisy - - -	—	—	—	15	15	—					
	Pneumonia - - -	22	20	2	3	2	1					
	Asthma - - -	2	2	—	—	—	—					
	Epistaxis - - -	1	1	—	—	—	—					
	ORDER 4.											
	Obstipatio - - -	59	59	—	25	25	—	1,477	1,478	19	225.19	2.89
	Gastritis - - -	3	3	—	4	4	—					
	Enteritis - - -	2	2	—	9	7	2					
	Peritonitis - - -	—	—	—	1	1	—					
	Ascites - - -	1	—	1	2	—	2					
	Prolapsus Ani - - -	1	1	—	—	—	—					
	Hernia - - -	10	10	—	2	1	1					
	Ileus and Colic - - -	230	230	—	166	165	—					
	Hæmorrhoids - - -	48	48	—	26	26	—					
	Fistula - - -	7	7	—	5	5	—					
	Hepatitis - - -	211	222	10	122	119	1					
	Jaundice - - -	28	28	—	16	14	1					
	Spleen Disease, &c. - -	17	17	1	16	16	—					
	Dyspepsia - - -	312	310	—	154	158	—					
	ORDER 5.											
	Nephritis - - -	—	—	—	5	4	—	14	13	—	2.13	—
	Ischuria - - -	—	—	—	1	1	—					
Hæmaturia - - -	—	—	—	1	1	—						
Dysuria - - -	5	5	—	—	—	—						
Stone - - -	1	1	—	—	—	—						
Cystitis - - -	—	—	—	1	1	—						
ORDER 6.												
Hydrocele - - -	2	2	—	2	2	—	5	5	—	.76	—	
Sarcocœle - - -	1	1	—	—	—	—						
ORDER 7.												
Joint Disease, &c. - -	4	4	—	3	3	—	8	8	—	1.22	—	
Contractura - - -	—	—	—	1	1	—						
ORDER 8.												
Phlegmon - - -	571	575	—	487	482	—	1,630	1,624	—	248.51	—	
Abscess - - -												
Ulcer - - -												
Tumor - - -												
Skin Disease, &c. - -												2	2	—	20	20	—
V.	ORDER 1.— <i>Accident or Negligence.</i>											
Burns or Scalds - - -	2	2	—	2	1	—	1,113	1,113	—	169.69	—	
Contusion - - -	393	394	—	284	284	—						
Sub-luxation - - -	109	113	—	90	89	—						
Luxation - - -	2	1	—	2	3	—						
Fracture - - -	14	14	—	5	4	—						
Wounds { Gunshot - - -	1	—	—	1	2	—						
{ Incised - - -	127	125	—	80	80	—						
Amputatio - - -	—	—	—	1	1	—						
ORDER 5.												
Punitus - - -	1	1	—	7	6	—	33	25	—	5.03	—	
Observatio - - -	—	—	—	25	18	—						

BOMBAY.—DEESA STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 10 Years	-	-	-	8,930
Mean Annual Strength	-	-	-	893

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	8,506	8,302	166	5,853	5,696	70	14,359	13,998	236	1,608·	26·41
	CLASSES.											
I.	ZYMOTIC DISEASES -	6,039	5,910	103	4,089	4,002	26	10,128	9,912	129	1,134·21	14·44
II.	CONSTITUTIONAL -	126	116	13	106	91	13	232	207	26	25·98	2·91
III.	LOCAL - - -	2,021	1,952	46	1,464	1,404	29	3,485	3,356	75	390·26	8·39
IV.	DEVELOPMENTAL -	—	—	—	7	7	—	7	7	—	·78	—
V.	VIOLENCE - - -	320	324	4	87	192	2	507	516	6	56·77	·67
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	6	5	—	6	5	1	7,677	7,525	118	859·69	13·21
	Measles - - -	—	—	—	7	7	—					
	Erythema - - -	1	1	—	—	—	—					
	Quinsy - - -	59	55	1	41	40	—					
	Catarrh and Influenza -	294	293	5	260	261	1					
	Ophthalmia - - -	217	215	—	194	193	—					
	Fever (C. C.) - - -	773	766	5	456	470	1					
	Typhus - - -	2	—	2	—	—	—					
	Erysipelas - - -	4	5	—	3	3	—					
	Dysentery - - -	296	278	25	80	73	7					
	Diarrhoea - - -	502	492	15	252	233	2					
	Cholera - - -	50	27	23	3	1	2					
	Ague - - -	1,078	1,079	1	1,415	1,398	—					
	Remittent Fever - - -	633	592	18	106	98	8					
	Rheumatism - - -	595	589	—	344	346	1					
	ORDER 2.— <i>Enthetic Dis.</i>							2,266	2,220	5	253·75	·56
	Syphilis, &c. - - -	1,402	1,398	4	832	787	1					
	Stricture of Urethra -	15	17	—	15	16	—					
	Lepra - - -	2	2	—	—	—	—					
	ORDER 3.— <i>Dietic Dis.</i>							126	124	6	14·16	·67
	Purpura and Scurvy -	66	63	4	39	40	—					
	Alcoholism, Del. Tremens -	9	9	—	12	12	2					
	ORDER 4.— <i>Parasitic Dis.</i>							59	53	—	6·61	—
	Vermes - - -	13	12	—	24	19	—					
	Dracunculus - - -	22	22	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>							106	101	3	11·87	·33
	Lumbago - - -	46	44	—	40	41	—					
	Dropsy - - -	13	10	2	7	6	1					
	ORDER 2.— <i>Tubercular Dis.</i>							126	106	23	14·11	2·58
	Morbus Coxarius - - -	4	6	—	2	2	—					
	Scrofula - - -	36	41	—	26	22	1					
	Phthisis - - -	21	9	11	29	18	11					
	Hæmoptysis - - -	6	6	—	2	2	—					
III.	ORDER 1.							342	318	18	38·3	2·01
	Cephalitis - - -	18	18	—	69	68	—					
	Apoplexy - - -	8	5	4	20	12	8					
	Paralysis - - -	17	11	4	14	10	2					
	Odontalgia - - -	1	2	—	2	2	—					
	Insanity - - -	10	10	—	26	25	—					
	Neuralgia - - -	5	5	—	2	2	—					
	Epilepsy - - -	10	10	—	9	9	—					
	Chorea - - -	—	—	—	1	—	—					
	Otitis - - -	78	76	—	47	47	—					
	Brain Disease, &c. - - -	1	1	—	—	—	—					
	Dysecœa - - -	1	2	—	3	3	—					

No. 82.—Bombay ; Deesa Station; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 2.											
	Pericarditis - - -	12	12	1	55	53	3	117	118	6	13.10	.67
	Aneurism - - -	—	—	—	1	1	—					
	Varix - - -	2	2	—	6	7	—					
	Heart Disease, &c. - -	22	18	2	25	25	—					
	ORDER 3.											
	Epistaxis - - -	4	4	—	1	1	—	195	185	8	21.83	.89
	Laryngitis - - -	—	—	—	1	1	—					
	Bronchitis - - -	52	47	1	38	38	1					
	Pleurisy - - -	2	2	—	14	14	1					
	Pneumonia - - -	45	40	4	20	19	—					
	Asthma - - -	6	6	1	12	13	—					
	ORDER 4.											
	Dyspepsia - - -	347	345	1	169	144	—	1,943	1,865	38	217.59	4.26
	Gastritis - - -	4	4	—	10	9	1					
	Enteritis - - -	5	4	—	3	2	1					
	Peritonitis - - -	6	7	1	3	1	2					
	Ascites - - -	1	—	1	5	2	1					
	Prolapsus Ani - - -	1	1	—	4	5	—					
	Hernia - - -	7	6	—	9	10	—					
	Ileus and Colic - - -	118	119	—	79	68	—					
	Hæmatemesis - - -	5	4	—	1	1	1					
	Stricture of Rectum - -	3	3	—	1	2	—					
	Fistula - - -	—	—	—	8	5	—					
	Hæmorrhoids - - -	60	61	—	39	40	—					
	Obstipatio - - -	140	141	—	34	35	—					
	Hepatitis - - -	407	378	24	282	279	4					
	Jaundice - - -	33	33	—	32	28	1					
	Spleen Disease, &c. - -	54	55	—	73	73	—					
	ORDER 5.											
	Nephritis - - -	9	8	1	3	2	1	34	34	2	3.81	.22
	Ischuria - - -	—	—	—	8	10	—					
	Enuresis - - -	1	1	—	—	—	—					
	Dysuria - - -	12	12	—	—	—	—					
	Diabetes - - -	—	—	—	1	1	—					
	ORDER 6.											
	Hydrocele - - -	9	9	—	11	8	1	20	17	2	2.24	.22
	ORDER 7.											
	Contractura - - -	—	—	—	2	2	—	20	19	—	2.24	—
	Arthritis - - -	2	2	—	—	—	—					
	Joint Disease, &c. - -	1	—	—	15	15	—					
	ORDER 8.											
	Phlegmon } - - -	277	273	—	165	162	—	814	780	1	91.15	.12
	Abscess }											
	Ulcer - - -	201	195	1	129	131	—					
	Tumor - - -	—	—	—	3	3	—					
	Skin Disease, &c. - -	24	20	—	15	16	—					
IV.	ORDER 4.											
	Atrophy - - -	—	—	—	7	7	—	7	7	—	.78	—
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	4	4	—	7	4	—	452	463	6	50.61	.67
	Contusion - - -	133	140	—	98	104	—					
	Sub-luxation - - -	71	70	—	41	42	—					
	Luxation - - -	6	6	—	12	12	—					
	Fracture - - -	7	9	—	9	9	—					
	Wounds { Gunshot - - -	2	2	—	2	2	—					
	{ Incised - - -	43	41	—	16	17	—					
	Morsus Serpents - - -	1	1	—	—	—	—					
	Drowning - - -	—	—	2	—	—	2					
	Sudden - - -	—	—	2	—	—	—					
	ORDER 5.											
	Punitus - - -	4	4	—	1	1	—	55	53	—	6.16	—
	Observatio - - -	49	47	—	1	1	—					

No. 83.

BOMBAY.—POONA STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY’S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 10 Years	-	-	-	12,863
Mean Annual Strength	-	-	-	1,286

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	13,315	13,182	247	9,164	8,904	93	22,479	22,086	340	1,747·6	26·43
	CLASSES.											
I.	ZYMOTIC DISEASES -	10,095	9,954	176	6,143	5,980	27	16,238	15,934	203	1,262·4	15·78
II.	CONSTITUTIONAL -	148	123	15	118	110	6	266	233	21	20·69	1·63
III.	LOCAL - - -	2,467	2,498	53	2,424	2,363	49	4,891	4,861	102	380·24	7·93
V.	VIOLENCE - - -	605	607	3	479	451	11	1,084	1,058	14	84·27	1·09
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	4	3	1	17	14	3	12,894	12,597	196	1,002·43	15·24
	Vaccinia - - -	9	9	—	3	3	—					
	Parotitis - - -	4	4	—	—	—	—					
	Quinsy - - -	95	92	—	68	69	—					
	Catarrh and Influenza -	368	366	1	290	291	1					
	Ophthalmia - - -	501	492	—	200	194	—					
	Fever (C.C.) - - -	1,803	1,742	19	247	249	2					
	Erysipelas - - -	15	13	2	8	8	—					
	Dysentery - - -	583	511	72	78	72	8					
	Diarrhoea - - -	1,036	1,027	7	250	255	1					
	Cholera - - -	98	80	46	12	7	5					
	Ague - - -	1,932	1,971	6	2,997	2,839	2					
	Remittent Fever - - -	419	440	15	213	216	3					
	Rheumatism - - -	994	981	2	650	649	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	2,057	2,049	1	991	989	—	3,101	3,096	2	241·08	15
	Stricture of Urethra -	11	11	1	42	47	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy -	32	32	1	17	17	—	106	100	5	8·24	·39
	Alcoholism, Del. Tremens -	40	36	2	17	15	2					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	30	36	—	43	46	—	137	141	—	10·65	—
	Psora - - -	3	4	—	—	—	—					
	Dracunculus - - -	61	55	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Gout - - -	—	—	—	1	1	—	115	106	3	8·95	·23
	Lumbago - - -	29	23	—	65	65	—					
	Dropsy - - -	9	8	2	11	9	1					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	1	1	—	—	—	—	151	127	18	11·74	1·4
	Scrofula - - -	80	74	—	18	18	—					
	Phthisis - - -	27	15	13	15	11	4					
	Hæmoptysis - - -	2	2	—	8	6	1					

No. 83.—Bombay; Poona Station; Infantry. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	13	12	—	82	80	—	266	252	19	20·68	1·48
	Odontalgia - - -	14	16	—	7	7	—					
	Apoplexy - - -	13	2	13	3	3	—					
	Paralysis - - -	19	18	2	18	16	2					
	Neuralgia - - -	2	1	—	1	1	—					
	Insanity - - -	25	23	1	13	11	—					
	Dyseecæa - - -	1	—	—	3	3	—					
	Epilepsy - - -	37	37	—	32	31	1					
	Vertigo - - -	2	2	—	—	—	—					
	Otitis - - -	49	53	—	26	28	—					
	Brain Disease, &c. - -	5	7	—	—	—	—					
	Nostalgia - - -	1	1	—	—	—	—					
	ORDER 2.											
	Pericarditis - - -	28	24	—	82	66	13	179	154	21	13·92	1·63
	Aneurism - - -	—	—	—	12	7	6					
	Varix - - -	8	9	—	6	6	—					
	Heart Disease, &c. - -	40	39	1	3	3	1					
	ORDER 3.											
	Epistaxis - - -	2	2	—	3	3	—	220	214	10	17·10	·78
	Bronchitis - - -	53	52	4	40	38	2					
	Pleurisy - - -	27	28	—	3	3	—					
	Hydrothorax - - -	1	1	—	1	1	—					
	Pneumonia - - -	38	33	1	26	25	3					
	Asthma - - -	16	18	—	10	10	—					
	ORDER 4.											
	Dyspepsia - - -	356	363	1	540	543	—	2,983	2,928	50	231·92	3·9
	Gastritis - - -	7	8	—	13	13	—					
	Enteritis - - -	10	7	3	1	1	—					
	Peritonitis - - -	8	4	1	4	2	2					
	Ascites - - -	1	1	1	3	2	—					
	Hernia - - -	8	6	—	11	13	—					
	Ileus and Colic - - -	294	293	—	224	224	—					
	Hæmatemesis - - -	2	2	—	1	—	1					
	Fistula - - -	3	3	—	2	4	—					
	Hæmorrhoids - - -	70	70	—	52	52	—					
	Obstipatio - - -	120	119	1	29	29	—					
	Hepatitis - - -	449	408	22	457	445	15					
	Jaundice - - -	41	44	—	25	23	2					
	Prolapsus Ani - - -	1	1	—	—	—	—					
	Spleen Disease, &c. - -	77	74	1	174	174	—					
	ORDER 5.											
	Nephritis - - -	6	6	—	11	10	1	34	34	1	2·64	·07
	Ischuria - - -	—	—	—	9	9	—					
	Dysuria - - -	4	5	—	—	—	—					
	Stone - - -	1	1	—	—	—	—					
	Cystitis - - -	1	1	—	2	2	—					
	ORDER 6.											
	Hydrocele - - -	8	7	—	12	13	—	20	20	—	1·55	—
	ORDER 7.											
	Contractura - - -	1	—	—	—	—	—	14	10	—	1·09	
	Periostitis - - -	2	3	—	—	—	—					
	Joint Disease, &c. - -	7	3	—	4	4	—					
	ORDER 8											
	Phlegmon - - -	442	423	1	239	235	—	1,175	1,150	1	91·34	·07
	Ulcer - - -	202	204	—	200	184	—					
	Tumor - - -	3	4	—	6	7	—					
	Skin Disease, &c. - -	49	51	—	34	32	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	13	13	—	5	3	—	970	945	14	75·41	1·09
	Contusion - - -	313	319	—	232	213	—					
	Sub-luxation - - -	138	138	—	95	90	—					
	Luxation - - -	3	3	—	5	5	—					
	Fracture - - -	21	20	—	12	11	1					
	Wounds { Gunshot - - -	3	3	—	2	1	—					
	{ Incised - - -	86	83	—	41	41	—					
	Amputatio - - -	—	—	—	1	2	—					
	Drowning - - -	—	—	1	—	—	4					
	Found Dead - - -	—	—	2	—	—	4					
	Sudden - - -	—	—	—	—	—	1					
	Venenatio - - -	—	—	—	—	—	1					
	ORDER 5.											
	Punitus - - -	3	3	—	4	3	—	114	113	—	8·86	—
	Observatio - - -	25	25	—	82	82	—					

No. 84.

BOMBAY.—KURRACHEE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 9 Years " " " " 10,604
Mean Annual Strength " " " " 1,178

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Four Years,* 1852 to 1855.			Total for 9 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	9,230	9,026	219	10,118	9,867	141	19,348	18,893	360	1,824.74	33.94
	CLASSES.											
I.	ZYMOTIC DISEASES -	6,496	6,358	148	7,860	7,720	86	14,356	14,078	234	1,353.04	22.07
II.	CONSTITUTIONAL -	171	149	26	135	116	19	306	265	45	28.86	4.24
III.	LOCAL - - -	2,203	2,171	40	1,764	1,675	33	3,967	3,846	73	374.11	6.88
IV.	DEVELOPMENTAL -	1	1	—	6	5	1	7	6	1	.66	.09
V.	VIOLENCE - - -	359	347	5	353	351	2	712	698	7	67.14	.66
	ORDERS.											
I.	ORDER 1.—Miasmatic Dis.											
	Small-pox - - -	3	2	1	—	—	—	12,226	12,022	226	1,153.	21.32
	Vaccinia - - -	—	—	—	1	1	—					
	Quinsy - - -	98	94	—	46	49	—					
	Catarrh and Influenza -	494	492	1	364	323	2					
	Ophthalmia - - -	458	462	—	170	176	—					
	Fever (C. C.) - - -	879	873	9	346	374	—					
	Typhus - - -	—	—	—	1	1	—					
	Erysipelas - - -	16	13	—	3	1	1					
	Dysentery - - -	762	707	54	225	200	23					
	Diarrhœa - - -	777	773	3	449	438	5					
	Cholera - - -	66	30	55	18	10	8					
	Ague - - -	720	686	3	4,369	4,351	6					
	Remittent Fever - - -	403	413	19	520	500	36					
	Rheumatism - - -	614	638	—	424	415	—					
	ORDER 2.—Enthetic Dis.											
	Syphilis, &c. - - -	1,104	1,064	—	789	755	—	1,940	1,860	—	182.95	—
	Stricture of Urethra -	17	15	—	30	26	—					
	ORDER 3.—Dietic Dis.											
	Purpura and Scurvy -	14	18	—	17	16	1	127	124	8	11.98	.75
	Alcoholism, Del. Tremens -	38	35	3	58	55	4					
	ORDER 4.—Parasitic Dis.											
	Vermes - - -	23	29	—	30	29	—	63	72	—	6.04	—
	Psora - - -	—	2	—	—	—	—					
	Dracunculus - - -	12	12	—	—	—	—					
II.	ORDER 1.—Diathetic Dis.											
	Lumbago - - -	15	19	1	26	27	—	88	86	7	8.3	.66
	Dropsy - - -	23	21	2	24	19	4					

No. 84.—Bombay ; Kurrachee Station; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Four Years,* 1852 to 1855.			Total for 9 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
II.	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	86	85	1	45	46	1	218	179	38	20.56	3.58
	Phthisis - - -	37	16	21	31	17	13					
	Hæmoptysis - - -	10	8	1	9	7	1					
III.	ORDER 1.											
	Cephalitis - - -	34	34	—	80	76	—	385	360	23	36.31	2.17
	Apoplexy - - -	19	6	12	8	2	6					
	Odontalgia - - -	2	2	—	3	3	—					
	Paralysis - - -	9	8	—	27	20	3					
	Dysœcœa - - -	10	12	—	4	4	—					
	Insanity - - -	35	42	—	15	14	—					
	Neuralgia - - -	5	5	—	3	3	—					
	Epilepsy - - -	27	28	—	16	19	—					
	Otitis - - -	46	47	—	38	33	—	242	233	7	22.82	.66
	Brain Disease, &c. - - -	1	—	1	3	2	1					
	ORDER 2.											
	Pericarditis - - -	73	70	1	46	39	3	242	233	7	22.82	.66
	Aneurism - - -	1	1	—	11	7	3					
	Varix - - -	12	12	—	32	36	—					
	Heart Disease, &c. - - -	51	51	—	16	17	—	166	162	8	15.65	.75
	ORDER 3.											
	Epistaxis - - -	1	1	—	3	3	—					
	Hydrothorax - - -	1	1	—	—	—	—					
	Bronchitis - - -	27	28	1	27	27	1					
	Pleurisy - - -	10	11	—	15	16	—					
	Pneumonia - - -	36	31	3	7	7	1	2,112	2,009	34	199.18	3.21
	Asthma - - -	10	9	1	30	29	1					
	ORDER 4.											
	Dyspepsia - - -	187	189	—	293	287	—					
	Gastritis - - -	11	11	—	12	12	—					
	Prolapsus Ani - - -	3	2	—	1	—	—					
	Enteritis - - -	2	2	—	6	5	1					
	Peritonitis - - -	5	4	—	—	—	—					
	Ascites - - -	4	3	—	19	15	1					
	Hernia - - -	12	12	—	13	13	—					
	Ileus and Colic - - -	119	91	—	87	89	—					
	Colonitis - - -	1	1	—	—	—	—					
	Stricture of Rectum - - -	2	1	—	—	—	—					
	Fistula - - -	13	13	—	2	2	—					
	Obstipatio - - -	147	147	—	98	98	—					
	Hepatitis - - -	385	362	20	283	232	11					
	Jaundice - - -	74	79	—	24	23	1					
	Hæmorrhoids - - -	75	88	—	41	39	—					
	Spleen Disease, &c. - - -	84	80	—	103	102	—					
	Hæmatemesis - - -	2	4	—	1	—	—					
	Physconia - - -	3	3	—	—	—	—					
	ORDER 5.											
	Nephritis - - -	9	10	—	13	13	—	52	52	—	4.91	—
	Enuresis - - -	10	10	—	7	6	—					
	Ischuria - - -	—	—	—	5	5	—					
	Dysuria - - -	6	6	—	—	—	—					
	Diabetes - - -	—	—	—	1	1	—					
	Cystitis - - -	1	1	—	—	—	—					
	ORDER 6.											
	Sarcocele - - -	2	1	—	—	—	—	12	12	—	1.13	—
	Hydrocele - - -	4	2	—	6	9	—					
	ORDER 7.											
	Arthritis - - -	1	—	1	—	—	—	10	9	1	.94	.09
	Joint Disease, &c. - - -	5	5	—	2	2	—					
	Contractura - - -	—	—	—	2	2	—					

No. 84.—Bombay ; Kurrachee Station; Infantry. Stational Returns. European Troops ; H.M. Regts.—cont.

Class.	Diseases.	Five Years, 1847 to 1851.			Four Years,* 1852 to 1855.			Total for 9 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.)	(E.)	(F.)	(C.)	(E.)	(F.)	(C.)	(E.)	(F.)	Attacked.	Died.
		No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.	No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.	No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.		
III.	ORDER 8.											
	Phlegmon - - - }	381	399	—	239	235	—	988	1,009	—	93·17	—
	Abscess - - - }	200	201	—	88	96	—					
	Ulcer - - - }	8	8	—	9	8	—					
	Tumor - - - }	37	37	—	26	25	—					
	Skin Disease, &c. - -											
IV.	ORDER 4.											
	Atrophy - - -	1	1	—	6	5	1	7	6	1	·66	·09
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - -	8	9	—	4	4	—	672	662	6	63·37	·57
	Contusion - - -	198	195	—	188	188	—					
	Sub-luxation - - -	80	77	—	74	74	—					
	Luxation - - -	9	7	—	3	4	—					
	Fracture - - -	13	14	—	10	10	—					
	Amputatio - - -	1	—	1	—	—	—					
	Wounds { Gunshot - -	1	—	1	—	—	—					
	{ Incised - - -	32	31	—	48	48	—					
	Otherwise - - -	—	—	—	1	—	1					
	Found dead - - -	—	—	2	—	—	—					
	Concussio Cerebri - -	1	—	1	1	1	—					
	ORDER 4.— <i>Suicide (attempted or accomplished).</i>											
	Wounds, Gunshot - -	—	—	—	—	—	1	—	—	1	—	·09
	ORDER 5.											
	Punitus - - -	7	7	—	11	10	—	40	36	—	3·77	—
	Observatio - - -	9	7	—	13	12	—					

* No Troops separately accounted for at this Station during the Year 1856.

N.B.—Invalids are included in these Numbers, but the Returns do not enable them to be distinguished.

No. 85.

BOMBAY.—COLABA.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 8 Years - - - - 3,174
 Mean Annual Strength - - - - 397

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Three Years,* 1852, 1855, 1856.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	3,562	3,736	97	2,967	2,869	48	6,529	6,605	145	2,057·08	45·68
	CLASSES.											
I.	ZYMOTIC DISEASES -	2,264	2,336	63	1,816	1,747	22	4,080	4,083	85	1,285·5	26·78
II.	CONSTITUTIONAL -	22	16	4	28	23	2	50	39	6	15·75	1·89
III.	LOCAL - - -	1,043	1,041	27	941	919	22	1,984	1,960	49	625·08	15·44
IV.	DEVELOPMENTAL -	—	—	—	3	3	—	3	3	—	·94	—
V.	VIOLENCE - - -	233	343	3	179	177	2	412	520	5	129·81	1·57
	ORDERS.											
	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	1	—	1	—	—	—	3,431	3,390	82	1,081·03	25·83
	Quinsy - - -	8	7	—	16	14	—					
	Catarrh and Influenza -	45	46	—	64	61	1					
	Ophthalmia - - -	67	72	—	41	42	—					
	Fever (C. C.) - - -	429	428	4	285	287	—					
	Erysipelas - - -	3	3	—	1	1	—					
	Dysentery - - -	377	354	31	91	80	13					
	Diarrhoea - - -	322	328	1	176	171	—					
	Cholera - - -	47	30	17	6	1	4					
	Ague - - -	317	322	1	422	403	—					
	Remittent Fever - - -	104	110	8	199	185	1					
	Rheumatism - - -	196	235	—	214	209	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	302	354	—	252	247	2	568	614	2	178·95	·63
	Stricture of Urethra - -	1	1	—	13	12	—					
	ORDER 3.— <i>Dietic Diseases.</i>											
	Purpura and Scurvy - -	8	8	—	5	5	—	37	36	1	11·66	·32
	Alcoholism { a. Del. Tremens	10	10	—	12	11	1					
	{ b. Intemperance	—	—	—	2	2	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	9	8	—	17	16	—	44	43	—	13·86	—
	Psora - - -	8	9	—	—	—	—					
	Dracunculus - - -	10	10	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	4	4	—	5	5	—	14	14	2	4·41	·63
	Dropsy - - -	1	1	1	4	4	1					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - -	—	—	—	1	1	—	36	25	4	11·34	1·26
	Scrofula - - -	12	10	—	11	8	—					
	Phthisis - - -	4	—	3	5	3	1					
	Hæmoptysis - - -	1	1	—	2	2	—					

No 85.—Bombay ; Colaba Station ; Infantry. Stational Return. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Three Years,* 1852, 1855, 1856.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.						
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.					
III.	ORDER 1.																
	Cephalitis - - -	2	2	—	30	28	1	136	132	9	42·85	2·83					
	Apoplexy - - -	11	7	4	2	—	1										
	Phrenitis - - -	1	1	—	—	—	—										
	Paralysis - - -	7	9	1	3	4	1										
	Insanity - - -	14	16	—	5	5	—										
	Odontalgia - - -	2	2	—	1	1	—										
	Epilepsy - - -	8	8	1	12	10	—										
	Neuralgia - - -	—	—	—	6	7	—										
	Otitis - - -	17	19	—	11	11	—	75	75	4	23·63	1·26					
	Dysecœa - - -	3	1	—	1	1	—										
	ORDER 2.																
	Pericarditis - - -	5	6	1	50	50	2										
	Aneurism - - -	—	—	—	5	4	1										
	Varix - - -	4	3	—	8	8	—										
	Heart Disease, &c. - - -	3	4	—	—	—	—										
	ORDER 3.																
	Bronchitis - - -	16	18	—	25	25	—	79	77	2	24·89	·63					
	Pleurisy - - -	1	1	—	7	7	—										
	Pneumonia - - -	2	3	—	3	3	—										
	Asthma - - -	11	9	—	14	11	2										
	ORDER 4.																
	Dyspepsia - - -	289	289	—	337	332	1	1,264	1,223	34	398·25	10·72					
	Gastritis - - -	—	—	—	5	4	1										
	Prolapsus Ani - - -	2	2	—	—	—	—										
	Peritonitis - - -	4	1	2	2	1	—										
	Ascites - - -	5	3	2	5	5	1										
	Hæmatemesis - - -	—	—	—	5	5	—										
	Ileus and Colic - - -	33	40	—	37	37	—										
	Hæmorrhoids - - -	37	39	—	9	9	—										
	Fistula - - -	5	4	—	2	3	—										
	Obstipatio - - -	18	20	—	23	21	—										
Hepatitis - - -	267	237	16	128	121	11											
Jaundice - - -	10	11	—	8	9	—											
Spleen Disease, &c. - - -	12	11	—	20	18	—											
Enteritis - - -	1	1	—	—	—	—											
ORDER 5.																	
Nephritis - - -	1	1	—	4	4	—	15	15	—	4·72	—						
Ischuria - - -	1	1	—	3	3	—											
Enuresis - - -	1	1	—	—	—	—											
Dysuria - - -	4	4	—	—	—	—											
Cystitis - - -	—	—	—	1	1	—											
ORDER 6.																	
Hydrocele - - -	5	4	—	2	2	—	7	6	—	2·20	—						
ORDER 7.																	
Joint Disease, &c. - - -	—	1	—	4	3	—	4	4	—	1·26	—						
ORDER 8.																	
Phlegmon - - -	133	139	—	93	93	—	404	428	—	127·28	—						
Abscess - - -																	
Ulcer - - -												91	104	—	57	59	—
Tumor - - -												3	2	—	1	1	—
Skin Disease, &c. - - -	14	17	—	12	13	—											
IV.																	
ORDER 4.																	
Atrophy - - -	—	—	—	3	3	—	3	3	—	·94	—						
V.																	
ORDER 1.— <i>Accident or Negligence.</i>																	
Burns or Scalds - - -	3	3	—	1	1	—	390	398	5	122·87	1·57						
Contusion - - -	135	142	—	103	102	—											
Sub-luxation - - -	53	53	—	35	34	—											
Fracture - - -	8	9	—	7	7	—											
Wounds { Gunshot - - -	—	1	—	—	—	—											
{ Incised - - -	24	25	—	21	21	—											
Found dead - - -	—	—	2	—	—	—											
Sudden - - -	—	—	1	—	—	1											
Drowned - - -	—	—	—	—	—	1											
ORDER 5.																	
Punitus - - -	9	9	—	4	4	—	22	22	—	6·94	—						
Observatio - - -	1	1	—	8	8	—											

* No Troops separately accounted for at this Station during the Years 1853 and 1854.

No. 86.

BOMBAY.—EN ROUTE, &c.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY’S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 6 Years	-	-	-	-	2,866
Mean Annual Strength	-	-	-	-	478

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Four Years,* 1847 to 1850.			Two Years,* 1853 and 1855.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	4,092	3,345	81	1,736	1,855	22	5,828	6,200	103	2,033·53	35·92
	CLASSES.											
I.	ZYMOTIC DISEASES -	3,124	3,327	57	1,256	1,341	15	4,380	4,668	72	1,528·3	25·12
II.	CONSTITUTIONAL -	46	40	5	34	44	2	80	84	7	27·91	2·44
III.	LOCAL - - -	777	830	15	380	410	3	1,157	1,240	18	493·7	6·28
V.	VIOLENCE - - -	145	148	4	66	60	2	211	208	6	73·62	2·08
	ORDERS.											
I.	ORDER 1.—Miasmatic Dis.											
	Varicella - - -	3	3	—	—	—	—	3,537	3,783	64	1,234·16	22·35
	Quinsy - - -	25	32	—	14	14	—					
	Catarrh and Influenza - - -	88	95	2	79	82	—					
	Ophthalmia - - -	106	142	—	27	31	—					
	Fever (C. C.) - - -	452	517	5	47	50	1					
	„ Ephemeral - - -	1	1	—	—	—	—					
	Erysipelas - - -	1	1	—	1	1	—					
	Dysentery - - -	189	193	20	52	47	6					
	Diarrhœa - - -	249	257	1	82	100	1					
	Cholera - - -	24	17	17	1	—	1					
	Ague - - -	884	926	1	539	583	1					
	Remittent Fever - - -	391	378	5	20	20	2					
	Rheumatism - - -	152	171	1	110	122	—					
	ORDER 2.—Enthetic Dis.											
	Syphilis, &c. - - -	498	539	2	236	242	—	742	792	2	258·9	·69
	Stricture of Urethra - - -	3	4	—	5	7	—					
	ORDER 3.—Dietic Dis.											
	Purpura and Scurvy - - -	8	6	—	27	27	—	69	62	6	24·08	2·08
	Alcoholism, Del. Tremens - - -	21	19	3	13	10	3					
	ORDER 4.—Parasitic Dis.											
	Psora - - -	15	12	—	—	—	—	32	1	—	11·16	—
	Vermes - - -	5	5	—	3	5	—					
	Dracunculus - - -	9	9	—	—	—	—					
II.	ORDER 1.—Diathetic Dis.											
	Lumbago - - -	3	2	—	10	11	—	19	18	1	6·63	·36
	Dropsy - - -	3	2	1	2	2	—					
	Fungus Hæmatodes - - -	1	1	—	—	—	—					
	ORDER 2.—Tubercular Dis.											
	Morbus Coxarius - - -	1	1	—	—	—	—	61	66	6	21·28	2·08
	Scrofula - - -	20	19	—	5	11	—					
	Phthisis - - -	11	8	4	17	18	2					
	Hæmoptysis - - -	7	7	—	—	2	—					

No. 86.—Bombay ; Troops en Route, &c. ; Infantry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Four Years,* 1847 to 1850.			Two Years,* 1853 and 1855.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	12	13	—	25	30	—	116	128	3	40·47	1·04
	Vertigo - - -	1	1	—	1	2	—					
	Apoplexy - - -	4	2	1	1	—	1					
	Paralysis - - -	8	10	—	12	14	—					
	Insanity - - -	10	18	—	3	3	—					
	Neuralgia - - -	4	3	—	1	—	—					
	Epilepsy - - -	3	3	—	3	4	—					
	Otitis - - -	19	15	—	5	7	—					
	Dyseœœa - - -	3	3	—	—	—	—					
	Brain Disease, &c. - -	1	—	1	—	—	—					
	ORDER 2.											
	Trismus Idiopathicus - -	1	—	1	—	—	—	46	49	1	16·06	·36
	Pericarditis - - -	15	18	—	17	17	—					
	Varix - - -	—	—	—	6	5	—					
	Heart Disease, &c. - -	—	1	—	7	8	—					
	ORDER 3.											
	Epistaxis - - -	2	2	—	—	—	—	63	66	3	21·99	1·04
	Bronchitis - - -	19	16	1	6	8	—					
	Pleurisy - - -	3	3	1	8	9	—					
	Pneumonia - - -	6	7	1	3	2	—					
	Asthma - - -	11	13	—	5	6	—					
	ORDER 4.											
	Dyspepsia - - -	75	80	—	45	51	1	634	680	11	221·23	3·84
	Gastritis - - -	3	1	—	—	—	—					
	Enteritis - - -	3	3	—	—	—	—					
	Peritonitis - - -	1	1	1	1	1	—					
	Ascites - - -	—	—	—	3	2	—					
	Hernia - - -	1	1	—	4	3	—					
	Ileus and Colic - - -	78	80	—	21	19	—					
	Prolapsus Ani - - -	2	3	—	1	1	—					
	Fistula - - -	1	—	—	—	—	—					
	Obstipatio - - -	35	30	—	21	21	—					
	Hepatitis - - -	198	226	7	53	63	1					
	Jaundice - - -	17	17	—	2	2	—					
	Hæmorrhoids - - -	27	23	—	13	12	—					
	Spleen Disease, &c. - -	22	32	1	4	5	—					
	Hæmatemesis - - -	3	3	—	—	—	—					
	ORDER 5.											
	Nephritis - - -	2	3	—	2	2	—	10	11	—	3·49	—
	Ischuria - - -	—	—	—	3	2	—					
	Enuresis - - -	—	—	—	3	4	—					
	ORDER 6.											
	Sarcocœle - - -	—	1	—	—	1	—	2	4	—	·69	—
	Hydrocœle - - -	2	2	—	—	—	—					
	ORDER 7.											
	Joint Disease, &c. - -	2	2	—	4	4	—	6	6	—	2·08	—
Phlegmon - - -	92	99	—	59	64	—	280	296	—	97·69	—	
Abscess - - -												
Ulcer - - -												
Skin Disease, &c. - -	6	5	—	9	8	—						
V.	ORDER 1.— <i>Accident or Negligence.</i>											
Contusion - - -	71	70	—	42	39	—	198	196	5	69·09	1·72	
Sub-luxation - - -	36	40	—	18	17	—						
Luxation - - -	2	3	—	—	—	—						
Fracture - - -	4	1	—	3	2	—						
Wounds, Incised - - -	20	22	—	2	2	—						
Drowning - - -	—	—	1	—	—	1						
Found dead - - -	—	—	2	—	—	1						
ORDER 5.												
Punitus - - -	3	3	—	—	—	—	13	12	1	4·53	·36	
Observatio - - -	9	9	1	1	—	—						

* No Troops accounted for under this heading during the Years 1851, 1852, 1854, and 1856.

N.B.—Invalids are included in these Numbers, but the Returns do not enable them to be distinguished.

No. 87.

BOMBAY.—BELGAUM STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 6 Years - - - - 5,915
Mean Annual Strength - - - - 986

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1847 to 1849.			Three Years,* 1854 to 1856.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	5,008	5,008	51	4,282	4,260	58	9,290	9,268	109	1,570·6	18·43
	CLASSES.											
I.	ZYMOTIC DISEASES -	3,658	3,701	30	3,046	3,040	35	6,704	6,741	65	1,133·41	10·99
II.	CONSTITUTIONAL -	61	60	3	99	90	3	160	150	6	27·05	1·01
III.	LOCAL - - -	1,006	964	14	890	885	15	1,896	1,849	29	320·54	4·9
V.	VIOLENCE - - -	283	283	4	247	245	5	530	528	9	89·6	1·52
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	5	5	—	7	3	2	3,565	3,537	60	602·72	10·15
	Quinsy - - -	44	42	—	45	47	—					
	Catarrh and Influenza - -	93	100	3	165	167	—					
	Ophthalmia - - -	156	158	—	153	156	—					
	Fever (C. C.) - - -	245	249	—	25	25	—					
	Erysipelas - - -	6	6	—	3	3	—					
	Dysentery - - -	215	188	19	285	256	29					
	Diarrhoea - - -	218	215	2	186	185	—					
	Cholera - - -	11	9	—	3	3	—					
	Ague - - -	234	230	—	564	569	1					
	Remittent Fever - - -	53	60	1	58	55	1					
	Rheumatism - - -	471	476	2	320	330	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	1,821	1,886	3	1,195	1,204	1	3,037	3,103	4	513·44	·67
	Stricture of Urethra - -	9	1	—	12	12	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	2	2	—	4	4	—	31	30	1	5·24	·17
	Alcoholism, Del. Tremens -	7	6	—	18	18	1					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	4	4	—	3	3	—	71	71	—	12·01	—
	Psora - - -	63	63	—	—	—	—					
	Dracunculus - - -	1	1	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	14	13	—	43	43	—	62	60	2	10·48	·34
	Dropsy - - -	3	3	1	2	1	1					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	39	39	—	43	37	—	98	90	4	16·57	·67
	Phthisis - - -	3	3	2	6	4	2					
	Hæmoptysis - - -	2	2	—	5	5	—					

No. 87.—Bombay ; Belgaum Station ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1847 to 1849.			Three Years,* 1854 to 1856.			Total for 6 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	—	—	—	72	71	—	163	152	9	27.56	1.52
	Apoplexy - - -	2	1	3	5	5	1					
	Paralysis - - -	2	—	1	16	14	2					
	Odontalgia - - -	—	—	—	1	1	—					
	Insanity - - -	4	3	—	19	15	1					
	Neuralgia - - -	—	—	—	1	1	—					
	Epilepsy - - -	—	—	—	3	3	—					
	Otitis - - -	14	14	—	20	20	—					
	Brain Disease, &c. - -	—	—	—	1	1	1					
	Dysœcœa - - -	—	—	—	3	3	—					
	ORDER 2.											
	Pericarditis - - -	51	48	1	13	11	1	66	60	3	11.16	.51
	Aneurism - - -	—	—	—	2	1	1					
	ORDER 3.											
	Bronchitis - - -	17	15	1	18	18	—	132	123	3	22.31	.51
	Pleurisy - - -	—	—	—	26	26	—					
	Pneumonia - - -	8	3	—	10	10	1					
	Asthma - - -	8	8	—	42	41	—					
	Epistaxis - - -	2	1	1	1	1	—					
	ORDER 4.											
	Dyspepsia - - -	208	205	—	72	68	—	987	968	13	166.87	2.19
	Enteritis - - -	4	4	—	2	1	1					
	Peritonitis - - -	—	—	—	2	1	1					
	Prolapsus Ani - - -	1	1	—	5	5	—					
	Ascites - - -	1	—	—	1	—	—					
	Hernia - - -	1	2	—	7	8	—					
	Ileus and Colic - - -	35	38	—	50	51	—					
	Hæmorrhoids - - -	12	11	—	32	34	—					
	Fistula - - -	1	1	—	1	1	—					
	Obstipatio - - -	18	18	—	10	11	—					
	Hepatitis - - -	192	178	6	225	229	4					
	Jaundice - - -	18	18	—	10	9	1					
	Spleen Disease, &c. - -	45	40	—	32	32	—					
	Hæmatemesis - - -	2	2	—	—	—	—					
	ORDER 5.											
	Nephritis - - -	—	—	—	5	5	—	11	11	—	1.86	—
	Enuresis - - -	2	2	—	3	3	—					
	Cystitis - - -	1	1	—	—	—	—					
	ORDER 6.											
	Hydrocele - - -	6	6	—	9	9	—	15	15	—	2.53	—
	ORDER 7.											
	Hydrarthrus - - -	2	2	—	—	—	—	7	7	—	1.18	—
	Joint Disease, &c. - -	1	1	—	4	4	—					
	ORDER 8.											
	Phlegmon - - -	157	156	1	84	86	—	515	513	1	87.07	.17
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Disease, &c. - -	12	12	—	26	28	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	4	4	—	5	5	—	516	514	6	87.23	1.02
	Contusion - - -	168	169	—	144	145	—					
	Sub-luxation - - -	70	70	—	28	28	—					
	Luxation - - -	1	1	—	2	2	—					
	Fracture - - -	5	4	—	13	13	—					
	Wounds { Gunshot - - -	—	—	1	2	2	—					
	{ Incised - - -	31	31	—	42	39	—					
	Amputatio - - -	—	—	—	1	1	—					
	Drowned - - -	—	—	3	—	—	—					
	Found dead - - -	—	—	—	—	—	2					
	ORDER 4.— <i>Suicide (attempted or accomplished).</i>											
	Wounds, Cut, Stab - -	—	—	—	—	—	3	—	—	3	—	.51
	ORDER 5.											
	Punitus - - -	4	4	—	9	9	—	14	14	—	2.37	—
	Observatio - - -	—	—	—	1	1	—					

* No Troops separately accounted for at this Station during the Years 1850, 1851, 1852, and 1853.

No. 88.

BOMBAY.—ADEN STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN,

Aggregate Strength for 5 Years - - - - 2,103
Mean Annual Strength - - - - 420

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Two Years,* 1850 and 1851.			Three Years,* 1852, 1855, and 1856.			Total for 5 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	878	862	20	1,562	1,509	14	2,440	2,371	34	1,160·25	16·17
I.	ZYMOTIC DISEASES -	448	450	6	776	750	4	1,224	1,200	10	582·03	4·75
II.	CONSTITUTIONAL -	5	1	2	35	34	—	40	35	2	19·02	·96
III.	LOCAL - - -	378	361	10	649	626	10	1,027	987	20	488·35	9·5
V.	VIOLENCE - - -	47	50	2	102	99	—	149	149	2	70·85	·96
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Quinsy - - -	2	2	—	8	8	—	993	973	9	472·18	4·28
	Catarrh and Influenza - - -	6	6	—	146	131	—					
	Ophthalmia - - -	26	26	—	23	26	—					
	Fever (C. C.) - - -	150	153	3	119	119	—					
	Dysentery - - -	4	3	1	24	23	1					
	Diarrhœa - - -	52	51	—	79	80	—					
	Ague - - -	72	70	1	111	112	—					
	Remittent Fever - - -	13	12	1	58	49	2					
	Rheumatism - - -	36	41	—	64	61	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c/- - -	69	65	—	77	76	—	152	147	—	72·28	—
	Stricture of Urethra - - -	3	3	—	3	3	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - - -	10	11	—	41	40	1	53	53	1	25·2	·47
	Alcoholism, Del. Tremens - -	—	—	—	2	2	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	2	2	—	21	20	—	26	27	—	12·37	—
	Dracunculus - - -	2	2	—	—	—	—					
	Psora - - -	1	3	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	—	—	—	23	22	—	25	24	—	11·89	—
	Dropsy - - -	1	1	—	1	1	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Morbus Coxarius - - -	—	—	—	1	1	—	15	11	2	7·13	·96
	Scrofula - - -	—	—	—	2	2	—					
	Phthisis - - -	4	—	2	5	6	—					
	Hæmoptysis - - -	—	—	—	3	2	—					
III.	ORDER 1.											
	Cephalitis - - -	4	3	—	3	3	—	52	46	4	24·73	1·90
	Apoplexy - - -	7	5	3	2	1	1					
	Paralysis - - -	—	—	—	2	2	—					
	Odontalgia - - -	—	—	—	2	2	—					
	Insanity - - -	—	—	—	9	8	—					
	Epilepsy - - -	1	1	—	4	4	—					
	Otitis - - -	7	6	—	11	11	—					

No. 88.—Bombay; Aden Station; Infantry. Stational Returns. European Troops; H.M. Regiments.—*cont.*

Class.	Diseases.	Two Years,* 1850 and 1851.			Three Years,* 1852, 1855, and 1856.			Total for 5 Years.*			Annual Ratio per 1000 of Mean Strength.		
		(C.)	(E.)	(F.)	(C.)	(E.)	(F.)	(C.)	(E.)	(F.)	Attacked.	Died.	
		No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.	No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.	No. of Attacks.	No. dis- charged to Duty.	No. of Deaths.			
III	ORDER 2.												
	Pericarditis - - -	7	8	—	27	22	3	}	43	39	3	20·45	1·42
	Aneurism - - -	—	—	—	1	1	—						
	Varix - - -	—	—	—	8	8	—						
	ORDER 3.												
	Bronchitis - - -	5	4	1	14	14	—	}	35	30	4	16·64	1·90
	Pneumonia - - -	2	2	—	5	3	1						
	Asthma - - -	4	2	1	5	5	1						
	ORDER 4.												
	Dyspepsia - - -	88	83	—	178	177	—	}	585	566	9	278·17	4·28
	Gastritis - - -	—	2	—	1	1	—						
	Peritonitis - - -	3	3	—	1	1	—						
	Ascites - - -	1	1	—	1	—	1						
	Hæmatemesis - - -	—	—	—	—	1	—						
	Ileus and Colic - - -	25	21	1	45	45	—						
	Obstipatio - - -	—	—	—	13	13	—						
	Hepatitis - - -	90	88	4	75	68	3						
	Hæmorrhoids - - -	3	1	—	15	15	—						
	Spleen Disease, &c. - - -	19	19	—	26	26	—						
	Jaundice - - -	1	1	—	—	—	—						
	ORDER 5.												
	Nephritis - - -	—	—	—	14	14	—	}	17	14	—	8·08	—
	Enuresis - - -	—	—	—	3	—	—						
ORDER 7.													
Joint Disease, &c. - - -	—	—	—	5	5	—	5	5	—	2·38	—	—	
ORDER 8.													
Phlegmon - - -	81	80	—	116	115	—	}	290	287	—	137·9	—	
Ulcer - - -	23	24	—	44	44	—							
Tumor - - -	—	—	—	4	3	—							
Skin Disease, &c. - - -	7	7	—	15	14	—							
V.	ORDER 1.— <i>Accident or Negligence.</i>												
	Burns or Scalds - - -	—	—	—	2	2	—	}	134	134	1	63·72	·48
	Contusion - - -	18	20	—	64	62	—						
	Sub-luxation - - -	10	10	—	12	12	—						
	Fracture - - -	2	3	—	—	—	—						
	Wounds, Incised - - -	8	8	1	17	16	—						
	Suffocation - - -	—	—	—	1	1	—						
	ORDER 5.												
	Punitus - - -	1	1	—	—	—	—	}	15	15	1	7·13	·48
	Observatio - - -	8	8	1	6	6	—						

* No Troops separately accounted for at this Station during the Years 1847 to 1849, 1853 and 1854.

No. 89.

BOMBAY.—HYDERABAD STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 4 Years - - - - 1,728
 Mean Annual Strength - - - - 432

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1850.*			Three Years,* 1852, 1853, and 1854.			Total for 4 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	759	741	14	3,299	3,271	48	4,058	4,012	62	2,348·4	35·85
	CLASSES.											
I.	ZYMOTIC DISEASES -	603	585	13	2,727	2,693	37	3,330	3,278	50	1,927·11	28·93
II.	CONSTITUTIONAL -	6	6	—	20	18	3	26	24	3	15·04	1·73
III.	LOCAL - - -	123	125	1	447	450	8	570	575	9	329·86	5·19
V.	VIOLENCE - - -	27	25	—	105	110	—	132	135	—	76·39	—
	ORDERS-											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Quinsy - - -	9	9	—	18	19	—	2,847	2,844	46	1,647·6	
	Catarrh and Influenza - -	10	11	—	50	55	—					
	Ophthalmia - - -	15	16	—	33	32	—					
	Fever (C. C.) - - -	2	1	1	109	119	—					
	Icterodes - - -	—	—	—	3	3	—					
	Erysipelas - - -	—	—	—	3	3	—					
	Dysentery - - -	32	29	1	53	54	4					
	Diarrhœa - - -	51	50	—	91	93	—					
	Cholera - - -	5	2	3	9	8	1					
	Ague - - -	44	44	—	947	953	—					
	Remittent Fever - - -	245	243	7	983	960	29					
	Rheumatism - - -	17	17	—	118	123	—					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. - - -	155	145	—	278	242	—	438	392	—	253·47	—
	Stricture of Urethra - -	1	1	—	4	4	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy - -	2	2	—	1	1	—	41	38	4	23·73	2·31
	Alcoholism, Del. Tremens -	15	15	1	23	20	3					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Verues - - -	—	—	—	4	4	—	4	4	—	2·31	—
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago - - -	—	—	—	4	4	—	9	10	—	5·21	—
	Dropsy - - -	—	—	—	5	6	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula - - -	4	4	—	4	5	—	17	14	3	9·83	1·73
	Phthisis - - -	—	—	—	4	—	3					
	Hæmoptysis - - -	2	2	—	3	3	—					
III.	ORDER 1.											
	Cephalitis - - -	—	—	—	11	12	—	44	44	3	25·46	1·73
	Apoplexy - - -	—	—	—	2	—	2					
	Paralysis - - -	—	—	—	5	6	1					
	Insanity - - -	1	2	—	1	1	—					
	Odontalgia - - -	—	—	—	2	2	—					
	Epilepsy - - -	1	1	—	2	2	—					
	Otitis - - -	3	3	—	16	15	—					

No. 89.—Bombay; Hyderabad Station; Infantry. Stational Returns. European Troops; H.M. Regts.—*cont*

Class.	Diseases.	One Year, 1850.*			Three Years,* 1852, 1853, and 1854.			Total for 4 Years.*			Annual Ratio per 1000 of Mean Strength.								
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.							
III.	ORDER 2.																		
	Pericarditis - - -	3	3	—	8	8	1	}	38	31	3	21·99	1·73						
	Aneurism - - -	1	—	1	4	3	1												
	Varix - - -	3	3	—	15	11	—												
	Heart Disease, &c. - -	—	—	—	4	3	—												
	ORDER 3.																		
	Epistaxis - - -	—	—	—	1	1	—	}	15	15	—	8·68	—						
	Bronchitis - - -	—	—	—	5	4	—												
	Pneumonia - - -	—	1	—	6	6	—												
	Asthma - - -	—	—	—	3	3	—												
	ORDER 4.																		
	Dyspepsia - - -	15	15	—	100	109	1	}	293	304	3	169·57	1·73						
	Gastritis - - -	2	2	—	1	1	—												
	Enteritis - - -	—	—	—	1	1	—												
	Ascites - - -	—	—	—	3	3	—												
	Hernia - - -	1	1	—	1	2	—												
	Ileus and Colic - - -	4	4	—	9	9	—												
	Fistula - - -	—	—	—	3	3	—												
	Hæmatemesis - - -	1	1	—	1	1	—												
	Obstipatio - - -	—	—	—	33	33	2												
	Hepatitis - - -	45	47	—	51	50	—												
	Hæmorrhoids - - -	3	3	—	7	7	—												
	Jaundice - - -	1	1	—	4	4	—												
	Spleen Disease, &c. - -	—	—	—	7	7	—												
	ORDER 5.																		
	Nephritis - - -	2	2	—	2	1	—	}	8	7	—	4·63	—						
	Ischuria - - -	—	—	—	2	2	—												
	Enuresis - - -	2	2	—	—	—	—												
	ORDER 6.																		
	Hydrocele - - -	—	—	—	1	1	—	1	1	—	·58	—							
	ORDER 7.																		
	Arthritis - - -	1	1	—	—	—	—	}	3	3	—	1·73	—						
	Joint Disease, &c. - -	—	—	—	1	1	—												
	Contractura - - -	—	—	—	1	1	—												
	ORDER 8.																		
	Phlegmon - - -	25	24	—	73	75	—	}	168	170	—	97·22	—						
	Abscess - - -																		
	Ulcer - - -													9	9	—	36	38	—
	Tumor - - -													—	—	—	2	1	—
	Skin Disease, &c. - -	—	—	—	23	23	—												
V.																			
ORDER 1.— <i>Accident or Negligence.</i>																			
Burns or Scalds - - -	—	—	—	2	2	—	}	122	125	—	70·6	—							
Contusion - - -	11	11	—	65	67	—													
Sub-luxation - - -	2	2	—	10	10	—													
Luxation - - -	2	2	—	3	2	—													
Fracture - - -	2	—	—	6	10	—													
Wounds { Gunshot - - -	—	—	—	10	9	—													
{ Incised - - -	8	9	—	—	—	—													
Venenatio - - -	—	—	—	1	1	—													
ORDER 5.																			
Punitus - - -	—	—	—	2	2	—	}	10	10	—	5·79	—							
Observatio - - -	2	1	—	6	7	—													

* No Troops separately accounted for at this Station during the Years 1847, 1848, 1849, 1851, 1855, and 1856.

No. 90.

BOMBAY.—MOUNT ABOO.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Mean Annual Strength - - - - - 83

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1851.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	101	101	7	101	101	7	1,216·86	84·32
	CLASSES.								
I.	ZYMOTIC DISEASES - -	61	65	3	61	65	3	734·94	36·14
II.	CONSTITUTIONAL - -	2	2	—	2	2	—	24·09	—
III.	LOCAL - - - -	35	31	4	35	31	4	421·69	48·18
V.	VIOLENCE - - - -	3	3	—	3	3	—	36·14	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Quinsy - - - -	2	2	—	48	52	3	578·32	36·14
	Catarrh and Influenza - -	1	—	1					
	Ophthalmia - - - -	1	1	—					
	Dysentery - - - -	6	5	1					
	Diarrhœa - - - -	4	4	—					
	Ague - - - -	19	19	—					
	Remittent Fever - - - -	1	1	—					
	Rheumatism - - - -	14	20	1					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	10	10	—	11	11	—	132·53	—
	Stricture of Urethra - -	1	1	—					
	ORDER 3.— <i>Dietic Dis.</i>								
	Alcoholism - { <i>a.</i> Del. Tremens - -	1	1	—	2	2	—	24·09	—
	{ <i>b.</i> Intemperance - -	1	1	—					
II.	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	2	2	—	2	2	—	24·09	—
III.	ORDER 1.								
	Epilepsy - - - -	2	2	—	2	2	—	24·09	—
	ORDER 4.								
	Dyspepsia - - - -	5	5	—	29	25	4	349·42	48·18
	Gastritis - - - -	1	—	1					
	Hernia - - - -	2	2	—					
	Ileus and Colic - - - -	4	4	—					
	Obstipatio - - - -	3	3	—					
	Hæmorrhoids - - - -	1	1	—					
	Hepatitis - - - -	10	8	2					
	Jaundice - - - -	1	—	1					
	Spleen Disease, &c. - -	2	2	—					
	ORDER 8.								
	Phlegmon - - - -	1	1	—	4	4	—	48·18	—
	Ulcer - - - -	3	3	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Sub-luxation - - - -	2	2	—	3	3	—	36·14	—
	Fracture - - - -	1	1	—					

* Troops only separately accounted for at this Station during the Year 1851.

No. 91.

BOMBAY.—BOMBAY STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Mean Annual Strength - - - - - 273

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and (F.) the Number of DEATHS by different Diseases.

Class	Diseases.	One Year, 1849.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.)	(E.)	(F.)	(C.)	(E.)	(F.)	Attacked.	Died.
		No. of Attacks.	No. discharged to Duty.	No. of Deaths.	No. of Attacks.	No. discharged to Duty.	No. of Deaths.		
	SPECIFIED CAUSES - -	641	620	16	641	620	16	2,348·02	58·6
	CLASSES.								
I.	ZYMOTIC DISEASES - -	458	442	11	458	442	11	1,677·7	40·29
II.	CONSTITUTIONAL - - -	4	5	1	4	5	1	14·65	3·66
III.	LOCAL - - - - -	154	147	4	154	147	4	564·1	14·65
V.	VIOLENCE - - - - -	25	26	—	25	26	—	91·57	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Quinsy - - - - -	2	2	—	420	402	11	1,538·5	40 29
	Catarrh and Influenza - -	18	15	—					
	Ophthalmia - - - - -	6	6	—					
	Fever (C. C.) - - - - -	204	204	1					
	Dysentery - - - - -	50	46	8					
	Diarrhœa - - - - -	64	59	—					
	Cholera - - - - -	3	1	2					
	Ague - - - - -	34	35	—					
	Remittent Fever - - - -	2	4	—					
	Rheumatism - - - - -	37	30	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - - -	33	34	—	33	34	—	120·88	—
	ORDER 3.— <i>Dietic Dis.</i>								
	Purpura and Scurvy - - -	1	1	—	4	4	—	14·65	—
	Alcoholism, Del. Tremens -	3	3	—					
	ORDER 4.— <i>Parasitic Dis.</i>								
	Vermes - - - - -	—	1	—	1	2	—	3·66	—
	Dracunculus - - - - -	1	1	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>								
	Lumbago - - - - -	3	3	—	3	3	—	10·99	—
	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - - -	1	2	—	1	2	1	3·66	3·66
	Phthisis - - - - -	—	—	1					

No. 91.—Bombay ; Bombay Station ; Infantry. Stational Returns. European Troops; H.M. Regts.—*cont.*

Class.	Diseases.	One Year, 1849.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.		
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.	
III.	ORDER 1.									
	Cephalitis - - - -	1	1	—	}	2	2	1	7·33	3·66
	Apoplexy - - - -	—	—	1						
	Insanity - - - -	—	—	—						
	Otitis - - - -	1	1	—						
	ORDER 2.				}	1	2	—	3·66	—
	Pericarditis - - - -	1	1	—						
	Varix - - - -	—	1	—						
	ORDER 3.									
	Asthma - - - -	6	6	—	6	6	—	21·98	—	
	ORDER 4.				}	98	89	3	358·98	10·99
	Dyspepsia - - - -	14	10	—						
	Prolapsus Ani - - - -	1	1	—						
	Ileus and Colic - - - -	10	10	—						
	Fistula - - - -	3	—	—						
	Obstipatio - - - -	2	2	—						
	Hepatitis - - - -	40	40	3						
	Hæmorrhoids - - - -	9	9	—						
	Jaundice - - - -	6	6	—						
	Spleen Disease, &c. - - - -	13	11	—						
	ORDER 5.									
	Dysuria - - - -	1	1	—	1	1	—	3·66	—	
	ORDER 6.									
	Hydrocele - - - -	1	1	—	1	1	—	3·66	—	
	ORDER 8.				}	45	46	—	164·84	—
	Phlegmon - - - -	31	36	—						
	Ulcer - - - -	14	10	—						
V.	ORDER 1.— <i>Accident or Negligence.</i>				}	23	24	—	84·24	—
	Contusion - - - -	10	10	—						
	Sub-luxation - - - -	3	3	—						
	Luxation - - - -	3	3	—						
	Fracture - - - -	—	1	—						
	Wounds, Incised - - - -	7	7	—						
	ORDER 5.									
	Punitus - - - -	2	2	—	2	2	—	7·33	—	

* Troops only separately accounted for at this Station during the Year 1849.

No. 92.

BOMBAY.—PESHAWUR STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY’S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Mean Annual Strength - - - - - 498

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1849.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	1,470	1,359	30	1,470	1,359	30	2,951·82	60·24
	CLASSES.								
I.	ZYMOTIC DISEASES - -	1,306	1,216	15	1,306	1,216	15	2,622·5	30·12
II.	CONSTITUTIONAL - -	6	6	—	6	6	—	12·05	—
III.	LOCAL - - - -	139	118	15	139	118	15	279·12	30·12
V.	VIOLENCE - - - -	19	19	—	19	19	—	38·15	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Small-pox - - - -	3	1	2	1,201	1,117	15	2,411·55	30·12
	Quinsy - - - -	8	7	—					
	Catarrh and Influenza - - - -	20	25	—					
	Ophthalmia - - - -	88	53	—					
	Fever (C. C.) - - - -	772	752	6					
	Dysentery - - - -	26	27	2					
	Diarrhœa - - - -	60	59	4					
	Ague - - - -	190	159	—					
	Remittent Fever - - - -	4	2	1					
	Rheumatism - - - -	30	32	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	100	94	—	103	97	—	206·93	—
	Stricture of Urethra - - - -	3	3	—					
	ORDER 3.— <i>Dietic Dis.</i>								
	Purpura and Scurvy - - - -	1	1	—	2	2	—	4·02	—
	Alcoholism, Delirium Tremens - - - -	1	1	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>								
	Lumbago - - - -	1	1	—	2	2	—	4·02	—
	Dropsy - - - -	1	1	—					
	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	4	4	—	4	4	—	8·03	—

No. 92.—Bombay; Peshawur Station; Infantry. Stational Returns. European Troops. H. M. Regts.—*cont*

Class.	Diseases.	One Year, 1849.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.		
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.	
III.	ORDER 1.									
	Cephalitis - - - -	6	7	—	}	20	10	9	40' 16	18' 05
	Apoplexy - - - -	10	2	9						
	Insanity - - - -	3	—	—						
	Otitis - - - -	1	1	—						
	ORDER 2.									
	Pericarditis - - - -	1	—	1	}	6	4	1	12' 05	2' 02
	Heart Disease - - - -	5	4	—						
	ORDER 3.									
	Pleurisy - - - -	1	—	—	}	3	1	1	6' 02	2' 02
	Pneumonia - - - -	2	1	1						
	ORDER 4.									
	Dyspepsia - - - -	10	9	—	}	79	77	4	158' 63	8' 03
	Ileus and Colic - - - -	10	10	—						
	Obstipatio - - - -	6	5	—						
	Hæmorrhoids - - - -	2	3	—						
	Hepatitis - - - -	23	23	4						
	Jaundice - - - -	20	19	—						
	Spleen Disease, &c. - - - -	8	8	—						
	ORDER 5.									
	Dysuria - - - -	1	1	—	1	1	—	2' 02	—	
	ORDER 8.									
	Phlegmon - - - -	25	23	—	}	30	25	—	60' 24	—
	Ulcer - - - -	5	2	—						
V.	ORDER 1.— <i>Accident or Negligence.</i>									
	Contusion - - - -	7	8	—	}	18	18	—	36' 13	—
	Sub-luxation - - - -	8	7	—						
	Fracture - - - -	2	2	—						
	Wounds { Gunshot - - - -	—	1	—						
	{ Incised - - - -	1	—	—						
	ORDER 5.									
	Punitus - - - -	1	1	—	1	1	—	2' 02	—	

* Troops only separately accounted for at this Station during the Year 1849.

No. 93.

BOMBAY.—KIRKEE STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, Number constantly Sick, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1847	10th Hussars - -	633	633		1,592	1,573	19
1848	10th Hussars - -	704	704		1,447	1,547	9
1849	10th Hussars - -	687	687		1,624	1,588	17
1850	10th Hussars - -	652	652		1,486	1,473	28
1851	10th Hussars - -	664	664		1,406	1,397	15
1852	10th Hussars - -	676	676		1,666	1,644	6
1853	10th Hussars - -	681	681		1,620	1,623	12
1854	10th Hussars - -	639·75	640		1,298	1,309	11
1855	14th Dragoons - -	537	537		830	752	6
1856	14th Dragoons - -	685	685		619	635	8
	Total - - -	6,558·75	6,559		13,588	13,541	131
	Mean - - -	656	656		1,359	1,354	13

No. 94.

BOMBAY.—DEESA STATION.

1847	28th Foot - -	858	} 1,057 {		1,115	1,053	36
1847	86th Foot - -	199·25			378	358	9
1848	86th Foot - -	1,158	1,158		1,801	1,760	37
1849	86th Foot - -	1,141	1,141		1,802	1,757	28
1850	86th Foot - -	832·50	} 1,087 {		1,342	1,329	28
1850	8th Foot - -	254·25			357	387	3
1851	8th Foot - -	969·75	970		1,713	1,669	21
1852	8th Foot - -	1,008	1,008		1,514	1,483	26
1853	8th Foot - -	733	733		1,141	1,113	10
1854	83rd Foot - -	432	432		1,003	993	7
1855	83rd Foot - -	411	411		863	856	8
1856	83rd Foot - -	933	933		1,360	1,297	19
	Total - - -	8,929·75	8,930		14,379	14,055	232
	Mean - - -	—	893		1,438	1,405	23·2

No. 95.

BOMBAY.—POONA STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.			Mean Strength during the Year.	Mean Number constantly sick in Hospital	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.						
1847	8th Foot	-	-	1,012	} 2,326 {	2,241	2,253	9
1847	22nd Foot	-	-	889		2,172	2,199	43
1847	86th Foot	-	-	425		720	683	16
1848	8th Foot	-	-	542	} 1,695 {	1,020	990	14
1848	22nd Foot	-	-	1,153		2,206	2,119	37
1849	64th Foot	-	-	397	} 1,060 {	976	881	38
1849	83rd Foot	-	-	663		949	848	57
1850	83rd Foot	-	-	821	} 1,094 {	1,079	1,048	15
1850	86th Foot	-	-	273		457	466	7
1851	86th Foot	-	-	1,054	1,054	1,173	1,759	12
1852	86th Foot	-	-	1,042	1,042	1,445	1,435	9
1853	78th Foot	-	-	955	} 1,888 {	2,242	2,202	21
1853	84th Foot	-	-	933		1,422	1,406	11
1854	78th Foot	-	-	927	927	1,883	1,864	23
1855	78th Foot	-	-	870	870	1,194	1,193	14
1856	78th Foot	-	-	907	907	1,051	955	14
	Total	-	-	12,863	12,863	22,230	22,301	340
	Mean	-	-	—	1,286	2,223	2,230	34

No. 96.—BOMBAY.—KURRACHEE STATION.

1847	60th Foot - -	929	929			959	948	23
1848	60th Foot - -	791·75	} 1,060 {			1,046	985	23
1848	8th Foot - -	268·50				556	543	6
1849	8th Foot - -	805	805			1,633	1,587	30
1850	64th Foot - -	1,029·50	} 1,812 {			1,585	1,584	28
1850	8th Foot - -	512·25				849	834	8
1850	83rd Foot - -	270	} 1,575 {			293	290	5
1851	64th Foot - -	541·50				910	889	19
1851	83rd Foot - -	1,033·50	} 1,541 {			1,489	1,449	71
1852	64th Foot - -	542·50				1,202	1,154	14
1852	83rd Foot - -	998·25	} 1,196 {			2,164	2,021	65
1853	64th Foot - -	751				2,809	2,755	15
1853	83rd Foot - -	444·75	} 1,094 {			1,210	1,266	9
1854	83rd Foot - -	554				850	826	12
1854	86th Foot - -	539·75	} 593 {			954	874	22
1855	83rd Foot - -	131·75				176	173	2
1855	86th Foot - -	461·50				730	750	9
Total	- - -	10,604·5	10,605			19,415	18,928	361
Mean	- - -	—	1,178			2,157	2,103	40

No. 97.

BOMBAY.—COLABA STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS—NON-COMMISSIONED OFFICERS
AND MEN.(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, Number constantly
SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.			Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.		Strength.					
1847	17th Foot	-	114·75	} 394 {		170	205	4
1847	28th Foot	-	279·50			456	482	11
1848	28th Foot	-	41		41	8	58	1
1849	22nd Foot	-	570	570		1,327	1,282	37
1850	78th Foot	-	399·75	400		771	769	30
1851	78th Foot	-	508	508		848	819	16
1852	78th Foot	-	525	525		1,218	1,177	28
1855	83rd Foot	-	277	277		623	602	8
1856	86th Foot	-	459	459		1,157	1,100	16
	Total	-	3,174	3,174		6,578	6,494	151
	Mean	-	—	397		822	812	19

No. 98.

BOMBAY.—EN ROUTE, &c.

1847	Sundry	-	209	209		396	405	8
1848	Sundry	-	269	269		650	665	10
1849	Sundry	-	977	977		2,232	2,573	49
1850	Sundry	-	520	520		747	716	14
1853	Sundry	-	654	654		1,273	1,381	12
1855	Sundry	-	237	237		470	469	9
	Total	-	2,866	2,866		5,768	6,209	102
	Mean	-	—	478		961	1,035	17

No. 99.

BOMBAY.—BELGAUM STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.			Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.		Strength.					
1847	78th Foot	- -	1,094·75	1,095		2,158	2,185	16
1848	78th Foot	- -	1,105	1,105		1,756	1,721	18
1849	78th Foot	- -	806	806		1,099	1,094	22
1854	64th Foot	- -	1,019	1,019		1,886	1,865	18
1855	64th Foot	- -	1,083	1,083		1,413	1,404	21
1856	64th Foot	- -	806·75	807		996	985	20
	Total	- - -	5,914·5	5,915		9,308	9,254	115
	Mean	- - -	—	986		1,551	1,542	19

No. 100.

BOMBAY.—ADEN STATION.

1850	Detachment, 78th Foot	-	369	369		417	408	12
1851	Detachment, 78th Foot	-	476	476		461	463	8
1852	Detachment, 78th Foot	-	469	469		532	517	9
1855	Detachment, 86th Foot	-	328·75	329		465	444	4
1856	Detachment, 86th Foot	-	460	460		561	563	1
	Total	- - -	2,102·75	2,103		2,436	2,395	34
	Mean	- - -	—	421		486	479	6

No. 101.

BOMBAY.—HYDERABAD STATION.

1850	64th Foot	- -	479	479		759	741	13
1852	64th Foot	- -	459	459		1,933	1,923	35
1853	83rd Foot	- -	397	397		602	587	7
1854	86th Foot	- -	393	393		736	785	7
	Total	- - -	1,728	1,728		4,030	4,036	62
	Mean	- - -	—	432		1,007	1,009	15

No. 102.

BOMBAY.—MOUNT ABOO STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1851	8th Foot - -	83	83		101	94	7
	Total and Mean - -	—	83		101	94	7

No. 103.

BOMBAY.—BOMBAY STATION.

1849	22nd Foot - -	273	273		636	619	16
	Total and Mean - -	—	273		636	619	16

No. 104.

BOMBAY.—PESHAWUR STATION.

1849	60th Foot - -	498	498		1,470	1,359	30
	Total and Mean - -	—	498		1,470	1,359	30

No. 105.

MADRAS.—BANGALORE STATION.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 8 Years - - - - 5,153
 Mean Annual Strength - - - - 644

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Three Years,* 1852 to 1854.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	4,509	4,451	51	2,579	2,544	38	7,088	6,969	89	1,375.52	17.27
	CLASSES.											
I.	ZYMOTIC DISEASES -	2,522	2,489	21	1,482	1,455	18	4,004	3,944	39	777.02	7.57
II.	CONSTITUTIONAL -	40	30	5	38	34	2	78	64	7	15.14	1.36
III.	LOCAL - - -	1,342	1,320	20	767	751	15	2,109	2,071	35	409.28	6.79
IV.	DEVELOPMENTAL -	—	—	—	4	4	—	4	4	—	.77	—
V	VIOLENCE - - -	605	612	5	288	274	3	893	886	8	173.3	1.55
	ORDERS.											
I	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	3	3	—	2	4	—	2,227	2,183	35	432.18	6.7
	Varicella - - -	1	1	—	—	—	—					
	Measles - - -	1	1	—	2	2	—					
	Quinsy - - -	52	51	—	23	25	—					
	Catarrh and Influenza -	156	152	—	79	76	—					
	Ophthalmia - - -	79	79	—	68	68	—					
	Fever (C. C.) - - -	278	270	4	158	154	4					
	Erythema - - -	—	—	—	1	1	—					
	Erysipelas - - -	2	2	—	8	8	—					
	Dysentery - - -	276	270	9	82	78	2					
	Diarrhoea - - -	152	151	—	153	150	3					
	Cholera - - -	14	12	2	6	2	4					
	Ague - - -	7	3	—	13	12	1					
	Remittent Fever - - -	34	35	3	46	43	3					
	Rheumatism - - -	316	315	—	215	215	—					
	ORDER 2.— <i>Enthetic Dis.</i>							1,688	1,677	2	327.58	.39
	Syphilis, &c. - - -	1,083	1,080	2	589	584	—					
	Stricture of Urethra - -	11	8	—	5	5	—					
	ORDER 3.— <i>Dietic Dis.</i>							77	72	2	14.94	.39
	Purpura and Scurvy - -	1	1	—	—	—	—					
	Alcoholism { <i>a.</i> Del. Tremens -	33	30	1	19	15	1					
	{ <i>b.</i> Intemperance -	16	18	—	8	8	—					
	ORDER 4.— <i>Parasitic Dis.</i>							12	12	—	2.33	—
	Verues - - -	6	6	—	2	2	—					
	Psora - - -	—	—	—	3	3	—					
	Porrigo, &c. - - -	1	1	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>							39	33	2	7.57	.39
	Lumbago - - -	17	14	—	17	17	—					
	Gout - - -	—	—	—	1	1	—					
	Dropsy - - -	1	—	1	3	1	1					
	ORDER 2.— <i>Tubercular Dis.</i>							39	31	5	7.57	.97
	Morbus Coxarius - - -	5	3	—	3	3	—					
	Scrofula - - -	11	11	—	11	10	—					
	Phthisis - - -	4	1	3	—	—	—					
	Hæmoptysis - - -	2	1	1	3	2	1					

No. 105.—Madras ; Bangalore Station ; Cavalry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Three Years,* 1852 to 1854.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	37	37	—	67	66	—	208	191	14	40·36	2·72
	Meningitis - - -	2	2	—	—	—	—					
	Apoplexy - - -	4	1	3	2	—	3					
	Paralysis - - -	20	12	5	15	13	2					
	Odontalgia - - -	3	3	—	—	—	—					
	Insanity - - -	5	5	—	7	6	1					
	Epilepsy - - -	12	12	—	19	19	—					
	Otitis - - -	8	8	—	5	5	—					
	Dyscœa - - -	1	1	—	—	—	—					
	Brain Disease, &c. - -	1	1	—	—	—	—					
	ORDER 2.							93	86	4	18·05	·77
	Pericarditis - - -	60	58	2	21	21	—					
	Aneurism - - -	1	1	—	1	—	1					
	Varix - - -	1	1	—	3	2	—					
	Heart Disease, &c. - -	2	1	—	4	2	1					
	ORDER 3.							46	46	1	8·93	·19
	Pleurisy - - -	—	—	—	1	1	—					
	Pneumonia - - -	16	16	—	1	1	—					
	Asthma - - -	21	23	—	7	5	1					
	ORDER 4.							771	761	16	149·62	3·11
	Dyspepsia - - -	50	50	—	24	25	—					
	Gastritis - - -	16	16	—	6	6	—					
	Enteritis - - -	12	11	2	1	1	—					
	Hernia - - -	4	4	—	—	—	—					
	Ileus and Colic - - -	75	75	—	15	15	—					
	Hæmorrhoids - - -	14	16	—	22	23	—					
	Fistula - - -	2	2	—	6	6	—					
	Obstipatio - - -	66	63	—	8	8	—					
	Hepatitis - - -	249	247	7	145	138	5					
	Jaundice - - -	11	11	1	7	7	—					
	Hæmatemesis - - -	2	2	—	1	—	1					
	Spleen Disease, &c. - -	19	19	—	16	16	—					
	ORDER 5.							36	35	—	6·98	—
	Nephritis - - -	3	3	—	8	8	—					
	Ischuria - - -	19	18	—	2	2	—					
	Enuresis - - -	—	—	—	1	1	—					
	Cystitis - - -	2	2	—	1	1	—					
	ORDER 6.							2	3	—	·39	—
	Hydrocele - - -	2	3	—	—	—	—					
	ORDER 7.							14	12	—	2·72	—
	Arthritis - - -	2	2	—	—	—	—					
	Joint Disease, &c. - -	12	10	—	—	—	—					
	ORDER 8.							939	937	—	182·23	—
	Phlegmon - - -	348	349	—	214	215	—					
	Ulcer - - -	122	122	—	78	77	—					
	Tumor - - -	2	2	—	—	—	—					
	Skin Disease, &c. - -	116	111	—	59	61	—					
IV.	ORDER 4.							4	4	—	·77	—
	Atrophy - - -	—	—	—	4	4	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>							883	876	8	171·36	1·55
	Drowned - - -	—	—	2	—	—	1					
	Burns or Scalds - - -	5	5	—	4	4	—					
	Contusion - - -	467	472	—	211	198	—					
	Concussio Cerebri - -	3	3	—	2	2	—					
	Sub-luxation - - -	55	54	—	14	15	—					
	Luxation - - -	7	7	—	—	—	—					
	Fracture - - -	18	18	—	6	5	—					
	Wounds, Incised - - -	48	51	—	43	42	—					
	ORDER 3.— <i>Suicide.</i>							1	1	—	—	—
	Wounds, Gunshot - -	—	—	3	—	—	1					
	Not stated - - -	—	—	—	—	—	—					
	ORDER 5.							10	10	—	1·94	—
	Punitus - - -	1	1	—	—	—	—					
	Observatio - - -	1	1	—	8	8	—					

* No Cavalry separately accounted for at this Station during the Years 1855 and 1856.

No. 106.

MADRAS.—EN ROUTE, &c.—CAVALRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS,—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 3 Years	-	-	-	-	333
Annual Mean Strength	-	-	-	-	111

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years, 1854 to 1856.*			Total for 3 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	541	553	9	541	553	9	1,624·65	27·03
	CLASSES.								
I.	ZYMOTIC DISEASES - -	356	353	6	356	353	6	1,069·1	18·03
II.	CONSTITUTIONAL - -	10	10	—	10	10	—	30·03	—
III.	LOCAL - - - -	131	137	2	131	137	2	393·39	6·00
V.	VIOLENCE - - - -	44	53	1	44	53	1	132·13	3·00
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Small-pox - - - -	1	1	—	200	198	5	600·63	15·02
	Vaccinia - - - -	1	1	—					
	Quinsy - - - -	4	4	—					
	Catarrh and Influenza - -	18	20	—					
	Ophthalmia - - - -	9	8	—					
	Fever (C. C.) - - - -	39	38	1					
	Erysipelas - - - -	2	2	—					
	Dysentery - - - -	22	23	1					
	Diarrhoea - - - -	47	45	—					
	Cholera - - - -	9	6	3					
	Ague - - - -	1	1	—					
	Remittent Fever - - - -	2	2	—					
	Rheumatism - - - -	45	47	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	142	139	1	143	139	1	429·43	3·01
	Stricture of Urethra - -	1	—	—					
	ORDER 3.— <i>Dietic Dis.</i>								
	Alcoholism { <i>a.</i> Del. Tremens - -	9	12	—	11	14	—	33·03	—
	<i>b.</i> Intemperance - -	2	2	—					
	ORDER 4.— <i>Parasitic Dis.</i>								
	Vermes - - - -	2	2	—	2	2	—	6·01	—
II.	ORDER 1.— <i>Diathetic Dis.</i>								
	Lumbago - - - -	6	5	—	7	6	—	21·02	—
	Dropsy - - - -	1	1	—					

No. 106.—Madras ; Cavalry ; En Route, &c. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	3 Years, 1854 to 1856.*			Total for 3 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
II.	ORDER 2.— <i>Tubercular Dis.</i>								
	Morbus Coxarius - - -	3	3	—	3	4	—	9·01	—
	Scrofula - - -	—	1	—					
III.	ORDER 1.								
	Cephalitis - - -	10	10	1	18	18	1	54·05	3·00
	Apoplexy - - -	1	1	—					
	Paralysis - - -	2	2	—					
	Insanity - - -	1	1	—					
	Epilepsy - - -	4	4	—					
	ORDER 2.								
	Pericarditis - - -	1	2	—	2	5	—	6·01	—
	Varix - - -	—	1	—					
	Heart Disease, &c. - - -	1	2	—					
	ORDER 3.								
	Pneumonia - - -	2	2	—	2	3	—	6·01	—
	Asthma - - -	—	1	—					
	ORDER 4.								
	Dyspepsia - - -	8	7	—	46	46	1	130·14	3·00
	Ileus and Colic - - -	5	4	—					
	Hæmorrhoids - - -	4	3	—					
	Fistula - - -	1	1	—					
	Obstipatio - - -	11	11	—					
	Hepatitis - - -	11	14	1					
	Jaundice - - -	2	2	—					
	Spleen Disease, &c. - - -	4	4	—					
	ORDER 6.								
	Hydrocele - - -	2	2	—	2	2	—	6·01	—
	ORDER 7.								
	Joint Disease, &c. - - -	1	1	—	1	1	—	3·00	—
	ORDER 8.								
	Phlegmon - - -	32	35	—	60	62	—	180·17	—
	Ulcer - - -	15	17	—					
	Skin Disease, &c. - - -	13	10	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Contusion - - -	34	43	—	42	51	1	126·12	3·01
	Fracture - - -	2	2	—					
	Concussion of Brain - - -	2	1	1					
	Wounds, Incised - - -	4	5	—					
	ORDER 5.								
	Observatio - - -	2	2	—	2	—	—	6·01	—

* No Cavalry separately accounted for under this heading except during the Years 1854, 1855, and 1856.

No. 107.

MADRAS.—CANNANORE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 10 Years - - - - 9,032
 Mean Annual Strength - - - - 903

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	7,965	7,869	112	5,298	5,185	80	13,263	13,064	192	1,468·44	21·25
	CLASSES.											
I.	ZYMOTIC DISEASES -	4,666	4,632	58	3,005	2,956	34	7,671	7,588	92	849·31	10·18
II.	CONSTITUTIONAL -	115	102	15	108	99	12	223	201	27	24·69	2·99
III.	LOCAL -	2,610	2,558	32	1,778	1,729	29	4,388	4,287	61	485·83	6·75
IV.	DEVELOPMENTAL -	1	—	1	4	4	—	5	4	1	·55	·11
V.	VIOLENCE -	573	577	6	403	397	5	976	974	11	108·06	1·22
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox -	3	3	—	2	2	—	4,744	4,654	80	525·25	8·86
	Varicella -	1	1	—	2	2	—					
	Measles -	5	5	—	—	—	—					
	Quinsy -	58	60	—	50	53	—					
	Catarrh and Influenza -	704	702	1	335	316	3					
	Ophthalmia -	235	240	—	68	69	—					
	Fever (C. C.) -	267	270	6	249	246	4					
	Ephemeral -	—	—	—	6	6	—					
	Erysipelas -	4	3	1	7	7	—					
	Anthrax -	—	—	—	3	3	—					
	Dysentery -	403	360	38	302	282	15					
	Diarrhœa -	565	561	1	386	382	—					
	Cholera -	1	1	—	10	8	3					
	Ague -	36	34	—	224	225	—					
	Remittent Fever -	28	29	—	12	8	3					
	Rheumatism -	427	421	3	351	355	2					
	ORDER 2.— <i>Enthetic Dis.</i>											
	Syphilis, &c. -	1,604	1,611	1	821	817	1	2,471	2,473	2	273·58	·22
	Stricture of Urethra -	16	15	—	30	30	—					
	ORDER 3.— <i>Dietic Dis.</i>											
	Purpura and Scurvy -	36	44	1	10	9	1	370	375	10	40·96	1·10
	Alcoholism - { <i>a.</i> Del. Tremens	63	63	2	21	8	2					
	<i>b.</i> Intemperance	194	194	4	46	57	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes -	16	15	—	16	17	—	86	86	—	9·52	—
	Psora -	—	—	—	54	54	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>											
	Lumbago -	43	42	—	50	52	—	104	103	2	11·51	·22
	Dropsy -	4	4	—	6	4	2					
	Cancer -	—	—	—	1	1	—					
	ORDER 2.— <i>Tubercular Dis.</i>											
	Scrofula -	32	27	1	12	14	—	119	98	25	13·18	2·77
	Phthisis -	23	15	14	29	16	10					
	Hæmoptysis -	13	14	—	10	12	—					
III.	ORDER 1.											
	Cephalitis -	21	19	—	41	41	—	326	317	9	36·09	·99
	Apoplexy -	3	3	—	5	2	3					
	Paralysis -	7	5	2	16	15	2					
	Odontalgia -	24	25	—	2	2	—					
	Insanity -	27	29	—	5	5	—					
	Tetanus -	1	—	1	—	—	—					
	Epilepsy -	41	40	1	18	19	—					
	Otitis -	68	68	—	44	42	—					
	Brain Disease, &c. -	1	1	—	1	1	—					
	Dysœcœa -	—	—	—	1	—	—					

No. 107.—Madras; Cannanore Station; Infantry. Stational Returns. European Troops; H.M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 2.											
	Pericarditis - - -	23	21	2	25	19	4	119	98	13	13.18	1.44
	Aneurism - - -	5	—	5	14	4	2					
	Varix - - -	16	16	—	4	5	—					
	Heart Disease, &c. - -	—	—	—	31	32	—					
	Phlebitis - - -	1	1	—	—	—	—					
	ORDER 3.											
	Laryngitis - - -	—	—	—	1	1	—	184	173	7	20.37	.77
	Hydrothorax - - -	2	—	2	—	—	—					
	Bronchitis - - -	—	—	—	104	105	2					
	Pleurisy - - -	—	—	—	1	1	—					
	Pneumonia - - -	23	20	1	9	6	2					
	Asthma - - -	25	21	—	19	19	—					
	ORDER 4.											
	Dyspepsia - - -	272	271	—	274	273	1	2,118	2,066	32	234.5	3.55
	Gastritis - - -	31	30	—	18	18	—					
	Enteritis - - -	2	1	1	2	2	—					
	Hæmatemesis - - -	2	2	—	—	—	—					
	Ascites - - -	—	—	—	1	1	—					
	Hernia - - -	18	16	—	7	6	—					
	Ileus and Colic - - -	163	163	—	29	26	—					
	Fistula - - -	9	10	—	6	6	—					
	Obstipatio - - -	419	421	—	168	162	—					
	Hæmorrhoids - - -	83	76	—	80	80	1					
	Hepatitis - - -	296	276	13	206	196	12					
	Jaundice - - -	10	8	1	9	9	—					
	Spleen Disease, &c. - -	7	7	—	6	6	—					
	ORDER 5.											
	Nephritis - - -	—	—	—	5	6	—	22	24	—	2.44	—
	Enuresis - - -	2	2	—	—	—	—					
	Ischuria - - -	—	—	—	5	5	—					
	Cystitis - - -	4	4	—	2	2	—					
	Dysuria - - -	4	5	—	—	—	—					
	ORDER 6.											
	Hydrocele - - -	6	6	—	10	9	—	17	16	—	1.88	—
	Sarcoma - - -	1	1	—	—	—	—					
	ORDER 7.											
	Hydrarthrus - - -	3	3	—	—	—	—	14	12	—	1.55	—
	Arthritis - - -	4	4	—	1	1	—					
	Joint Disease, &c. - -	3	2	—	2	1	—					
	Contractura - - -	—	—	—	1	1	—					
	ORDER 8.											
	Phlegmon - - -	416	415	—	315	311	—	1,588	1,581	—	175.82	—
	Abscess - - -											
	Ulcer - - -											
	Tumor - - -											
	Skin Disease, &c. - -	238	237	—	80	77	—					
IV.	ORDER 4.											
	Atrophy - - -	1	—	1	4	4	—	5	4	1	.55	.11
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Cause not known - - -	—	—	—	—	—	1	911	905	6	100.87	.66
	Burns or Scalds - - -	8	9	—	2	2	—					
	Contusion - - -	292	292	—	212	210	—					
	Sub-luxation - - -	140	140	—	94	88	—					
	Luxation - - -	9	9	—	1	6	—					
	Fracture - - -	12	12	—	9	7	1					
	Wounds - { Gunshot - -	4	4	—	1	1	—					
	{ Incised - -	89	90	—	34	31	1					
	Concussio Cerebri - -	1	1	—	3	3	—					
	Drowned - - -	—	—	2	—	—	1					
	ORDER 2.— <i>Battle.</i>											
	Killed in Action - - -	—	—	4	—	—	—	—	—	4	—	.45
	ORDER 4.— <i>Suicide.</i>											
	Not stated - - -	—	—	—	—	—	1	—	—	1	—	.11
	ORDER 5.											
	Punitus - - -	1	1	—	2	2	—	65	69	—	7.19	—
	Observatio - - -	17	19	—	45	47	—					

No. 108.

MADRAS.—BANGALORE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 10 Years - - - - 8,271
 Mean Annual Strength - - - - 827

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856,			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	6,952	6,808	146	4,392	4,373	50	11,344	11,181	196	1,371.53	23.69
	CLASSES.											
I.	ZYMOTIC DISEASES -	4,923	4,817	77	3,251	3,256	28	8,174	8,073	105	988.27	12.69
II.	CONSTITUTIONAL -	88	72	17	48	44	3	136	116	20	16.44	2.42
III.	LOCAL - - -	1,513	1,484	43	886	864	18	2,399	2,348	61	290.05	7.37
IV.	DEVELOPMENTAL -	2	2	—	1	1	—	3	3	—	.36	—
V.	VIOLENCE - - -	426	433	9	206	208	1	632	641	10	76.41	1.21
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Anthrax - - -	3	3	—	—	—	—	4,624	4,548	100	559.06	12.09
	Small-pox - - -	7	4	3	2	2	—					
	Varicella - - -	2	2	—	3	3	—					
	Measles - - -	8	8	—	2	2	—					
	Quinsy - - -	144	142	—	53	52	—					
	Catarrh and Influenza -	579	570	2	208	205	—					
	Ophthalmia - - -	194	196	—	154	152	—					
	Fever (C. C.) - - -	439	436	7	318	320	7					
	Erysipelas - - -	4	4	—	1	—	1					
	Dysentery - - -	426	406	28	162	165	9					
	Diarrhoea - - -	298	301	2	303	309	—					
	Cholera - - -	36	9	28	12	7	6					
	Ague - - -	27	26	—	197	194	—					
	Remittent Fever - - -	5	2	4	48	45	2					
	Rheumatism - - -	631	621	—	358	362	1					
	ORDER 2.— <i>Enthetic Dis.</i>							3,438	3,415	4	415.67	.48
	Syphilis, &c. - - -	2,063	2,031	3	1,337	1,348	1					
	Stricture of Urethra -	24	24	—	14	12	—					
	ORDER 3.— <i>Dietic Dis.</i>							80	78	1	9.67	.12
	Purpura and Scurvy -	6	6	—	—	—	—					
	Alcoholism { a. Del. Tremens -	23	22	—	35	34	1					
	{ b. Intemperance -	3	3	—	13	13	—					
	ORDER 4.— <i>Parasitic Dis.</i>							32	32	—	3.87	—
	Vermes - - -	1	1	—	11	11	—					
	Psora - - -	—	—	—	20	20	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>							25	24	1	3.02	.12
	Lumbago - - -	11	11	—	3	3	—					
	Dropsy - - -	8	7	1	3	3	—					
	ORDER 2.— <i>Tubercular Dis.</i>							111	92	19	13.42	2.30
	Morbus Coxarius - -	1	2	—	—	—	—					
	Scrofula - - -	19	19	—	12	11	—					
	Phthisis - - -	43	27	16	21	20	2					
	Hæmoptysis - - -	6	6	—	9	7	1					

No. 108.—Madras ; Bangalore Station ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Five Years, 1847 to 1851.			Five Years, 1852 to 1856.			Total for 10 Years.			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1											
	Cephalitis - - -	40	40	—	23	23	—	236	230	18	28·53	2·18
	Vertigo - - -	1	1	—	—	—	—					
	Apoplexy - - -	8	—	10	10	9	1					
	Paralysis - - -	26	34	2	9	8	—					
	Insanity - - -	18	20	1	9	10	1					
	Neuralgia - - -	—	—	—	1	1	—					
	Epilepsy - - -	15	15	—	20	17	1					
	Odontalgia - - -	11	10	—	2	2	—					
	Otitis - - -	26	25	—	11	11	—					
	Brain Disease, &c. - - -	2	—	2	—	—	—					
	Dyseecæa - - -	1	1	—	3	3	—					
	ORDER 2.							128	110	21	15·48	2·54
	Pericarditis - - -	30	24	8	16	15	1					
	Aneurism - - -	4	—	6	10	8	2					
	Varix - - -	4	3	—	2	3	—					
	Heart Disease, &c. - - -	15	12	2	47	45	2					
	ORDER 3.							109	106	5	13·18	·60
	Bronchitis - - -	—	—	—	7	6	1					
	Pleurisy - - -	—	—	—	9	9	—					
	Pneumonia - - -	32	30	—	10	7	3					
	Asthma - - -	42	42	1	8	11	—					
	Phlebitis - - -	1	1	—	—	—	—					
	ORDER 4.							1,022	991	17	123·57	2·05
	Dyspepsia - - -	31	31	—	115	110	—					
	Gastritis - - -	24	24	—	4	4	—					
	Enteritis - - -	4	2	1	—	—	—					
	Ascites - - -	1	1	—	—	—	—					
	Hæmatemesis - - -	—	—	—	1	—	1					
	Hernia - - -	6	6	—	2	2	—					
	Ilæus and Colic - - -	14	14	—	37	37	—					
	Hæmorrhoids - - -	102	102	—	35	36	—					
	Fistula - - -	6	7	—	—	—	—					
	Obstipatio - - -	62	62	—	43	37	—					
	Hepatitis - - -	361	352	10	134	126	5					
	Jaundice - - -	18	18	—	7	4	—					
	Spleen Disease, &c. - - -	8	9	—	7	7	—					
	ORDER 5.							24	23	—	2·90	—
	Nephritis - - -	4	5	—	6	5	—					
	Ischuria - - -	4	4	—	5	5	—					
	Hæmaturia - - -	—	—	—	2	2	—					
	Cystitis - - -	2	1	—	1	1	—					
	ORDER 6.							6	6	—	·72	—
	Sarcocele - - -	1	1	—	—	—	—					
	Hydrocele - - -	3	3	—	2	2	—					
	ORDER 7.							9	10	—	1·09	—
	Arthritis - - -	—	—	—	2	2	—					
	Joint Disease, &c. - - -	6	7	—	—	—	—					
	Contractura - - -	—	—	—	1	1	—					
	ORDER 8.							865	872	—	104·58	—
	Phlegmon - - -	291	290	—	164	175	—					
	Abscess - - -	175	176	—	92	92	—					
	Ulcer - - -	3	3	—	4	4	—					
	Tumor - - -	111	108	—	25	24	—					
	Skin Disease, &c. - - -	—	—	—	—	—	—					
IV.	ORDER 4.							3	3	—	·36	—
	Atrophy - - -	2	2	—	1	1	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Killed by elephant - - -	—	—	1	—	—	—	533	543	8	64·44	·97
	Not known - - -	—	—	1	—	—	—					
	Burns or Scalds - - -	7	7	—	8	7	—					
	Contusion - - -	210	217	—	79	83	—					
	Sub-luxation - - -	88	87	—	55	58	—					
	Luxation - - -	—	—	—	2	2	—					
	Fracture - - -	12	11	1	9	8	1					
	Concussio Cerebri - - -	3	2	—	—	—	—					
	Wounds, Incised - - -	34	36	—	24	23	—					
	Amputatio - - -	—	—	—	2	2	—					
	Drowned - - -	—	—	4	—	—	—					
	ORDER 4.— <i>Suicide.</i>							—	—	2	—	·24
	Wounds, Gunshot - - -	—	—	2	—	—	—					
	ORDER 5.							99	98	—	11·97	—
	Punitus - - -	8	8	—	4	5	—					
	Observatio - - -	64	65	—	23	20	—					

No. 109.

MADRAS.—FORT ST. GEORGE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS.—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 8 Years - - - 6,601
 Mean Annual Strength - - - 825

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Five Years, 1847 to 1851.			Three Years,* 1852 to 1854.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	9,131	8,878	171	3,108	3,245	58	12,239	12,123	229	1,854·11	34·69
	CLASSES.											
I.	ZYMOTIC DISEASES -	5,804	5,680	86	1,983	2,110	35	7,787	7,790	121	1,179·67	18·33
II.	CONSTITUTIONAL -	155	123	30	44	34	6	199	157	36	30·15	5·45
III.	LOCAL - - -	2,630	2,538	51	898	912	16	3,528	3,450	67	534·46	10·15
V.	VIOLENCE - - -	542	537	4	183	189	1	725	726	5	109·83	·76
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	7	6	—	—	1	—	5,038	4,976	107	763·22	16·21
	Measles - - -	1	1	—	6	8	—					
	Scarlatina - - -	1	1	—	—	—	—					
	Quinsy - - -	57	58	—	23	23	—					
	Catarrh and Influenza -	572	578	3	189	194	1					
	Ophthalmia - - -	177	164	—	41	59	—					
	Fever (C. C.) - - -	1,124	1,108	10	383	381	4					
	Ephemeral - - -	—	—	—	6	6	—					
	Erysipelas - - -	—	—	—	3	4	—					
	Anthrax - - -	—	—	—	2	2	—					
	Dysentery - - -	601	550	43	163	173	13					
	Diarrhœa - - -	452	444	4	361	359	1					
	Cholera - - -	18	5	12	24	9	15					
	Ague - - -	64	68	—	50	31	—					
	Remittent Fever - - -	10	10	—	40	53	1					
	Rheumatism - - -	541	540	—	122	140	—					
	ORDER 2.— <i>Enthetic Dis.</i>							2,490	2,560	3	377·21	·45
	Syphilis, &c. - - -	1,932	1,913	3	496	587	—					
	Stricture of Urethra - -	45	39	—	17	21	—					
	ORDER 3.— <i>Dietic Dis.</i>							246	241	11	37·27	1·67
	Purpura and Scurvy - -	34	38	3	4	4	—					
	Alcoholism { <i>a. Del. Tremens</i> <i>b. Intemperance</i>	79 82	71 79	8 —	14 33	16 33	— —					
	ORDER 4.— <i>Parasitic Dis.</i>							13	13	—	1·97	—
	Vermes - - -	7	7	—	6	6	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>							43	38	1	6·51	·15
	Lumbago - - -	29	25	—	9	9	—					
	Dropsy - - -	3	2	1	2	2	—					
	ORDER 2.— <i>Tubercular Dis.</i>							156	119	35	23·65	5·30
	Morbus Coxarius - - -	1	—	—	1	1	—					
	Scrofula - - -	54	55	1	11	11	—					
	Phthisis - - -	51	23	28	15	8	6					
	Hæmoptysis - - -	17	18	—	4	3	—					

No 109.—Madras ; Fort St. George ; Infantry. Stational Returns. European Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Five Years. 1847 to 1851.			Three Years.* 1852 to 1854.			Total for 8 Years.*			Annual Ratio per 1000 of Mean Strength.							
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.						
III.	ORDER 1.																	
	Cephalitis - - -	76	75	—	19	21	—	}	319	302	11	48·33	1·67					
	Apoplexy - - -	6	1	6	3	3	—											
	Paralysis - - -	12	10	1	10	10	—											
	Odontalgia - - -	13	13	—	1	1	—											
	Insanity - - -	13	8	1	7	7	—											
	Epilepsy - - -	19	15	2	8	8	—											
	Neuralgia - - -	2	2	—	3	3	—											
	Otitis - - -	95	95	—	23	23	—											
	Chorea - - -	2	1	—	—	—	—											
	Brain Diseases, &c. - -	1	—	1	—	—	—											
	Dyseecæa - - -	5	5	—	1	1	—											
	ORDER 2.																	
	Pericarditis - - -	14	13	1	9	10	—	}	79	71	5	11·97	·76					
	Aneurism - - -	—	—	—	3	—	3											
	Varix - - -	9	9	—	2	1	—											
	Heart Disease, &c. - -	2	2	—	40	36	1											
	ORDER 3.																	
	Epistaxis - - -	—	—	—	1	1	—	}	89	83	5	13·48	·76					
	Bronchitis - - -	—	—	—	2	1	1											
	Pleurisy - - -	—	—	—	10	9	—											
	Pneumonia - - -	34	33	1	7	4	2											
	Asthma - - -	29	27	1	6	8	—											
	ORDER 4.																	
	Dyspepsia - - -	223	220	1	71	73	—	}	1,675	1,627	39	253·75	5·91					
	Gastritis - - -	78	78	1	23	23	1											
	Enteritis - - -	3	3	—	—	—	—											
	Peritonitis - - -	1	1	—	—	—	—											
	Ascites - - -	1	—	1	4	3	1											
	Hæmatemesis - - -	1	—	—	1	1	—											
	Hernia - - -	8	8	—	4	4	—											
	Ileus and Colic - - -	51	51	—	40	40	—											
	Hæmorrhoids - - -	102	102	—	20	22	—											
	Fistula - - -	10	10	—	—	—	—											
	Obstipatio - - -	295	295	—	70	70	—											
	Hepatitis - - -	526	470	31	86	101	3											
	Jaundice - - -	17	12	—	5	5	—											
	Spleen Disease, &c. - -	29	29	—	6	6	—											
	ORDER 5.																	
	Nephritis - - -	14	15	—	3	3	—	}	35	35	2	5·30	·30					
	Ischuria - - -	—	—	—	3	2	—											
	Dysuria - - -	12	12	—	—	—	—											
	Hæmaturia - - -	—	—	—	—	1	1											
	Cystitis - - -	3	2	1	—	—	—											
	ORDER 6.																	
	Sarcocœle - - -	2	2	—	—	—	—	}	21	21	—	3·18	—					
	Hydrocœle - - -	10	10	—	9	9	—											
	ORDER 7.																	
	Hydrarthrus - - -	—	—	—	1	1	—	}	11	9	1	1·67	·15					
	Arthritis - - -	—	—	—	2	2	—											
	Joint Disease, &c. - -	4	2	1	4	4	—											
	ORDER 8.																	
	Phlegmon - - -	} 501	508	1	249	253	2	}	1,299	1,302	4	196·78	·60					
Abscess - - -																		
Ulcer - - -	257													252	—	106	107	—
Tumor - - -	—													—	—	3	2	1
Skin Disease, &c. - -	150	147	—	33	33	—												
ORDER 1.— <i>Accident or Negligence.</i>																		
Burns or Scalds - - -	9	9	—	1	2	—	}	630	631	5	95·44	·76						
Contusion - - -	256	256	1	63	68	—												
Sub-luxation - - -	111	112	—	51	54	—												
Luxation - - -	11	11	—	2	2	—												
Fracture - - -	19	19	1	13	9	1												
Wounds, Incised - - -	82	78	1	11	11	—												
Concussio Cerebri - -	1	—	1	—	—	—												
ORDER 5.																		
Punitus - - -	3	3	—	3	3	—	}	95	95	—	14·39	—						
Observatio - - -	50	49	—	39	40	—												

* No Troops separately accounted for at this Station during the Years 1855 and 1856.

N.B.—Invalids are included in these Numbers, but the Returns do not enable them to be distinguished.

No. 110.

MADRAS.—EN ROUTE, &c.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 7 Years - - - - 3,118
 Mean Annual Strength - - - - 445

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years,* 1847 to 1849.			Four Years,* 1852 to 1855.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	2,108	1,975	49	2,480	2,476	76	4,588	4,451	125	1,471·47	40·08
	CLASSES.											
I.	ZYMOTIC DISEASES -	1,388	1,287	30	1,648	1,627	54	3,036	2,914	84	973·72	26·94
II.	CONSTITUTIONAL -	19	23	4	38	31	3	57	54	7	18·28	2·24
III.	LOCAL - - -	570	544	14	615	632	17	1,185	1,176	31	380·05	9·94
IV.	DEVELOPMENTAL -	2	1	1	2	2	—	4	3	1	1·28	·32
V.	VIOLENCE - - -	129	120	—	177	184	2	306	304	2	98·14	·64
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Small-pox - - -	3	3	—	—	—	—	2,053	1,958	81	658·44	25·98
	Measles - - -	—	—	—	4	4	—					
	Quinsy - - -	14	12	—	20	22	—					
	Catarrh and Influenza -	141	148	1	172	168	—					
	Ophthalmia - - -	25	22	—	63	57	—					
	Fever (C. C.) - - -	158	143	2	190	196	3					
	Dysentery - - -	85	72	23	195	217	2					
	Diarrhœa - - -	187	207	3	143	149	2					
	Cholera - - -	76	35	—	1	1	44					
	Ague - - -	87	83	—	125	120	—					
	Remittent Fever - - -	27	7	—	3	4	—					
	Rheumatism - - -	123	113	—	211	175	1					
	ORDER 2.— <i>Enthetic Dis.</i>							912	887	1	292·5	·3
	Syphilis, &c. - - -	417	400	1	491	481	—					
	Stricture of Urethra - -	3	5	—	1	1	—					
	ORDER 3.— <i>Dietic Dis.</i>							50	51	2	16·04	·64
	Purpura and Scurvy - -	—	—	—	9	10	—					
	Alcoholism { <i>a. Del. Tremens</i> <i>b. Intemperance</i>	2 22	1 21	— —	4 13	5 14	1 1					
	ORDER 4.— <i>Parasitic Dis.</i>							21	18	—	6·74	—
	Vermes - - -	15	13	—	3	3	—					
	Psora - - -	3	2	—	—	—	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>							16	17	—	5·13	—
	Lumbago - - -	7	7	—	6	6	—					
	Dropsy - - -	2	3	—	1	1	—					
	ORDER 2.— <i>Tubercular Dis.</i>							41	37	7	13·15	2·24
	Morbus Coxarius - - -	—	1	—	2	2	—					
	Scrofula - - -	3	3	—	16	15	—					
	Phthisis - - -	4	8	4	8	3	3					
	Hæmoptysis - - -	3	1	—	5	4	—					

No. 110.—Madras; Infantry; En Route, &c. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.	Three Years,* 1847 to 1849.			Four Years,* 1852 to 1855.			Total for 7 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	27	25	—	23	25	—	143	139	8	45·86	2·57
	Apoplexy - - -	5	—	3	2	—	5					
	Vertigo - - -	—	—	—	1	1	—					
	Paralysis - - -	4	2	—	6	10	—					
	Neuralgia - - -	1	1	—	4	4	—					
	Insanity - - -	9	9	—	9	8	—					
	Odontalgia - - -	2	2	—	11	11	—					
	Epilepsy - - -	8	8	—	6	6	—					
	Otitis - - -	14	16	—	6	8	—					
	Phlebitis - - -	—	—	—	1	1	—					
	Brain Disease, &c. - -	—	—	—	1	2	—					
	ORDER 2.											
	Pericarditis - - -	4	3	—	6	6	1	27	38	3	8·66	·96
	Aneurism - - -	—	—	—	1	8	1					
	Varix - - -	1	1	—	1	1	—					
	Heart Disease, &c. - -	3	6	1	11	13	—					
	ORDER 3.											
	Epistaxis - - -	—	—	—	2	2	—	38	46	2	12·19	·64
	Bronchitis - - -	—	—	—	1	2	—					
	Pleurisy - - -	—	—	—	1	2	—					
	Pneumonia - - -	13	17	1	3	3	1					
	Asthma - - -	13	16	—	5	4	—					
	ORDER 4.											
	Dyspepsia - - -	22	26	—	121	124	1	558	538	18	178·96	5·77
	Gastritis - - -	3	4	—	4	3	—					
	Enteritis - - -	1	2	—	—	—	—					
	Peritonitis - - -	—	—	—	1	—	1					
	Ascites - - -	2	—	2	1	—	—					
	Hæmatemesis - - -	—	—	—	1	1	—					
	Hernia - - -	3	3	—	4	4	—					
	Ileus and Colic - - -	24	24	—	9	11	—					
	Hæmorrhoids - - -	18	19	—	29	28	—					
Fistula - - -	2	—	—	—	—	—						
Obstipatio - - -	75	74	—	53	39	—						
Hepatitis - - -	126	128	7	51	41	6						
Jaundice - - -	—	—	—	2	1	1						
Spleen Disease, &c. - -	5	5	—	1	1	—						
ORDER 5.												
Nephritis - - -	3	2	—	1	1	—	6	7	—	1·92	—	
Ischuria - - -	—	—	—	1	2	—						
Stone - - -	1	1	—	—	—	—						
Cystitis - - -	—	1	—	—	—	—						
ORDER 6.												
Hydrocele - - -	8	6	—	2	2	—	11	9	—	3·53	—	
Sarcocoele - - -	1	1	—	—	—	—						
ORDER 7.												
Joint Disease, &c. - -	1	1	—	—	4	—	1	5	—	·32	—	
ORDER 8.												
Phlegmon - - -	119	114	—	84	84	—	401	394	—	128·61	—	
Ulcer - - -	63	66	—	93	79	—						
Tumor - - -	1	1	—	—	—	—						
Skin Disease, &c. - -	30	36	—	11	14	—						
IV.	ORDER 1.											
	Atrophy - - -	2	1	1	2	2	—	4	3	1	1·28	·32
V.	ORDER 1.— <i>Accident or Negligence.</i>											
	Burns or Scalds - - -	7	7	—	1	2	—	295	295	2	94·61	·64
	Contusion - - -	111	117	—	73	67	—					
	Sub-luxation - - -	39	41	—	30	28	—					
	Luxation - - -	2	1	—	1	1	—					
	Fracture - - -	5	4	—	3	4	—					
	Wounds { Gunshot - - -	—	1	—	1	—	1					
	{ Incised - - -	8	9	—	9	9	—					
	Amputatio - - -	—	—	—	5	4	—					
	Concussio Cerebri - -	—	—	—	—	—	1					
	ORDER 5.											
	Punitus - - -	2	1	—	1	1	—	11	9	—	3·53	—
	Observatio - - -	3	3	—	5	4	—					

* No Troops separately accounted for under this heading during the Years 1850, 1851, and 1856.

N.B.—Invalids are included in these Numbers, but the Returns do not enable them to be distinguished.

No. 111.

MADRAS.—TRICHINOPOLY STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY’S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 4 Years - - - - 4,005
Mean Annual Strength - - - - 1,001

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Two Years,* 1850 and 1851.			Two Years,* 1852 and 1853.			Total for 4 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES -	3,185	3,138	41	3,017	3,001	40	6,202	6,139	81	1,548·56	20·22
	CLASSES.											
I.	ZYMOTIC DISEASES -	2,402	2,381	24	2,191	2,188	17	4,593	4,569	41	1,146·81	10·24
II.	CONSTITUTIONAL -	24	21	5	65	56	6	89	77	11	22·22	2·74
III.	LOCAL - - -	658	639	12	631	623	12	1,289	1,262	24	321·85	5·99
V.	VIOLENCE - - -	101	97	—	130	134	5	231	231	5	57·68	1·25
	ORDERS.											
I.	ORDER 1.— <i>Miasmatic Dis.</i>											
	Varicella - - -	—	—	—	1	1	—	3,682	3,656	38	919·35	9·49
	Quinsy - - -	12	12	—	33	32	—					
	Catarrh and Influenza -	127	116	3	191	196	2					
	Ophthalmia - - -	72	70	—	69	71	—					
	Fever (C. C.) - - -	409	406	5	113	111	1					
	Anthrax - - -	—	—	—	1	1	—					
	Dysentery - - -	113	115	5	80	73	6					
	Diarrhoea - - -	170	172	—	244	244	1					
	Cholera - - -	10	2	8	7	3	4					
	Ague - - -	824	826	1	794	793	2					
	Remittent Fever - - -	—	—	—	1	1	—					
	Rheumatism - - -	191	191	—	220	220	—					
	ORDER 2.— <i>Enthetic Dis.</i>							849	852	2	211·98	·50
	Syphilis, &c. - - -	443	440	2	386	393	—					
	Stricture of Urethra - -	11	11	—	9	8	—					
	ORDER 3.— <i>Dietic Dis.</i>							9	8	1	2·25	·25
	Bronchochele - - -	1	1	—	—	—	—					
	Purpura and Scurvy - -	3	3	—	—	—	—					
	Alcoholism { <i>a.</i> Del. Tremens	—	—	—	2	1	1					
	{ <i>b.</i> Intemperance	—	—	—	3	3	—					
	ORDER 4.— <i>Parasitic Dis.</i>											
	Vermes - - -	16	16	—	37	37	—	53	53	—	13·23	—
II.	ORDER 1.— <i>Diathetic Dis.</i>							37	33	3	9·24	·75
	Lumbago - - -	2	2	—	17	17	—					
	Dropsy - - -	1	1	—	17	13	3					
	ORDER 2.— <i>Tubercular Dis.</i>							52	44	8	12·98	1·99
	Scrofula - - -	7	9	—	11	9	1					
	Phthisis - - -	8	6	3	17	13	2					
	Hæmoptysis - - -	6	3	2	3	4	—					

No. 111.—Madras ; Trichinopoly Station ; Infantry. Stational Returns. European Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Two Years,* 1850 and 1851.			Two Years,* 1852 and 1853.			Total for 4 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis - - -	36	34	—	40	39	—	157	143	11	39.2	2.74
	Apoplexy - - -	3	—	3	6	2	5					
	Paralysis - - -	6	7	—	4	4	—					
	Odontalgia - - -	—	—	—	1	1	—					
	Insanity - - -	11	4	1	5	6	1					
	Tetanus - - -	—	—	1	—	—	—					
	Epilepsy - - -	12	12	—	3	3	—					
	Neuralgia - - -	—	—	—	3	3	—					
	Otitis - - -	11	11	—	13	13	—					
	Dysœcœa - - -	1	1	—	2	3	—					
	ORDER 2.											
	Pericarditis - - -	2	3	—	1	1	—	39	37	3	9.74	.75
	Aneurism - - -	—	—	—	1	—	1					
	Varix - - -	7	7	—	3	3	—					
	Heart Disease, &c. - - -	11	8	2	13	14	—					
	Phlebitis - - -	1	1	—	—	—	—					
	ORDER 3.											
	Epistaxis - - -	—	—	—	1	1	—	47	47	—	11.74	—
	Laryngitis - - -	—	—	—	2	2	—					
	Pneumonia - - -	4	4	—	10	10	—					
	Asthma - - -	13	13	—	17	17	—					
	ORDER 4.											
	Dyspepsia - - -	36	35	—	64	65	—	541	533	9	135.09	2.25
	Gastritis - - -	—	—	—	4	4	—					
	Peritonitis - - -	2	2	—	—	—	—					
	Hernia - - -	5	3	—	—	—	—					
	Ileus and Colic - - -	4	4	—	4	4	—					
	Hæmatemesis - - -	—	—	—	1	1	—					
	Hæmorrhoids - - -	9	9	—	14	13	—					
	Fistula - - -	1	1	—	—	—	—					
Obstipatio - - -	64	64	—	46	46	—						
Hepatitis - - -	138	137	4	131	129	3						
Jaundice - - -	3	2	—	10	10	1						
Spleen Disease, &c. - - -	3	2	1	2	2	—						
ORDER 5.												
Nephritis - - -	2	2	—	3	3	—	17	15	—	4.24	—	
Ischuria - - -	5	4	—	5	5	—						
Stone - - -	—	—	—	1	1	—						
Cystitis - - -	—	—	—	1	—	—						
ORDER 6.												
Sarcocele - - -	—	1	—	—	—	—	8	10	—	1.99	—	
Hydrocele - - -	6	7	—	2	2	—						
ORDER 7.												
Arthritis - - -	—	—	—	1	1	—	1	1	—	.25	—	
ORDER 8.												
Phlegmon - - -	161	160	—	120	121	—	479	476	1	119.6	.25	
Abscess - - -												
Ulcer - - -												
Tumor - - -												
Skin Disease, &c. - - -	12	10	—	30	30	—						
V.												
ORDER 1.— <i>Accident or Negligence.</i>												
Found dead - - -	—	—	—	—	—	1	210	210	5	52.43	1.25	
Contusion - - -	58	56	—	63	64	1						
Sub-luxation - - -	22	22	—	43	43	—						
Luxation - - -	1	2	—	—	—	—						
Fracture - - -	1	1	—	2	2	—						
Lightning Stroke - - -	—	—	—	1	1	1						
Wounds, Incised - - -	8	8	—	11	11	—						
Drowned - - -	—	—	—	—	—	2						
ORDER 5.												
Punitus - - -	2	1	—	2	3	—	21	21	—	5.25	—	
Observatio - - -	9	7	—	8	10	—						

* No Troops separately accounted for at this Station during the Years 1847 to 1849 and 1854 to 1856.

No. 112.

MADRAS.—SECUNDERABAD STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Aggregate Strength for 3 Years - - - - 3,022
 Mean Annual Strength - - - - 1,007

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (Z.) the Number DISCHARGED to DUTY; and
 (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years, 1847 to 1849.*			Total for 3 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(Z.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(Z.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	4,803	4,680	97	4,803	4,680	97	1,589·43	32·09
	CLASSES.								
I.	ZYMOTIC DISEASES - -	3,783	3,710	59	3,783	3,710	59	1,251·9	19·52
II.	CONSTITUTIONAL - -	43	37	8	43	37	8	14·23	2·65
III.	LOCAL - - - -	831	786	26	831	786	26	274·99	8·60
IV.	DEVELOPMENTAL - -	1	1	—	1	1	—	·33	—
V.	VIOLENCE - - - -	145	145	4	145	145	4	47·98	1·32
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Small-pox - - - -	7	6	1	2,521	2,447	56	834·21	18·53
	Vaccinia - - - -	1	1	—					
	Quinsy - - - -	32	31	—					
	Catarrh and Influenza - -	201	200	3					
	Ophthalmia - - - -	118	122	—					
	Fever (C. C.) - - - -	832	818	8					
	Icterodes - - - -	1	1	—					
	Erysipelas - - - -	2	2	—					
	Dysentery - - - -	368	324	35					
	Diarrhœa - - - -	399	396	2					
	Cholera - - - -	5	5	1					
	Ague - - - -	291	286	—					
	Remittent Fever - - - -	7	5	2					
	Rheumatism - - - -	257	250	4					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	1,233	1,235	3	1,241	1,243	3	410·65	·99
	Stricture of Urethra - -	8	8	—					
	ORDER 3.— <i>Dietic Dis.</i>								
	Purpura and Scurvy - -	12	12	—	17	18	—	5·62	—
	Alcoholism { <i>a.</i> Del. Tremens - -	1	2	—					
	{ <i>b.</i> Intemperance - -	4	4	—					
	ORDER 4.— <i>Parasitic Dis.</i>								
	Vermes - - - -	2	2	—	4	2	—	1·32	—
	Dracunculus - - - -	2	—	—					
II.	ORDER 2.— <i>Tubercular Dis.</i>								
	Morbus Coxarius - - - -	1	1	—	43	37	8	14·23	2·65
	Scrofula - - - -	14	14	—					
	Phthisis - - - -	13	8	7					
	Hæmoptysis - - - -	15	14	1					

No. 112.—Madras ; Secunderabad Station ; Infantry. Stational Returns. Europ. Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	Three Years, 1847 to 1849.*			Total for 3 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.								
	Cephalitis - - - -	20	18	1	67	57	4	22·17	1·32
	Apoplexy - - - -	2	2	—					
	Paralysis - - - -	8	5	1					
	Insanity - - - -	15	13	—					
	Odontalgia - - - -	1	1	—					
	Epilepsy - - - -	4	4	—					
	Tetanus - - - -	1	—	1					
	Otitis - - - -	13	13	1					
	Brain Disease, &c. - - -	3	1	—					
	ORDER 2.								
	Pericarditis - - - -	11	6	2	22	18	4	7·28	1·32
	Varix - - - -	2	2	—					
	Heart Disease, &c. - - -	9	10	1					
	Aneurism - - - -	—	—	1					
	ORDER 3.								
	Epistaxis - - - -	4	4	—	42	37	1	13·90	·33
	Hydrothorax - - - -	1	—	1					
	Pneumonia - - - -	21	20	—					
	Asthma - - - -	16	13	—					
	ORDER 4.								
	Dyspepsia - - - -	40	38	1	413	391	16	136·68	5·30
	Gastritis - - - -	1	1	—					
	Enteritis - - - -	1	1	—					
	Peritonitis - - - -	2	1	1					
	Hernia - - - -	1	1	—					
	Ileus and Colic - - - -	32	31	1					
	Hæmorrhoids - - - -	32	32	—					
	Fistula - - - -	8	8	—					
	Obstipatio - - - -	105	104	1					
	Hepatitis - - - -	190	173	12					
	Spleen Disease, &c. - - -	1	1	—					
	ORDER 5.								
	Nephritis - - - -	2	2	—	6	6	—	1·98	—
	Dysuria - - - -	4	4	—					
	ORDER 6.								
	Hydrocele - - - -	1	—	1	1	—	1	·33	·33
	ORDER 7.								
	Arthritis - - - -	1	—	—	1	—	—	·33	—
	ORDER 8.								
	Phlegmon - - - -	215	215	—	279	277	—	92·32	—
	Abscess - - - -								
	Ulcer - - - -								
	Skin Disease, &c. - - -								
IV.	ORDER 4.								
	Atrophy - - - -	1	1	—	1	1	—	·33	—
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Found dead - - - -	—	—	1	137	137	2	45·33	·66
	Burns or Scalds - - - -	1	1	—					
	Contusion - - - -	72	73	—					
	Sub-luxation - - - -	38	37	—					
	Luxation - - - -	3	3	—					
	Fracture - - - -	1	1	—					
	Wounds, Incised - - - -	22	22	—					
	Drowned - - - -	—	—	1					
	ORDER 4.— <i>Suicide.</i>								
	Not stated - - - -	—	—	1	—	—	2	—	·66
	Suspendium - - - -	—	—	1					
	ORDER 5.								
	Punitus - - - -	1	1	—	8	8	—	2·65	—
	Observatio - - - -	7	7	—					

* Troops only separately accounted for at this Station during the Years 1847 to 1849.

No. 113.

MADRAS.—JACKATALLA STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 3 Years - - - - 1,687
 Mean Annual Strength - - - - 562

RETURN showing (C.) the Number of ATTACKS of SICKNESS; (E.) the Number DISCHARGED to DUTY; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Three Years, 1854 to 1856.*			Total for 3 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	1,596	1,566	66	1,596	1,566	66	946·06	39·11
	CLASSES.								
I.	ZYMOTIC DISEASES - -	1,074	1,044	38	1,074	1,044	38	636·63	22·52
II.	CONSTITUTIONAL - - -	16	16	2	16	16	2	9·48	1·18
III.	LOCAL - - - -	382	380	26	382	380	26	226·44	15·41
IV.	DEVELOPMENTAL - - -	6	6	—	6	6	—	3·55	—
V.	VIOLENCE - - - -	118	120	—	118	120	—	69·95	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Small-pox - - - -	1	1	—	797	765	37	472·44	21·93
	Varicella - - - -	5	4	—					
	Quinsy - - - -	17	19	—					
	Catarrh and Influenza - -	63	63	1					
	Ophthalmia - - - -	78	77	—					
	Fever (C.C.) - - - -	27	31	2					
	Typhus - - - -	1	—	1					
	Ephemeral - - - -	23	24	—					
	Erythema - - - -	4	4	—					
	Erysipelas - - - -	1	1	—					
	Anthrax - - - -	1	1	—					
	Dysentery - - - -	89	71	19					
	Diarrhœa - - - -	182	174	6					
	Cholera - - - -	15	7	8					
	Ague - - - -	166	168	—					
	Remittent Fever - - -	52	58	—					
	Rheumatism - - - -	72	62	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	245	249	—	249	253	—	147·6	—
	Stricture of Urethra - -	4	4	—					
	ORDER 3.— <i>Dietic Dis.</i>								
	Alcoholism { <i>a.</i> Del. Tremens - -	3	2	1	17	15	1	10·08	·59
	{ <i>b.</i> Intemperance - -	14	13	—					
	ORDER 4.— <i>Parasitic Dis.</i>								
	Vermes - - - -	3	3	—	11	11	—	6·52	—
	Psora - - - -	8	8	—					
II.	ORDER 1.— <i>Diathetic Dis.</i>								
	Lumbago - - - -	7	7	—	8	7	2	4·74	1·18
	Dropsy - - - -	1	—	2					
	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	6	6	—	8	9	—	4·74	—
	Phthisis - - - -	1	2	—					
	Hæmoptysis - - - -	1	1	—					

No. 113.—Madras; Jackatalla Station; Infantry. Stational Returns. European Troops; H. M. Regts.—*cont.*

Class.	Diseases.				Three Years, 1854 to 1856.*			Total for 3 Years.*			Annual Ratio per 1000 of Mean Strength.	
					(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
III.	ORDER 1.											
	Cephalitis	-	-	-	22	22	—	45	41	8	26·67	4·74
	Apoplexy	-	-	-	4	1	6					
	Paralysis	-	-	-	7	7	—					
	Insanity	-	-	-	3	3	—					
	Epilepsy	-	-	-	4	4	—					
	Otitis	-	-	-	4	4	—					
	Brain Disease, &c.	-	-	-	1	—	1					
	Tetanus	-	-	-	—	—	1					
	ORDER 2.							18	16	3	10·67	1·78
	Pericarditis	-	-	-	5	4	1					
	Aneurism	-	-	-	3	2	2					
	Heart Disease, &c.	-	-	-	10	10	—					
	ORDER 3.							17	16	1	10·08	·59
	Bronchitis	-	-	-	11	11	—					
	Pleurisy	-	-	-	2	2	—					
	Pneumonia	-	-	-	4	3	1					
	ORDER 4.							184	183	13	109·08	7·71
	Dyspepsia	-	-	-	64	62	1					
	Gastritis	-	-	-	1	1	—					
	Enteritis	-	-	-	1	—	1					
	Ascites	-	-	-	1	1	—					
	Hæmatemesis	-	-	-	1	1	—					
	Ileus and Colic	-	-	-	6	6	—					
	Hæmorrhoids	-	-	-	9	9	—					
	Obstipatio	-	-	-	34	32	—					
	Hepatitis	-	-	-	56	63	9					
	Jaundice	-	-	-	6	3	2					
	Spleen Disease, &c.	-	-	-	5	5	—					
	ORDER 5.							6	5	1	3·55	·39
	Nephritis	-	-	-	1	1	—					
	Ischuria	-	-	-	3	3	—					
	Stone	-	-	-	1	1	—					
	Cystitis	-	-	-	1	—	1					
	ORDER 6.							—	1	—	—	—
	Hydrocele	-	-	-	—	1	—	—	1	—	—	—
	ORDER 7.							7	6	—	4·15	—
	Arthritis	-	-	-	2	2	—					
	Joint Disease, &c.	-	-	-	4	3	—					
	Contractura	-	-	-	1	1	—					
	ORDER 8.							105	112	—	62·24	—
	Phlegmon	-	-	-	45	46	—					
	Abscess	-	-	-	43	50	—					
	Ulcer	-	-	-	10	10	—					
	Tumor	-	-	-	7	6	—					
IV.	ORDER 4.							6	6	—	3·55	—
	Atrophy	-	-	-	6	6	—	6	6	—	3·55	—
V.	ORDER 1.— <i>Accident or Negligence.</i>							88	90	—	52·17	—
	Burns or Scalds	-	-	-	3	4	—					
	Contusion	-	-	-	35	35	—					
	Sub-luxation	-	-	-	25	24	—					
	Luxation	-	-	-	5	6	—					
	Fracture	-	-	-	14	14	—					
	Wounds { Gunshot	-	-	-	1	1	—					
	Incised	-	-	-	3	3	—					
	Amputatio	-	-	-	2	3	—					
	ORDER 5.							30	30	—	17·73	—
	Punitus	-	-	-	2	2	—					
	Observatio	-	-	-	28	28	—					

* Troops only separately accounted for at this Station during the Years 1854, 1855, and 1856.

No. 114.

MADRAS.—POONAMALLEE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

Aggregate Strength for 2 Years	-	-	-	-	201
Mean Annual Strength	-	-	-	-	100

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and (F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	Two Years, 1847 and 1848.*			Total for 2 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	299	362	18	299	362	18	1,487.58	89.55
	CLASSES.								
I.	ZYMOTIC DISEASES - -	218	276	14	218	276	14	1,084.6	69.65
II.	CONSTITUTIONAL - -	3	2	—	3	2	—	14.92	—
III.	LOCAL - - - -	61	64	4	61	64	4	303.48	19.90
V.	VIOLENCE - - - -	17	20	—	17	20	—	84.58	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Quinsy - - - -	1	1	—	146	180	14	726.38	69.65
	Catarrh and Influenza - -	6	5	—					
	Ophthalmia - - - -	1	2	—					
	Fever (C.C.) - - - -	36	46	—					
	Dysentery - - - -	86	99	14					
	Diarrhoea - - - -	8	10	—					
	Ague - - - -	3	8	—					
	Rheumatism - - - -	5	9	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	64	82	—	64	83	—	318.42	—
	Stricture of Urethra - -	—	1	—					
	ORDER 3.— <i>Dietic Dis.</i>								
	Alcoholism { a. Del. Tremens - -	5	10	—	7	12	—	34.83	—
	{ b. Intemperance - -	2	2	—					
	ORDER 4.— <i>Parasitic Dis.</i>								
	Vermes - - - -	1	1	—	1	1	—	4.97	—

No. 114.—Madras ; Poonamallee Station ; Infantry. Stational Returns. Europ. Troops ; H. M. Regts.—*cont.*

Class.	Diseases.	Two Years, 1847 and 1848.*			Total for 2 Years.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
II.	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	3	2	—	3	2	—	14·92	—
III.	ORDER 1.								
	Cephalitis - - - -	1	1	—	6	9	1	29·85	·97
	Paralysis - - - -	2	2	1					
	Insanity - - - -	—	3	—					
	Epilepsy - - - -	1	1	—					
	Otitis - - - -	2	2	—					
	ORDER 3.								
	Pneumonia - - - -	1	1	—	1	1	—	4·97	—
	ORDER 4.								
	Dyspepsia - - - -	2	2	—	36	36	3	179·12	14·93
	Gastritis - - - -	1	—	—					
	Enteritis - - - -	1	1	—					
	Ileus and Colic - - - -	3	3	—					
	Hæmorrhoids - - - -	5	7	—					
	Fistula - - - -	—	1	—					
	Obstipatio - - - -	1	1	—					
	Hepatitis - - - -	21	20	3					
	Jaundice - - - -	1	1	—					
	Spleen Disease, &c. - - - -	1	—	—					
	ORDER 5.								
	Nephritis - - - -	2	2	—	3	3	—	14·92	—
	Cystitis - - - -	1	1	—					
	ORDER 6.								
	Sarcocele - - - -	1	1	—	1	1	—	4·97	—
	ORDER 8.								
	Phlegmon - - - -	11	9	—	14	12	—	69·65	—
	Ulcer - - - -	3	3	—					
V.	ORDER 1.— <i>Accident or Negligence.</i>								
	Contusion - - - -	11	12	—	17	20	—	84·58	—
	Sub-luxation - - - -	5	6	—					
	Wounds, Incised - - - -	1	2	—					

* Troops only separately accounted for at this Station during the Years 1847 and 1848.

No. 115.

MADRAS.—KAMPTEE STATION.—INFANTRY.

STATIONAL RETURNS.—EUROPEAN TROOPS.—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.

Mean Annual Strength - - - - - 767

RETURN showing (C.) the Number of ATTACKS of SICKNESS ; (E.) the Number DISCHARGED to DUTY ; and
(F.) the Number of DEATHS by different DISEASES.

Class.	Diseases.	One Year, 1847.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.	
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.
	SPECIFIED CAUSES - -	1,029	1,023	27	1,029	1,023	27	1,341·59	35·2
	CLASSES.								
I.	ZYMOTIC DISEASES - -	793	793	16	793	793	16	1,033·9	20·86
II.	CONSTITUTIONAL - -	3	5	—	3	5	—	3·91	—
III.	LOCAL - - - -	201	189	11	201	189	11	262·06	14·34
IV.	DEVELOPMENTAL - -	1	1	—	1	1	—	1·30	—
V.	VIOLENCE - - - -	31	35	—	31	35	—	40·42	—
	ORDERS.								
I.	ORDER 1.— <i>Miasmatic Dis.</i>								
	Small-pox - - - -	2	2	—	599	587	15	780·97	19·56
	Quinsy - - - -	9	10	—					
	Catarrh and Influenza - -	28	31	—					
	Ophthalmia - - - -	9	11	—					
	Fever (C.C.) - - - -	142	144	5					
	Erysipelas - - - -	1	1	—					
	Dysentery - - - -	99	83	10					
	Diarrhoea - - - -	41	41	—					
	Ague - - - -	164	163	—					
	Remittent Fever - - - -	14	13	—					
	Rheumatism - - - -	90	88	—					
	ORDER 2.— <i>Enthetic Dis.</i>								
	Syphilis, &c. - - - -	183	196	1	186	199	1	242·5	1·30
	Stricture of Urethra - -	3	3	—					
	ORDER 3.— <i>Dietic Dis.</i>								
	Alcoholism { <i>a.</i> Del. Tremens -	3	2	—	7	6	—	9·13	—
	<i>b.</i> Intemperance -	4	4	—					
	ORDER 4.— <i>Parasitic Dis.</i>								
	Vermes - - - -	1	1	—	1	1	—	1·30	—
II.	ORDER 1.— <i>Diathetic Dis.</i>								
	Lumbago - - - -	1	1	—	2	2	—	2·61	—
	Dropsy - - - -	1	1	—					
	ORDER 2.— <i>Tubercular Dis.</i>								
	Scrofula - - - -	1	3	—	1	3	—	1·30	—

No. 115.—Madras ; Kamptee Station ; Infantry. Stational Returns. Europ. Troops ; H.M. Regts.—*cont.*

Class.	Diseases.	One Year, 1847.*			Total for 1 Year.*			Annual Ratio per 1000 of Mean Strength.		
		(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	(C.) No. of Attacks.	(E.) No. dis- charged to Duty.	(F.) No. of Deaths.	Attacked.	Died.	
III.	ORDER 1.									
	Cephalitis - - - -	13	13	—	}	29	23	7	37·81	9·13
	Apoplexy - - - -	4	—	6						
	Vertigo - - - -	1	1	—						
	Paralysis - - - -	1	1	—						
	Odontalgia - - - -	1	1	—						
	Insanity - - - -	1	2	—						
	Neuralgia - - - -	2	2	—						
	Epilepsy - - - -	2	1	1						
	Otitis - - - -	2	2	—						
	Dyseccœa - - - -	2	—	—						
	ORDER 2.									
	Pericarditis - - - -	2	1	1	}	4	3	1	5·22	1·30
	Varix - - - -	2	2	—						
	ORDER 3.									
	Pneumonia - - - -	3	3	—	}	10	9	—	13·04	—
	Asthma - - - -	7	6	—						
	ORDER 4.									
	Dyspepsia - - - -	28	29	—	}	91	91	9	118·64	3·91
	Enteritis - - - -	1	1	—						
	Peritonitis - - - -	1	1	—						
	Ileus and Colic - - - -	3	3	—						
	Hæmorrhoids - - - -	8	7	—						
	Obstipatio - - - -	10	11	—						
	Hepatitis - - - -	33	33	2						
	Jaundice - - - -	3	2	1						
	Spleen Disease, &c - - - -	4	4	—						
	ORDER 6.									
	Hydrocele - - - -	1	1	—	1	1	—	1·30	—	
	ORDER 7.									
	Arthritis - - - -	1	1	—	}	2	2	—	2·61	—
	Joint Disease, &c. - - - -	1	1	—						
	ORDER 8.									
	Phlegmon - - - -	17	17	—	}	64	60	—	83·44	—
	Ulcer - - - -	31	26	—						
	Tumor - - - -	1	1	—						
	Skin Diseases, &c. - - - -	15	16	—						
IV.	ORDER 4.									
Atrophy - - - -	1	1	—	1	1	—	1·30	—		
V.	ORDER 1.— <i>Accident or Negligence.</i>									
Burns or Scalds - - - -	2	2	—	}	31	35	—	40·42	—	
Contusion - - - -	13	15	—							
Sub-luxation - - - -	6	6	—							
Fracture - - - -	1	4	—							
Wounds { Gunshot - - - -	1	—	—							
Wounds { Incised - - - -	8	8	—							

* Troops only separately accounted for at this Station during the Year 1847.

No. 116.

MADRAS.—CANNANORE STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1847	25th Foot - -	1,149	1,149	103·25	2,179	2,145	41
1848	94th Foot - -	873	873	61·50	1,452	1,409	17
1849	94th Foot - -	1,131	1,131	72·75	1,675	1,665	17
1850	94th Foot - -	1,087·75	1,088	51·75	1,315	1,333	12
1851	94th Foot - -	1,028	1,028	52·50	1,329	1,317	23
1852	94th Foot - -	776·25	909 {	54·25	1,235	1,142	10
1852	25th Foot - -	132·75		7·25	193	196	2
1853	25th Foot - -	864	864	59·25	1,253	1,184	32
1854	25th Foot - -	938	938	57	1,150	1,158	21
1855	25th Foot - -	254	576 {	12·25	242	287	2
1855	74th Foot - -	321·75		21·25	505	491	7
1856	74th Foot - -	476	476	33·50	724	709	11
	Total - - -	9,031·5	9,032	586·5	13,252	13,036	195
	Mean - - -	—	903	59	1,325	1,304	19·5

No. 117.

MADRAS.—BANGALORE STATION.

1847	15th Hussars - -	665·75	1,609 {	61·75	846	815	8
1847	51st Foot - -	943·50		64	1,682	1,591	48
1848	15th Hussars - -	689	1,816 {	67·25	1,082	1,086	11
1848	51st Foot - -	1,127·50		87·25	1,757	1,707	23
1849	15th Hussars - -	667·75	1,492 {	38·50	765	774	10
1849	51st Foot - -	824		64·75	1,196	1,195	23
1850	15th Hussars - -	696·50	1,720 {	44·25	954	934	9
1850	25th Foot - -	1,023·75		66·75	1,265	1,263	26
1851	15th Hussars - -	685·50	1,692 {	45	880	889	14
1851	25th Foot - -	1,007		57·50	1,053	1,047	17
1852	15th Hussars - -	672·75	1,152 {	52	928	887	14
1852	25th Foot - -	479·25		28·50	583	578	5
1853	15th Hussars - -	694·25	1,047 {	56	1,052	1,037	19
1853	94th Foot - -	352·75		26	774	748	4
1854	12th Lancers - -	381·75	704 {	36	594	592	6
1854	43rd Foot - -	322·25		24	471	422	11
1855	43rd Foot - -	1,014	1,014	75	1,264	1,327	21
1856	43rd Foot - -	1,177	1,177	76	1,300	1,308	15
	Total - - -	13,424·25	13,424	969·5	18,446	18,200	269
	Mean - - -	—	1,342	97	1,845	1,820	26·9

No. 118.

MADRAS.—FORT ST. GEORGE STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—Return showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1847	94th Foot - -	897	897	56.75	1,331	1,228	29
1848	25th Foot - -	848.75	849	81.50	1,627	1,611	16
1849	25th Foot - -	1,083	1,083	104	2,288	2,252	69
1850	51st Foot - -	1,059	1,059	80	2,115	2,084	32
1851	51st Foot - -	995	995	94	1,779	1,739	28
1852	25th Foot - -	322	322	17.50	434	423	6
1853	25th Foot - -	102.25	623	6	149	157	5
1853	94th Foot - -	504.50		33.50	816	805	9
1853	43rd Foot - -	16.50	772	.75	25	10	—
1854	43rd Foot - -	617.50		48	1,151	1,094	26
1854	94th Foot - -	148.75		9.25	158	209	—
1854	51st Foot - -	6.85		.75	19	90	—
	Total - - -	6,601.1	6,601	532	11,892	11,702	223
	Mean - - -	—	825	67	1,487	1,463	28

No. 119.

MADRAS.—EN ROUTE, &c.

1847	Sundry - - -	226	226	10.75	279	297	16
1848	Sundry - - -	787	787	44.5	1,343	1,326	22
1849	Sundry - - -	530	530	38.5	857	869	13
1852	Sundry - - -	519	519	37.5	752	822	12
1853	Sundry - - -	106	106	7.5	171	207	2
1854	Sundry - - -	932	932	56	1,723	1,609	61
1855	Sundry - - -	327	327	26.5	688	640	10
1856	Sundry - - -	24	24	.5	40	16	—
	Total - - -	3,451	3,451	221.75	5,853	5,786	136
	Mean - - -	—	444	28	731	723	17

No. 120.

MADRAS.—TRICHINOPOLY STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS AND MEN.

(B.)—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.			Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.	
	Names.		Strength.						
1850	84th Foot	-	-	992	992	71·25	1,832	1,805	26
1851	84th Foot	-	-	1,004	1,004	57·50	1,290	1,338	15
1852	84th Foot	-	-	1,012	1,012	58·50	1,554	1,534	15
1853	84th Foot	-	-	997	997	59·50	1,466	1,467	26
	Total	-	-	4,005	4,005	246·75	6,142	6,144	82
	Mean	-	-	—	1,001	62	1,533	1,534	20

No. 121.

MADRAS.—SECUNDERABAD STATION.

1847	84th Foot - -	1,103		1,103	69·	1,860	1,799	39
1848	84th Foot - -	1,129·75		1,130	78·	1,671	1,637	36
1849	84th Foot - -	789		789	61·25	1,275	1,256	21
	Total - - -	3,021·75		3,022	208·25	4,806	4,692	96
	Mean - - -	—		1,007	69	1,602	1,230	32

No. 122.

MADRAS.—JACKATALLA STATION.

1854	74th Highlanders -	642		642	31·	782	758	28
1855	74th Highlanders -	602		602	24·25	478	485	29
1856	74th Highlanders -	443		443	17·25	355	337	11
	Total - - -	1,687		1,687	72·5	1,615	1,580	68
	Mean - - -	—		529	24	538	527	23

No. 123.

MADRAS.—POONAMALLEE STATION.

1847	63rd Foot - -	171		171	12	226	256	18
1848	63rd Foot - -	30		30	1·75	71	108	1
	Total - - -	201		201	13·75	297	364	19
	Mean - - -	—		100	7	148	182	9

No. 124.

MADRAS.—KAMPTEE STATION.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.(a).—RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly
SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.		Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.	Strength.					
1847	4th Foot - - -	767	767	41.50	1,023	1,025	27
	Total and Mean - -	—	767	41.5	1,023	1,025	27

No. 125.

TROOPS ON FIELD SERVICE IN BENGAL, MADRAS, AND BOMBAY.

1848	3rd Dragoons - •	171	1,898	6	191	158	8
1848	14th Dragoons - -	154		13	228	247	25
1848	10th Regiment - -	172		23	356	414	21
1848	24th Regiment - -	288		6	339	332	17
1848	32nd Regiment - -	588		47	1,606	1,556	84
1848	60th Regiment - -	252		Not stated	374	392	7
1848	61st Regiment - -	272	2,702	8	321	304	11
1849	3rd Dragoons - -	167		10	216	200	27
1849	9th Dragoons - -	179		7	155	133	12
1849	14th Dragoons - -	157		10	220	137	10
1849	10th Regiment - -	188		17	464	379	25
1849	Detachment, 18th Regiment	41		2	35	27	2
1849	22nd Regiment - -	245	2,702	14	510	391	9
1849	24th Regiment - -	215		15	433	357	238
1849	29th Regiment - -	208		27	696	547	81
1849	32nd Regiment - -	279		14	377	409	21
1849	60th Regiment - -	752		Not stated	1,818	1,682	38
1849	61st Regiment - -	270		10	395	392	21
1850	Detachment, 96th Regiment	27	27	—	3	—	—
1852	3rd Dragoons - -	160	176	8	135	165	1
1852	Detachments - -	16		1	3	3	—
1854	53rd Regiment - -	184	184	5	244	314	6
1856	64th Regiment - -	278	278	Not stated	396	387	4
	Total - -	5,265	5,265	—	9,518	8,926	668
	Mean - -	—	877	—	1,569	1,688	111

No. 126.

BURMAH.

STATIONAL RETURNS.—EUROPEAN TROOPS—HER MAJESTY'S REGIMENTS.—NON-COMMISSIONED OFFICERS
AND MEN.(B.) RETURN showing for each YEAR the REGIMENTS at the STATION, MEAN STRENGTH, NUMBER constantly
SICK, ADMISSIONS, DISCHARGES, and DEATHS.

Year.	Regiments or Detachments at the Station.				Mean Strength during the Year.	Mean Number constantly sick in Hospital.	Admissions into Hospital during the Year.	Discharged from Hospital.	Deaths.
	Names.		Strength.						
1852	51st Regiment	-	-	654	} 1,635 }	69.25	1,657	1,428	153
1852	18th	„	-	565		59	1,245	1,011	135
1852	80th	„	-	416		41	1,426	1,233	88
1853	51st Regiment	-	-	766	} 1,703 }	93.75	2,122	2,023	136
1853	18th	„	-	523		55.75	1,179	1,085	167
1853	80th	„	-	414		70.75	1,386	1,288	133
1854	84th Regiment	-	-	732	} 960 }	44.75	1,034	1,013	22
1854	29th	„	-	228		10	292	291	8
1855	29th Regiment	-	-	894	} 1,845 }	54.75	1,256	1,200	62
1855	Detachments	-	-	34		1	11	11	—
1855	84th Regiment	-	-	917		50.75	1,143	1,110	27
1856	84th Regiment	-	-	960	} 2,223 }	65	1,463	1,391	28
1856	29th	„	-	852		35.75	1,145	1,112	42
1856	35th	„	-	411		67	1,059	957	41
	Total	-	-	8,366	8,366	736.	16,418	15,160	1,042
	Mean	-	-	—	1,673	147.	3,283	3,032	208

No. 128,

INDIA.—HER MAJESTY'S TROOPS.

RETURN showing the DISEASES of INVALIDS of H.M. TROOPS found unfit for SERVICE, and DISCHARGED at CHATHAM from 1847 to 1856.

Year ending	Cachexies and Scrofula.	Dropsy and Visceral Diseases.	Dysentery and Hepatic Diseases.	Eye Diseases.	Wounds and Fractures.	Dislocations.	Contractions.	Hernia.	Mental Diseases.	Paralysis.	Epilepsia.	Deafness and Impediment of Speech.	Pulmonic and Thoracic Diseases.	Rheumatism and Chronic Pains.	Ulcers and Varix.	Stricture and Urinary Diseases.	Veneral Diseases.	Infirmities of Age and Worn-out.	Total.
31 March 1848	17	6	57	44	179	3	18	11	14	12	5	7	74	145	24	1	10	169	796
„ 1849	11	16	37	19	65	1	1	9	16	15	4	4	51	128	13	1	8	129	528
„ 1850	14	5	26	25	63	1	7	5	19	9	4	4	40	18	12	—	17	95	364
„ 1851	27	9	44	66	103	—	8	8	14	12	9	5	36	15	7	2	14	146	525
„ 1852	10	3	35	59	41	1	9	8	26	7	10	1	39	32	11	3	13	83	391
„ 1853	25	19	68	39	11	2	8	10	27	16	4	7	83	148	22	6	12	65	572
„ 1854	28	6	48	24	19	1	7	8	13	12	9	6	53	87	13	9	10	86	439
„ 1855	12	3	16	14	11	—	5	4	19	16	4	—	23	46	6	—	5	72	256
„ 1856	9	13	40	12	15	—	4	6	20	16	6	7	107	64	11	6	5	36	377
„ 1857	23	2	23	30	5	1	2	4	19	8	6	1	54	33	16	2	2	43	274
Total - -	176	82	394	332	512	10	69	73	187	123	61	42	560	716	135	30	96	924	4,522

No. 129.

PRESIDENCY OF BENGAL.

RETURN showing the DISEASES of INVALIDS of H.M. TROOPS found unfit for SERVICE, and DISCHARGED at CHATHAM from 1847 to 1856.

31 March 1848	6	2	34	35	176	2	15	9	6	5	5	5	43	77	16	1	4	122	563
„ 1849	6	9	19	15	62	—	1	1	7	3	1	3	23	54	4	1	2	64	275
„ 1850	5	2	10	19	11	—	2	1	5	2	—	—	8	9	3	—	5	44	126
„ 1851	5	2	4	42	40	—	3	3	4	—	2	1	3	2	2	—	1	20	134
„ 1852	1	—	10	33	9	1	2	1	9	3	4	—	11	14	5	2	3	18	126
„ 1853	6	3	9	10	5	—	3	2	5	5	2	1	21	50	6	—	3	13	144
„ 1854	5	—	14	10	8	—	2	2	2	2	2	2	9	31	1	2	3	34	119
„ 1855	3	1	9	9	9	—	2	1	12	—	1	—	6	18	4	—	2	29	106
„ 1856	4	4	14	8	8	—	1	3	9	10	5	1	30	29	6	5	1	7	145
„ 1857	13	—	14	19	3	1	1	—	6	4	3	—	28	14	7	1	1	24	139
Total - -	54	23	137	200	331	4	32	23	65	34	25	13	182	298	54	12	25	364	1,877

No. 130.

PRESIDENCY OF BOMBAY.

RETURN showing the DISEASES of INVALIDS of H.M. TROOPS found unfit for SERVICE, and DISCHARGED at CHATHAM from 1847 to 1856.

Year ending	Cachexies and Scrofula.	Dropsy and Visceral Diseases.	Dysentery and Hepatic Diseases.	Eye Diseases.	Wounds and Fractures.	Dislocations.	Contractions.	Hernia.	Mental Diseases.	Paralysis.	Epilepsia.	Deafness and Impediments of Speech.	Pulmonic and Thoracic Diseases.	Rheumatism and Chronic Pains.	Ulcers and Varix.	Strictures and Urinary Diseases.	Veneral Diseases.	Infirmities of Age and Worn Out.	Total.
31 March 1848	8	2	8	4	3	1	2	—	5	4	—	1	21	34	2	—	3	23	121
„ 1849	1	3	10	2	1	—	—	6	2	3	2	—	13	26	1	—	2	21	93
„ 1850	7	2	12	5	48	1	3	2	11	2	3	3	22	3	7	—	6	30	167
„ 1851	17	6	36	18	63	—	4	3	8	9	4	3	26	13	3	2	8	68	291
„ 1852	8	2	19	20	30	—	7	5	8	1	5	—	22	18	2	1	7	35	190
„ 1853	9	15	42	26	5	2	5	5	16	8	1	4	39	55	6	2	5	40	285
„ 1854	19	5	26	13	8	1	3	5	7	6	7	2	35	45	9	7	3	44	245
„ 1855	5	2	5	5	2	—	1	2	5	15	2	—	11	17	2	—	3	29	106
„ 1856	3	6	18	4	4	—	2	2	7	6	1	6	55	22	3	1	3	20	163
„ 1857	9	2	6	5	1	—	1	3	9	2	1	1	19	14	9	—	1	14	97
Total -	86	45	182	102	165	5	28	33	78	56	26	20	263	247	44	13	41	324	1,758

No. 131.

PRESIDENCY OF MADRAS.

RETURN showing the DISEASES of INVALIDS of H.M. TROOPS found unfit for SERVICE, and DISCHARGED at CHATHAM from 1847 to 1856.

31 March 1848	3	2	15	5	—	—	1	2	3	3	—	1	10	34	6	—	3	24	112
„ 1849	4	4	8	2	2	1	—	2	7	9	1	1	15	48	8	—	4	44	160
„ 1850	2	1	4	1	4	—	2	2	3	5	1	1	10	6	2	—	6	21	71
„ 1851	5	1	4	6	—	—	1	2	2	3	3	1	7	—	2	—	5	58	100
„ 1852	1	1	6	6	2	—	—	2	9	3	1	1	6	—	4	—	3	30	75
„ 1853	10	1	17	3	1	—	—	3	6	3	1	2	23	43	10	4	4	12	143
„ 1854	4	1	8	1	3	—	2	1	4	4	—	2	9	11	3	—	4	18	75
„ 1855	4	—	2	—	—	—	2	1	2	1	1	—	6	11	—	—	—	14	44
„ 1856	2	3	8	—	3	—	1	1	4	—	—	—	22	13	2	—	1	9	69
„ 1857	1	—	3	6	1	—	—	1	4	2	2	—	7	5	—	1	—	5	38
Total -	36	14	75	30	16	1	9	17	44	33	10	9	115	171	37	5	30	235	887

STATISTICS OF REGIMENTS WHICH HAVE SERVED IN INDIA.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Reinforce- ments.		
					By Trans- fer.	By Drafts.	
13TH REGIMENT OF HUSSARS, arrived in India, June 13, 1819; left India, in February 1840.	Apr. 1, 1820	Not known.	Not known.	Not known.	402	—	Arcot and Bangalore. Marched from Arcot February 1, 1820.
	" 1821	"	"	"	None	9	Bangalore.
	" 1822	"	"	"	"	6	Bangalore.
	" 1823	"	"	"	"	40	Bangalore.
	" 1824	"	"	"	"	22	Bangalore.
	" 1825	"	"	"	"	30	Bangalore.
	" 1826	"	"	"	"	42	Bangalore.
	" 1827	"	"	"	"	30	Bangalore and Arcot. Marched from Banga- lore July 15, 1826.
	" 1828	"	"	"	"	50	Arcot and Arnee. Marched from Arcot March 3, 1828.
	" 1829	"	3	"	"	79	Arnee.
	" 1830	"	Not known.	"	9	98	Bangalore.
	" 1831	"	"	"	None	59	Bangalore.
	" 1832	"	"	"	"	31	Bangalore.
	" 1833	"	"	"	"	23	Bangalore.
	" 1834	"	"	"	"	17	Bangalore.
	" 1835	"	"	14	"	38	Bangalore.
	" 1836	"	"	Not known.	"	31	Bangalore.
	" 1837	"	"	31	"	17	Bangalore.
	" 1838	"	"	11	1	—	Bangalore.
	" 1839	"	32	33	None	None	Bangalore, and 2 squadrons on field service to Bellary in March 1839.
	Feb. 1840	"	40	None	None	None	On march from Bangalore to Madras.
Average - -	—	Cannot be given.					

By the Digest of Services (such being the only means of obtaining the required information, so many years having elapsed) it appears that the Casualties of the Regiment, during 21 years in India, amounted to 15 officers and 1,051 men.

SOAME G. JENYNS, Lieut.-Col., commanding 13th Light Dragoons.

4TH QUEEN'S OWN REGIMENT OF HUSSARS, arrived in India, May 12, 1822.	- -	542	Further information cannot now be given, in consequence of there being no documents in possession of the Regiment to show it.				
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F. CORNWALLIS, Major, commanding 4th Q. O. Hussars.

16TH REGIMENT OF LANCERS, arrived in India, January 1823.	Apr. 1, 1846	329	The whole of the regimental records lost at the action of Buddewal on the 21st January 1846.				
		329*					

* Strength on departure from India.

CHARLES FOSTER, Lieut.-Col., commanding 16th Lancers.

16TH REGIMENT OF FOOT, arrived in India, November 23, 1828.	1828-29	698	58	—	157	7	Fort William.
	1830	818	64	6	64	17	Fort William.
	1831	784	54	6	21	14	Fort William and Chinsurah.
	1832	737	41	6	—	1	Chinsurah.
	1833	682	56	4	—	1	Chinsurah.
	1834	669	44	5	—	47	Chinsurah, on the March, and Cawnpore.
	1835	837	26	6	109	100	Cawnpore.
	1836	856	45	7	46	120	Cawnpore.
	1837	827	45	36	42	9	Cawnpore.
	1838	707	45	74	1	7	Cawnpore.
	1839	566	37	75	2	166	Cawnpore.
	1840	447	52	—	2	108	Dinapore and Calcutta.
Average - -	—	719 $\frac{10}{12}$	47 $\frac{1}{12}$	18 $\frac{9}{12}$	37	49 $\frac{9}{12}$	

The strength on the first of each military year cannot be stated, but the average annual strength of the regiment is shown during its services in India.

J. W. P. AUDAIN, Bt. Lieut.-Col., commanding 1st Bat. 16th Regt.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Reinforce- ments.		
					By Trans- fer.	By Drafts.	
15th "THE KING'S" REGIMENT OF HUSSARS, arrived in India, September 19, 1859; November 9, 1859; February 4, 1840; left India, February 27, 1854.	— Apr. 1, 1840 " 1841 " 1842 " 1843 " 1844 " 1845 " 1846 " 1847 " 1848 " 1849 " 1850 " 1851 " 1852 " 1853 Feb. 27, 1854	506 634 744 762 720 711 721 688 659 682 670 703 683 673 739 513	— 25 21 18 21 13 11 32 24 7 11 11 17 6 21 19	— — 4 6 13 12 12 21 21 35 30 19 31 26 — 39	— 101 — 24 — 1 — — — — 1 — — 29 — —	— 52 147 23 3 23 42 30 23 78 46 67 47 40 81 3	Bombay. On march. <

It will be observed that the strengths subsequent to 1840 do not agree with the increase and decrease, as men became non-effective otherwise than by "Death," and "Sent to England."

F. W. FITZWYGRAM, Lieut.-Col., commanding 15th, "The King's," Hussars.

1st Battalion, 22nd Regiment of Foot,	Apr. 1, 1842	1,007	102	3	6	139	Poona and Kurrachee and Sukkur.
" 1843	" 1843	981	215	16	—	102	Sinde and Kurrachee, on field service, engaged in the battles of Meeanee and Hyderabad.
arrived in India, May 21, 1841;	" 1844	871	68	51	5	200	Poona.
" 1845	" 1845	936	40	45	23	32	Poona and Kolapore, on the march and field service.
left India, March 23, 1855.	" 1846	989	37	50	3	36	Kolapore and Poona.
" 1847	" 1847	938	97	42	—	—	Poona and Bombay.
" 1848	" 1848	958	27	50	224	119	Poona.
" 1849	" 1849	1,152	45	73	1	122	Poona and Bombay, on the march to
" 1850	" 1850	1,081	67	22	12	26	Bombay and Kurrachee, on the march to
" 1851	" 1851	1,049	27	17	5	64	Dugshai, Himalayas.
" 1852	" 1852	1,045	27	49	9	53	Dugshai, Rawul Pindi, on the march to
" 1853	" 1853	988	45	37	3	40	Rawul Pindi and Peshawur, on the march to
" 1854	" 1854	978	38	59	2	61	Peshawur, on the march to
Mar. 23, 1855	Mar. 23, 1855	729	57	—	—	—	Kurrachee.
Average - -	—	978·71	63·72	39·57	20·92	71	

The casualties not accounted for in columns 4 and 5 occurred through desertion, volunteers, transfers, discharges, &c.

J. H. GRAHAM, Major, commanding 1st Bat. 22nd Regt.

14th (King's) Regiment of Hussars,	Apr. 1, 1842	449	8	—	150	—	Kirkee.
" 1843	" 1843	689	39	7	—	100	Kirkee.
" 1844	" 1844	713	17	13	—	60	Kirkee, and field service Kolapore.
" 1845	" 1845	693	21	25	—	35	Kirkee, Kolapore, and on march to the Punjab.
arrived in India, September 6, 1841;	" 1846	632	47	39	—	28	On march to the Punjab, Umballa.
" 1847	" 1847	641	71	17	10	75	Umballa.
" 1848	" 1848	669	42	9	5	96	Lahore. Field service, Punjab Campaign.
left India, February 11, 1860.	" 1849	622	82	10	—	50	Field service, Punjab Campaign, Lahore.
" 1850	" 1850	683	35	14	2	110	Lahore.
" 1851	" 1851	693	41	13	2	70	On march to Meerut. Meerut.
" 1852	" 1852	708	27	17	1	66	Meerut.
" 1853	" 1853	739	14	26	27	56	Meerut.
" 1854	" 1854	734	15	27	—	38	Meerut.
" 1855	" 1855	720	17	19	—	26	On march to Kirkee. Kirkee.
" 1856	" 1856	688	7	25	—	—	Kirkee.
" 1857	" 1857	656	7	26	1	—	Field service to Persia; Kirkee; and field service in India.
" 1858	" 1858	706	18	6	—	60	On field service.
" 1859	" 1859	639	62	36	—	28	On field service; Kirkee.
Feb. 11, 1860	Feb. 11, 1860	395	11	20	—	12	Kirkee.
Average	—	655·15	30·11	18·7	10·8	47·17	

R. H. GALL, Bt. Lieut.-Col., commanding 14th (King's) Hussars.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Reinforce- ments.		
					By Trans- fer.	By Drafts.	
29TH REGIMENT OF FOOT, arrived in India, July 29, 1842 ; left India, September 30, 1859.	July 29, 1842	1,004	—	—	—	—	Chinsurah.
	Apr. 1, 1843	998	106	—	—	24	Ghazee-pore.
	„ 1844	944	158	—	24	183	Ghazee-pore.
	„ 1845	987	260	21	9	93	Ghazee-pore and Meerut.
	„ 1846	835	223	61	132	68	Kussowlic, and Sutlej Campaign ; 141 killed and died of wounds.
	„ 1847	913	49	27	149	199	Kussowlic.
	„ 1848	1,162	176	8	1	38	Kussowlic and Ferozepore.
	„ 1849	1,006	112	86	3	235	Wuzeerabad, and Punjab Campaign, 48 killed and died of wounds.
	„ 1850	1,039	54	35	17	10	Wuzeerabad and march to Meerut.
	„ 1851	963	72	12	7	100	Meerut.
	„ 1852	1,012	51	26	5	62	Cawnpore, on march from Meerut to Dinapore.
	„ 1853	998	86	41	12	69	Dinapore.
	„ 1854	955	52	36	27	16	Moulmein, Burmah.
	„ 1855	907	68	23	2	137	Thayetmyo, Burmah.
	„ 1856	849	71	22	2	—	Thayetmyo, Burmah.
	„ 1857	949	69	37	1	137	Thayetmyo, Burmah, 1 Wing Calcutta.
	„ 1858	913	37	26	2	97	Thayetmyo, Burmah, 1 Wing Calcutta.
	„ 1859	824	17	—	2	—	Thayetmyo and Bengal (latter part of Indian Mutiny) ; on passage to England.
	to Sept. 30, 1859						
	Average - -	—	1,015	97	27	23	86

E. H. WESTROPP, Lieut.-Col., commanding 29th Regiment.

78TH REGIMENT OF HIGHLANDERS, arrived in India, July 30, 1842.	Apr. 1, 1843	1,035	29	—	—	—	Poona.
	" 1844	—	—	—	—	44	Kurrachee, Sind.
	" 1845	—	400	105	—	51	Hydrabad, Sind.
	" 1846	—	258*	—	100	638	Poona.
	" 1847				168	23	Belgaum.
	" 1848				—	27	Belgaum.
	" 1849				—	30	Belgaum.
	" 1850	—	—	—	—	2	1 Wing Bombay, 1 Wing Aden.
	" 1851				—	83	1 Wing Bombay, 1 Wing Aden.
	" 1852				—	80	1 Wing Bombay, 1 Wing Aden.
	" 1853				1	67	Poona.
	" 1854	—	—	—	—	11	Poona.
	" 1855	—	—	—	—	77	Poona.
	" 1856	914	—	—	1	59	Poona.
	" 1857	928	—	29	1	98	Mohumra, Persia, field service.
	" 1858	756	223	91	1	16	Busseratgunge, Oude, Bengal, field service.
	" 1859	540	48	18	—	—	Mhow.
Average - -	—	—	—	—	16	76½	

* From April 1, 1845, to September 1850.

This return cannot be filled up completely in consequence of several books and documents having been destroyed by fire at Cawnpore in November 1857.

J. A. EWART, Colonel, commanding 78th Highlanders.

1ST BATTALION, 10TH REGIMENT OF FOOT, arrived in India, August 4, 1842 ; left India, April 29, 1859.	Aug. 4, 1842	1,195	35	—	27	25	Stationed at Fort William, Calcutta.
	April 1, 1843	1,052	105	2	3	34	Stationed at Fort William, Calcutta.
	" 1844	986	60	77	5	58	Right wing removed to Chinsurah, February 2, 1844. Regiment marched to Meerut, November 15, 1844.
	" 1845	980	89	2	43	38	Stationed at Meerut from January 31, 1844, to December 16, 1845.
	" 1846	1,041	103	23	124	179	Left Meerut, December 16, 1845 ; with the army of the Sutlej, from January 8, 1846 to March 23, 1846. Left Lahore, March 23, and returned to Meerut, April 15, 1846. Left Meerut, October 27, 1846 ; arrived at Ferozepore, November 20, 1846 ; marched again on December 23, 1846 to Lahore.
	" 1847	955	99	117	69	111	Stationed at Lahore from January 2, 1847, to July 27, 1848.
	" 1848	1,024	92	44	4	133	Engaged with the army of the Punjab before Mooltan from August 12, 1848, to January 22, 1849.
	" 1849	1,054	76	28	2	181	Engaged with the Grand Army, under Sir Hugh Gough, from January 22, 1849, until the arrival of the regiment in quarters at Ferozepore on April 8, 1849.
	" 1850	1,097	53	86	3	4	The regiment left Ferozepore, February 4, 1850, and marched into quarters at Wuzeerabad, February 17, 1850.
	" 1851	996	44	35	5	74	Stationed at Wuzeerabad.
	" 1852	985	44	59	7	77	Stationed at Wuzeerabad.
	" 1853	991	30	7	15	93	The regiment marched from Wuzeerabad, No- vember 16, 1853, and marched into quarters at Mean Meer, November 22, 1853.
	" 1854	994	35	103	11	25	Stationed at Mean Meer.
	" 1855	964	36	26	5	25	Left Mean Meer, October 13, 1855, and marched into quarters at Dinapore, January 21, 1856.
	" 1856	976	33	45	4	93	Stationed at Dinapore.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Reinforce- ments.		
					By Trans- fer.	By Drafts.	
1st BATTALION, 10th REGIMENT OF FOOT—cont.	Apr. 1, 1857	808	30	49	—	1	The battalion was stationed at Dinapore; various detachments being engaged in the suppression of the mutiny in the surrounding districts. The whole regiment was subsequently engaged in the suppression of the mutiny from December 21 to June 12, 1858, when the head-quarters marched into Dinapore. Left Dinapore for embarkation on February 10, 1859. Head-quarters, consisting of 8 companies, embarked at Calcutta, March 17, 1859, on board the King Philip. The remainder 2 companies embarked at Calcutta on April 29, 1859.
	" 1858	706	128	45	—	70	
	" 1859	521	64	61	3	23	
Average - -	—	972 $\frac{2}{3}$	64 $\frac{1}{2}$	44 $\frac{1}{2}$	18 $\frac{3}{4}$	69 $\frac{1}{2}$	

Strength on embarkation, 521 non-commissioned officers, rank and file; 176 men volunteered.

H. E. LONGDEN, C.B., Colonel and Lieut.-Col., commanding 1st Bat. 10th Regt. of Foot.

84th REGIMENT OF FOOT, arrived in India, August 8, 1842; left India, April 8, 1859.	Apr. 1, 1843	1,064	14	Nil.	1	12	Stationed at Moulmein, Burmah, from August 1842, to March 28, 1845.
	" 1844	808	54	..	1	25	
	" 1845	808	28	36	Nil.	Nil.	
	" 1846	808	18	53	33	114	Fort St. George, Madras, from March 29, 1845, to January 5, 1847.
	" 1847	1,060	13	35	84	37	
	" 1848	1,140	42	25	39	119	On march from Madras to Secunderabad, January 5 to February 20, 1847.
	" 1849	1,073	30	26	1	10	
	" 1850	998	43	35	Nil.	11	Stationed there until December 4, 1849.
	" 1851	1,013	19	28	2	76	
	" 1852	1,006	17	46	2	65	Stationed at Trichinopoly from January 1850 to January 1854.
	" 1853	1,032	10	Nil.	Nil.	59	
	" 1854	986	28	39	4	83	Stationed at Rangoon, Burmah, from January 1854 to March 1857.
	" 1855	924	35	44	Nil.	33	
	" 1856	967	23	18	4	112	On field service from March 1857 to date of leaving India, April 8, 1859.
	" 1857	918	29	65	Nil.	49	
	" 1858	803	280	47	..	204	
	" 1859	481	74	67	..	112	
Average - -	—	962	46	33	10	66	

25th REGIMENT OF FOOT, arrived in India, August 9, 1842.	Apr. 1, 1843	1,104	82	—	5	8	Poonamallee, Arcot, Arnee, Cannanore.
	" 1844	1,027	28	32	—	36	Cannanore.
	" 1845	1,086	26	32	—	84	Cannanore.
	" 1846	1,199	38	30	129	28	Cannanore.
	" 1847	1,234	31	47	88	48	Cannanore.
	" 1848	1,226	41	69	105	28	Madras.
	" 1849	1,170	38	23	4	36	Madras.
	" 1850	1,126	56	35	—	24	Madras.
	" 1851	1,080	22	43	2	52	Bangalore.
	" 1852	1,067	19	61	6	57	Bangalore.
	" 1853	1,042	21	44	1	70	Cannanore.
	" 1854	1,039	33	40	2	78	Cannanore.
	" 1855	947	18	51	—	4	Cannanore.
Average - -	—	1,103 $\frac{2}{3}$	34 $\frac{1}{2}$	39	26 $\frac{1}{2}$	42 $\frac{1}{2}$	

FRANCIS FANE, Lieut.-Col., commanding 25th Regt.

86th ROYAL REGI- MENT OF FOOT, arrived in India, August 31, 1842; left India, April 18, 1859.	Aug. 31, 1842	1,052	135	95	—	19	Bombay and Belgaum. Attacked by cholera on arrival at Bombay.
	" 1843	936	35	19	1	120	Belgaum, Kurrachee, and Hyderabad.
	" 1844	999	83	34	9	118	Kurrachee and Hyderabad.
	" 1845	1,006	32	52	104	82	Kurrachee.
	" 1846	1,099	264	19	32	7	Kurrachee. Attacked by cholera after a march of 1,300 miles.
	" 1847	854	42	22	123	258	Poona and Deesa.
	" 1848	1,167	30	—	2	30	Deesa.
	" 1849	1,163	30	31	1	21	Deesa.
	" 1850	1,113	34	44	6	14	Deesa and Poona.
	" 1851	1,053	11	39	12	41	Poona.
	" 1852	1,056	10	48	2	14	Poona.
	" 1853	931	21	52	10	132	Poona, Kurrachee, and Hyderabad.
	" 1854	920	19	54	24	30	Hydrabad, Kurrachee, and Aden.
	" 1855	897	22	45	3	165	Kurrachee, Bombay, and Aden.
	" 1856	937	17	37	3	64	Bombay and Aden.
	" 1857	937	40	22	2	99	Divided into 7 detachments throughout the Bombay Presidency.
	" 1858	977	90	100	—	240	With Central India Field Force under Sir Hugh Rose. Gwalior, and march to Bombay.
	" 1859	727	5	—	—	—	Bombay.
	Apr. 18, 1859	722	—	—	—	—	Arrived at Gosport, August 20, 1859.
Average - -	—	976 $\frac{2}{3}$	51 $\frac{1}{2}$	39 $\frac{1}{2}$	18 $\frac{3}{4}$	77 $\frac{1}{2}$	

R. M. BLIST, Lieut.-Col., commanding 86th Regt.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Reinforce- ments.		
					By Trans- fer.	By Drafts.	
9TH QUEEN'S ROYAL REGIMENT OF LANCERS, arrived in India during September and October 1842 ; left India, April 29, 1859.	—	653	—	—	—	—	—
	Apr. 1, 1843	609	84	—	—	40	Calcutta. Passage by boats on the Ganges to Cawnpore.
	„ 1844	693	65	—	—	150	Cawnpore. Wing of the regiment on field service in Gwalior.
	„ 1845	690	62	—	—	68	Cawnpore.
	„ 1846	696	36	6	4	54	Cawnpore, and on the Sutlej campaign.
	„ 1847	707	41	6	24	45	Meerut.
	„ 1848	720	15	9	1	51	Meerut.
	„ 1849	705	23	12	—	33	Meerut and Punjab Campaign.
	„ 1850	663	68	6	1	38	Wuzeerabad.
	„ 1851	683	24	17	1	83	Wuzeerabad, and march to Umballa.
	„ 1852	682	13	20	2	63	Umballa.
	„ 1853	649	29	28	13	56	Umballa.
	„ 1854	639	18	26	8	61	Umballa.
	„ 1855	695	16	10	7	84	Umballa.
	„ 1856	693	17	14	1	33	Umballa.
	„ 1857	611	13	23	1	—	Umballa.
	„ 1858	547	107	—	1	51	On field service during Indian Mutiny.
	„ 1859	399	41	50	1	95	
Average	—	651·72	39·58	13·35	3·82	59·11	

W. DRYSDALE, Lieut.-Col., commanding 9th Lancers.

53RD REGIMENT OF FOOT, arrived in India, December 30, 1844.	Apr. 1, 1845	1,029	214	—	14	35	Chinsurah and Cawnpore.
	" 1846	837	116	6	195	46	Cawnpore, Agra, and on service with the Army of the Sutlej.
	" 1847	898	66	32	135	101	Umballa and Ferozepore.
	" 1848	1,083	79	34	39	66	Ferozepore and Lahore.
	" 1849	910	58	32	—	159	Lahore, and on service with the Army of the Punjab.
	" 1850	848	27	10	—	64	Rawul Pindi.
	" 1851	854	13	23	—	68	Rawul Pindi.
	" 1852	880	63	17	—	65	Rawul Pindi. Standing Camp, and on the march to Peshawur.
	" 1853	949	58	26	—	64	Peshawur.
	" 1854	993	34	31	—	94	Peshawur, and on the march to Dugshai.
	" 1855	1,165	47	36	195	71	Dugshai and Standing Camp, Umballa.
	" 1856	1,108	57	28	—	35	Dugshai, on the march, Dum Dum, and Fort William.
	" 1857	1,093	35	22	—	79	Fort William.
	" 1858	961	106	—	—	247	Calcutta and field service.
	" 1859	863	13	15	—	20	On field service and Lucknow.
	" 1860	807	64	9	—	—	Lucknow, on the march, and Calcutta.
Average - -	—	954 $\frac{1}{16}$	65 $\frac{7}{16}$	20 $\frac{1}{16}$	36 $\frac{2}{16}$	75 $\frac{1}{16}$	

F. ENGLISH, C.B., Lieut.-Col., commanding 53rd Regt.

39TH REGIMENT OF FOOT, return is made from January 1, 1845 ; left India, February 7, 1847.	Jan. 1, 1845	1,373	22	35	—	—	Dinapore.
	Apr. 1, 1845	1,288	118	83	—	78	
	" 1846	645	35	78	3	—	
	Feb. 7, 1847	297	—	—	—	—	
Average - -	—	900 $\frac{3}{4}$	58 $\frac{1}{3}$	65 $\frac{1}{3}$	1	26	

There are no documents at the depôt of a date prior to January 1, 1845.

C. DENISON PEDDER, Captain, commanding Depôt, 39th Regt.

1ST BATTALION, 60TH REGT. ROYAL RIFLES, arrived in India, October 15, 1845 ; left India, March 17, 1860.	Oct. 15, 1845	1,000	99	—	—	37	Landed in India October 15, 1845, to Poona; from Poona to Kurrachee, February 11, 1846.
	Apr. 1, 1846	938	45	33	—	82	Kurrachee.
	" 1847	925	31	50	—	205	Kurrachee.
	" 1848	—	—	—	—	—	From Kurrachee to active service in the Punjab October 8, 1848; capture of Mooltan; battle of Goozerat. No records for this year.
	" 1849	1,079	19	19	—	28	Peshawur.
	" 1850	1,053	27	51	—	20	Kussowlie.
	" 1851	959	45	51	1	91	From Kussowlie to Jullundur in September 1851.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Reinforcements.		
					By Transfer.	By Drafts.	
1ST BATTALION, 60TH REGIMENT OF ROYAL RIFLES— <i>cont.</i>	Apr. 1, 1852	933	47	55	1	104	Jullundur.
	" 1853	899	34	45	3	123	Jullundur.
	" 1854	918	26	46	42	55	From Jullundur, December 19, 1854, to Umballa, where it arrived on December 29, for the purpose of joining a Camp of Exercise under command of Major-General Fane, returned to Jullundur, March 1855.
	" 1855	913	10	48	5	93	From Jullundur to Meerut on the 1st, and arrived on December 28, 1855, in course of relief.
	" 1856	949	54	76	6	59	Meerut.
	" 1857	882	194	2	1	102	From Meerut on May 27, 1857, towards Delhi; engaged at the Hindun, May 30 to 31, Allpore on June 7. Engaged with the mutinous sepoys, June 18; encamped before Delhi on that date; siege operations before Delhi from June 8 till September 13. Assault and capture of the city on September 14, 1857. Stationed at Delhi till the end of December 1857.
	" 1858	789	43	137	5	290	To Meerut on January 1, 1858. Campaign in Rohilkund in April 1858; actions of Bagawalla and Nugena; relief of Moradabad; action on the Dajura; assault and capture of Bareilly; relief of Shahjehanpore; attack and destruction of Mahumdee and Shahabad; action of Bung-tra-Gong; served in Oudh in October 1858; actions of Pusgaon, Rissoolpoor; capture of Mittowlie; action at Biswah; in the field to end of year.
	" 1859	900	61	127	6	35	From service in the field to Camp at Seetapore, March 1, 1859. From Seetapore on March 21, 1859, to Benares, where it remained till September 20, 1859.
	" 1860	452	—	—	—	—	From Benares to Calcutta on September 21, 1859, and remained at Fort William, Calcutta, until March 17, 1860, when it embarked for England on board the Ship "Aliquis."
	Average - -	—	1,258.9	73.5	74.4	7	132.4

C. N. NORTH, Lieut.-Col., and Major commanding 1st Battalion, 60th Royal Rifles.

61ST REGIMENT OF FOOT, arrived in India, October 26, 1845; left India, June 30, 1860.	Apr. 1, 1846	No returns in possession for this period.			—	—	Dum Dum and Cawnpore.
	" 1847				3	98	Umballa.
	" 1848				3	98	Jullundur, Doab.
	" 1849				2	228	Active field service with the army of Punjab.
	" 1850				2	13	Peshawur, Afghanistan.
	" 1851				4	57	Peshawur, Afghanistan.
	" 1852	1,032	54	27	4	77	Kussowlie and Subathoo.
	" 1853	1,008	28	50	3	76	Kussowlie and Subathoo.
	" 1854	998	21	78	4	78	Wuzerabad.
	" 1855	977	43	23	93	43	Wuzerabad.
	" 1856	1,036	16	26	2	36	Wuzerabad.
	" 1857	945	27	76	1	15	Ferozepore.
	" 1858	787	284	1	3	115	At Delhi, active field service.
	" 1859	885	44	84	6	277	Line of march to Bombay.
	June 30, 1860	778	21	5	—	50	Poona and Bombay.
Average - -	—	938.44	59.77	41.11	10.00	90.05	

J. P. REDMOND, Lieut.-Col., commanding 61st Regt.

1ST BATTALION, 8TH, THE KING'S, REGIMENT OF INFANTRY, arrived in India, August 2, 1846; left India, May 4, 1860.	Apr. 1, 1847	869	—	—	—	—	Poona and Bombay.
	" 1848	1,022	10	—	49	31	—
	" 1849	1,010	9	4	99	—	Poona and Bombay.
	" 1850	1,144	33	11	3	150	Per steamer to Kurrachee, and left wing marched to Hyderabad.
	" 1851	1,029	46	86	—	30	Kurrachee and Hyderabad.
	" 1852	1,551	14	8	—	46	Kurrachee and Hyderabad.
	" 1853	1,020	30	48	—	52	Both wings marched to Deesa.
	" 1854	987	27	48	—	43	Deesa.
	" 1855	932	18	75	—	—	Marched to Agra.
	" 1856	977	18	1	21	98	Agra.
	" 1857	854	29	98	12	—	Marched to Jullundur.
	" 1858	891	40	70	1	119	Jullundur.
	" 1859	845	175	—	—	174	At the siege of Delhi various operations and relief of Lucknow and Umballa.
	" 1860	870	56	88	4	148	Agra, Futtighur and Subjugation of Oude.
	" 1860	475	29	99	7	90	Futtighur. March from Futtighur to Calcutta.
	May 4, 1860	319	9	209	—	1	Calcutta.
Average - -	—	1,021.11	32.11	60.11	14	70.11	

FRED. P. HAINES, Colonel, Lieut.-Col. commanding 1st Bat. The King's Regt.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Reinforce- ments.		
					By Trans- fer.	By Drafts.	
8TH REGIMENT, arrived in India, August 2, 1846 ; left India, May 4, 1860.	Apr. 1, 1846 " 1847 " 1848 " 1849 " 1850 " 1851 " 1852 " 1853 " 1854 " 1855 " 1856 " 1857 " 1858 " 1859 " 1860 May 1, 1860	869 1,022 1,010 1,144 1,030 1,051 1,020 987 932 977 854 891 845 870 475 319	— 10 9 33 46 14 30 27 18 18 29 40 175 56 29 9	— — 4 11 86 8 48 48 75 1 98 70 — 88 99 209	— 49 99 3 — — — — — 21 12 1 — 4 7 —	— 31 — 150 30 46 52 43 — 98 — 119 174 148 90 1	November and December, Poona. January to December, Poona. January to October, Poona ; October to De- cember, Kurrachee. January to December, Kurrachee. January to December, Right Wing, Kurra- chee ; Left Wing, Hyderabad. January to December, Deesa. January to December, Deesa. January to November, Deesa ; December, on the march. January, on the march ; February to Decem- ber, Agra. January to October, Agra ; November and December, on the march. January to December, Jullundur. January to December, in the Field. January and February, on the March ; March to July, Agra ; August to October, Futt- yghur ; November and December, in the Field. January to December, Futtighur January to May, Calcutta.
Average - -	—	1,021	39	60	14	70	

FRED. P. HAINES, Colonel, N. Wg., Com. 1st, 8th Foot.

10TH ROYAL REGIMENT OF HUSSARS, arrived in India, August 22, 1846 ; left India, February 1, 1855.	—	640	—	—	—	—	—
	Apr. 1, 1847	644	10	—	—	14	Kirkee, East Indies.
	" 1848	708	17	29	—	110	Kirkee, East Indies.
	" 1849	721	9	7	1	29	Kirkee, East Indies.
	" 1850	667	19	60	—	25	Kirkee, East Indies.
	" 1851	674	25	31	—	65	Kirkee, East Indies.
	" 1852	676	15	51	—	67	Kirkee, East Indies.
	" 1853	689	6	64	5	78	Kirkee, East Indies.
	" 1854	645	12	75	—	43	Kirkee, East Indies.
	Jan. 10, } Feb. 1, } 1855	672	12	38	—	77	Marched in two wings for Bombay, 1st wing Dec. 28, 1854, 2nd wing Jan. 12, 1855.
Average - -	—	693·7	13·88	44·37	·66	56·44	

V. BAKER, Lieut.-Col., commanding 10th Royal Hussars.

1ST BATTALION, 24TH REGIMENT OF INFANTRY, arrived in India, August 28, 1846.	Aug. 28, 1846	924	49	5	139	7	Dum Dum, Ghazepore, Allahabad, and Agra.
	Apr. 1, 1847	1,015					
	" 1848	1,185	88	18	109	173	Agra, Punjab campaign, Chillianwallah.
	" 1849	896	288	15	1	18	
	" 1850	1,103	39	56	2	318	Wuzeerabad.
	" 1851	1,015	60	36	6	10	Wuzeerabad and Lahore.
	" 1852	1,021	26	36	1	67	Wuzeerabad.
	" 1853	1,008	19	41	2	58	Sealkote.
	" 1854	1,049	27	54	58	74	Sealkote.
	" 1855	1,062	33	23	41	32	Sealkote and Peshawur.
	" 1856	1,049	37	32	13	46	Peshawur and Nowshera.
	" 1857	952	79	34	2	12	Peshawur, Rawul Pindi, Shelum, Wuzeer- abad, Fort Attock, Fort Phillour, Fort Govindghur, Jullundur, Umritsur, Goo- gana. The regiment (in detachments) was on the march from May 1857 to May 1858. Ferozepore (in pursuit of Tantia Topee).
	" 1858	954	105	—	2	106	Ferozepore. Ferozepore, and march to Kurrachee (via Mooltan).
	" 1859	1,141	27	89	6	297	
	" 1860	1,058	16	46	22	10	
	" 1861	633	11	96	5	1	
Average - -	—	1,077 $\frac{10}{15}$	60 $\frac{4}{15}$	38 $\frac{11}{15}$	27 $\frac{14}{15}$	82 $\frac{2}{15}$	

N.B.—Men discharged or "volunteers" to other corps not accounted for, there being no column for the same.

EDMUND WODEHOUSE, Lieut.-Col., commanding 1st Bat. 24th Regt.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Reinforcements.		
					By Transfer.	By Drafts.	
32ND REGIMENT INFANTRY, arrived in India, September 9, 1846; left India, March 24, 1859.	Sept. 9, 1846	943	—	—	—	—	Chinsurah, to Novr 26, 1846, when the regiment embarked on board for Meerdut, and arrived January 19, 1847, quartered in barracks. Meerut to February 11, 1848, when it marched on board to Umballa, and arrived March 1, 1848, quartered in barracks.
	Apr. 1, 1847	1,114	37	7	137	1	Chinsurah to May 14, 1848. Ferozepore from May 27 to August 19, 1848. On field service before Meerdut, and Goozerat to March 22, 1849. En route to Jullundur to March 31, 1849.
	" 1848	1,202	76	5	42	128	En route to Jullundur to April 17, 1849, after which quartered in barracks.
	" 1849	1,075	125	—	1	15	Jullundur (in barracks).
	" 1850	1,114	68	60	3	156	Jullundur till November 19, 1851. On march to Peshawur 10th February 8, 1852; were quartered in barracks whilst stationed there. Employed on field service in Rannazye valley from March 10 to 27, 1852.
	" 1851	998	45	25	—	21	Peshawur. Employed on field service in Rannazye valley from May 2 to June 1852.
	" 1852	1,021	31	26	4	44	Peshawur till January 2, 1854. On march to Kussowlie till March 6, 1854, from that time headquarters at Kussowlie, and left wing at Subathoo (both in barracks).
	" 1853	919	87	59	—	53	Head-quarters, Kussowlie. Left wing, Subathoo, to August 27, 1854; the whole regiment at Kussowlie till December 12, 1854. At camp of exercise, Umballa, from December 16, 1854 to March 4, 1855.
	" 1854	925	26	—	3	70	Head-quarters, Kussowlie; Left wing, Subathoo, remainder of the year.
	" 1855	—	{ Returns lost in Lucknow, and copies for the period from Jan. 1 to Dec. 31, 1855, could not be obtained from Horse Guards. }				Head-quarters, Kussowlie. } In barracks.
	" 1856	909					Left wing, Subathoo.
	" 1857	742	82	32	4	33	Head-quarters, Kussowlie; Left wing, Subathoo, till April 3, 1856; the whole regiment, Kussowlie, till October 20, 1856; on march to Lucknow till December 27, 1857; were quartered in barracks with one company at Cawnpore, with women and children.
	" 1858	510	384	32	2	185	Lucknow, with one company at Cawnpore; on field service in the neighbourhood of Lucknow from May 15 to June 30; employed in defence of the Residency from June 30 to November 22; on field service remainder of year.
	Mar. 24, 1859	341	63	65	2	58	On field service in the Allahabad and Oude districts till January 27, 1859; in camp at Allahabad till February 12, 1859; en route (back) from to Chinsurah till February 28; at Chinsurah in barracks till embarkation for England on March 23, 1859.
							Sailed for England.
Average - -	—	908 ² / ₁₇	93 ¹ / ₁₁	28 ³ / ₁₁	18	69 ⁵ / ₁₁	

G. G. C. STAPYLTON, Lieut.-Col., commanding 32nd Lt. Infantry.

32ND REGIMENT, arrived in India, September 9, 1846; left India, March 24, 1859.	Apr. 1, 1846	943	—	—	—	—	October and November, Chinsurah; December, on the March.
	" 1847	1,114	37	7	137	1	January and February, on the March; March to December, Meerut.
	" 1848	1,202	76	5	42	128	January and February, Meerut; March to May, Umballa; June to August, Ferozepore; September to December, Camp before Mooltan.
	" 1849	1,075	125	—	1	15	January, Camp before Mooltan; February to April, on the March; May to December, Jullundur.
	" 1850	1,114	68	60	3	156	January to December, Jullundur.
	" 1851	998	45	25	—	21	January to November, Jullundur; December, on the March.
	" 1852	1,021	31	26	4	44	January to April, Peshawur; May, in the Field; June to December, Peshawur.
	" 1853	919	87	59	—	53	January to December, Peshawur.
	" 1854	925	26	—	—	70	January and February, on the March; March to December, Kussowlie.
	" 1855	—	Returns lost in Lucknow, and copies for the period from 1st January to 31st December 1855 could not be obtained from the Horse Guards.				January to March, Umballa; April to December, Right Wing, Kussowlie; Left Wing, Subathoo.
	" 1856	909					January to October, Kussowlie; November and December, on March.
	" 1857	742	82	32	4	33	January to November, Lucknow; December, Cawnpore.
	" 1858	510	384	32	2	185	January to December, in the Field.
	" 1859	341	63	65	2	85	January, Camp Morawon; February, Allahabad; March, Chinsurah.
Average - -	—	908 ² / ₁₇	93 ¹ / ₁₁	28 ³ / ₁₁	18	69 ⁵ / ₁₁	

G. G. C. STAPYLTON, Lieut.-Col., commanding 32nd Regiment Light Infantry.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
96TH REGIMENT OF FOOT, arrived in India, April 26, 1849 ; left India, December 31, 1854.	Apr. 1, 1850 " 1850 " 1851 " 1852 " 1853 " 1854 Dec. 31, 1854	1,014 891 933 973 937 *954 633	60 121 122 69 44 58 —	4 53 63 48 44 Nil. 633	1 4 6 2 5 5 —	199 208 94 150 110 Nil. —	Calcutta and Ghazee-pore. Marched from Ghazee-pore to Cawnpore. Cawnpore. Marched from Cawnpore to Lahore. Lahore. Mean Meer. Mean Meer. Marched for Dinapore, Novem- ber 1853. Dinapore and Chinsurah. Embarked for England in December 1854.
Average - -	—	950 $\frac{1}{3}$	75 $\frac{2}{3}$	42 $\frac{2}{5}$	3 $\frac{3}{8}$	152 $\frac{1}{5}$	

* 279 men volunteered for further service in India.

E. W. SCOVELL, Colonel, commanding 96th Regiment.

83RD REGIMENT OF FOOT,	July 31, 1849	1,132	—	—	—	—	
arrived in India,	Apr. 1, 1850	1,100	47	3	—	19	Poona, Bombay Presidency.
May 10, 1849.	" 1851	1,061	27	20	—	10	Marched in November 1850 to Bombay, thence by sea to Kurrachee, Scinde.
"	" 1852	989	69	33	2	29	Kurrachee, Scinde.
"	" 1853	983	69	43	6	103	Kurrachee, Hyderabad, Scinde.
"	" 1854	992	19	53	4	80	Head-quarters, with three companies, marched to Deesa Dec. 1855, arrived in Deesa Feb. 1854.
"	" 1855	972	17	48	18	38	Seven companies embarked from Kurrachee for Bombay November 1854.
"	" 1856	934	24	57	4	43	Three companies, Deesa; seven companies from Bombay joined head-quarters at Deesa, Jan. 23, 1856.
"	" 1857	940	18	47	1	70	Deesa.
"	" 1858	1,006	45	44	—	156	Seven companies marched on field service to Nusserabad and Ajmeer in May and June 1857; head-quarters to Mount Aboo from Deesa in November 1857; head-quarters and three com- panies to Nusserabad on field service in Decem- ber 1857; two companies, January 1858, to siege of Awah; regiment siege of Kotah, March 9 to April 25, 1858.
"	" 1859	1,101	54	56	15	191	On field service July to September 1858; on field service November 1858 to February 1859; marched from Nusserabad, February 1860, Rajpootana.
"	" 1860	1,048	30	223	189	11	Reached Belgaum May 1860.
"	" 1861	965	18	72	6	70	Belgaum.
Average - -	—	1,101.92	36.42	58.25	20.42	68.33	

Under "Sent Home" all men discharged in India are included. Under "Transfers" all men joining in India other than drafts. Under "Drafts" Recruits. This return does not show the numbers transferred from the regiment to other corps or deserters.

H. DE R. PIGOTT, Captain commanding Depot 83rd Regiment.

64TH (2ND STAF- FORDSHIRE) REGIMENT OF IN- FANTRY,	May 17, 1849	1,103	78	4	—	14	Poona and Kurrachee.
arrived in India,	Apr. 1, 1850	1,035	14	28	—	—	Kurrachee.
May 17, 1849 ;	" 1851	993	—	—	—	—	Kurrachee.
"	" 1852	1,012	50	52	2	76	Kurrachee.
"	" 1853	989	—	—	—	—	Kurrachee and Belgaum.
left India,	" 1854	—	—	—	—	—	Belgaum - - } Return books for these
April 9, 1861.	" 1855	—	—	—	—	—	Belgaum - - } years and 1851 were lost
"	" 1856	—	—	—	—	—	Belgaum and Persia } while crossing the
"	" 1857	1,088	237	77	6	72	On Field Service in Persia and Bengal.
"	" 1858	852	39	115	100	430	On Field Service in Bengal.
"	" 1859	1,228	24	224	11	2	Kurrachee.
"	" 1860	993	12	452	7	60	Kurrachee.
"	" 1861	596	Date of Embarkation.				Kurrachee.
Average of Returns given - -	—	988 $\frac{9}{10}$	64 $\frac{7}{10}$	136	18	93 $\frac{7}{10}$	

Under "Number of men sent from India to England" men transferred to other regiments are included. Under "Drafts" recruits are included.

N. H. SHUTE, Lieut.-Col., commanding 64th Regiment.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year				Station at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts	
70TH REGIMENT OF Foot, arrived in India, May 17, 1849.	May 17, 1849 Apr. 1, 1850 " 1851 " 1852 " 1853 " 1854 " 1855 " 1856 " 1857 " 1858 " 1859 " 1860 Feb. 1, 1861	979 935 1,000 963 950 808 882 896 745 963 975 915 884	— 129 48 67 40 243 17 8 117 82 59 18 42	— 4 1 36 32 23 14 28 57 — 71 45 77	— 1 5 6 1 34 12 5 — 2 12 3 7	— 96 125 81 74 102 97 52 38 302 153 36 131	Calcutta and on march. Fort William and Cawnpore. Cawnpore. Cawnpore. Cawnpore and Ferozepore (on march). Ferozepore. Ferozepore. Ferozepore and Peshawur (on march). Peshawur. Peshawur, Nowsheras, and Rawul Pindi (march). Rawul Pindi and Allahabad and on march. Allahabad.
Average - -	—	910	72	32	7	107	

W. COOPER, Capt., commanding 70th Depôt.

87TH REGIMENT R. I. FUSILIERS, arrived in India, August 1, 1849; left India, 1860.	Aug. 1, 1849	1,032	—	—	—	—	Ferozepore, E.I.
	Apr. 1, 1850	852	168	12	—	—	Ferozepore, E.I.
	" 1851	852	88	37	11	238	Ferozepore, E.I.
	" 1852	992	72	19	31	94	Ferozepore, E.I.
	" 1853	991	26	15	12	88	Ferozepore, E.I.
	" 1854	946	22	22	23	85	Rawul Pindi, E.I.
	" 1855	956	23	31	11	—	Rawul Pindi, E.I.
	" 1856	896	15	31	2	46	Peshawur, E.I.
	" 1857	890	58	20	3	55	Peshawur, E.I.
	" 1858	889	58	55	3	136	En route to Jullundur.
	" 1859	943	58	43	111	123	Jullundur.
	" 1860	1,036	27	16	190	13	En route to China.
	" 1861	1,073	62	75	1	56	En route from China to Ireland.
Average - -	—	943	56.4	31.3	33.1	77.8	

A. H. COBBE, Major, commanding 87th Fusiliers.

75TH REGIMENT OF Foot, arrived in India, August 10, 1849.	Aug. 10, 1849	988	—	—	—	—	Calcutta and Allahabad.
	Apr. 1, 1850	956	188	1	—	9	Umballa.
	" 1851	1,033	50	—	1	132	Umballa.
	" 1852	1,041	30	14	2	69	Umballa. Left wing in Agra.
	" 1853	941	118	24	7	61	Umballa. Cholera.
	" 1854	994	31	26	38	97	March to Peshawur.
	" 1855	931	107	30	19	65	Peshawur
	" 1856	976	46	43	2	138	Rawul Pindi.
	" 1857	937	22	62	5	48	March to Kussowlie.
	" 1858	816	228	—	3	104	Field service in front of Delhi and Lucknow, 1857-58.
	" 1859	1,091	39	37	124	147	Meerut.
	" 1860	1,039	27	73	11	73	Allahabad.
	" 1861	951	57	71	3	99	Calcutta.
Average - -	—	1,058	78	31	17	86	

T. C. DUNBAR, Bt. Major, commanding Depôt 75th Regt.

52ND REGIMENT OF LIGHT INFANTRY, arrived in India, October 1, 1853.	Oct. 1, 1853	1,067	19	—	54	9	Calcutta, Umballa.
	Apr. 1, 1854	1,106	59	5	9	14	Umballa, Meerut.
	" 1855	1,041	40	24	2	34	Meerut, Lucknow.
	" 1856	1,002	103	75	1	56	Lucknow, Cawnpore, Delhi, Sealkote.
	" 1857	871	63	—	—	212	Sealkote, Loodiana, Jullundur. The monthly re- turns for July, September, and October 1857, and March 1858, have not been received at the depôt; regiment on service during those months in 1857.
	" 1858	888	25	94	22	417	Jullundur, Sealkote.
	" 1859	1,204	12	19	12	—	Sealkote.
	" 1860	1,131	13	96	63	49	Sealkote, Jhansi.
	" 1861	1,076	—	—	—	—	Jhansi.
Average - -	—	1,108	44.1	41.1	21.1	105.7	

ARTHUR HENLEY, Capt., commanding Depôt 52nd Lt. Infantry.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	B Drafts.	
81ST REGIMENT OF FOOT, arrived in India, October 7, 1853.	Apr. 1, 1854	1,063	29	1	13	1	Calcutta. On march. Meerut.
	" 1855	1,047	77	—	43	26	Meerut. On march. Meean Meer.
	" 1856	1,022	16	10	7	53	Mean Meer. Visited by cholera, August and September 1856.
	" 1857	1,047	170	1	1	26	Mean Meer, 150 men on field service for short periods, but continuously on duty and exposed on picket in cantonments. On march. Nowshera.
	" 1858	1,044	32	—	—	221	Nowshera. On march. Peshawur. 350 men on field service for short period. No rain at Peshawur, 1858-9. Regiment healthy.
	" 1859	1,074	41	59	94	28	Peshawur. On march. Rawul Pindi.
	" 1860	1,034	26	94	200	35	Rawul Pindi.
	to Mar. 31, 1861						
Average - -	—	1,047	55	23	51	77	

C. SKERRY, Capt., 81st Regt, commanding Depôt

43RD REGIMENT OF LIGHT INFANTRY, arrived in India, February 11, 1854; still serving in India.	Feb. 11, 1854	1,056	—	—	—	—	—
	Apr. 1, 1854	1,118	7	—	24	45	Madras, 2 months.
	" 1855	1,230	43	34	158	39	Madras, 11 months; Bangalore, 1 month.
	" 1856	1,181	24	33	3	8	Bangalore, 12 months.
	" 1857	1,094	50	43	—	30	Bangalore, 12 months.
	" 1858	1,041	31	28	1	6	Bangalore, 9 months; on field service, 3 months.
	" 1859	979	116	30	3	85	On field service, 7 months; Calpee, 3 months; Saugor, 2 months.
	" 1860	950	26	69	11	78	Saugor, 9 months; on march, 2 months; Madras, 1 month.
Average - -	" 1861	969	11	141	12	197	Madras, 12 months.
	—	1066 ⁴ / ₄₄	38 ⁵ / ₅₀	47 ²⁵ / ₂₅	26 ⁶⁰ / ₆₀	61	

H. J. BERNERS, Lieut., commanding Depôt 43rd Light Infantry.

74TH REGIMENT OF HIGHLANDERS, arrived in India, March, 1854.	March 1854	730	—	—	—	—	Head-quarters marched from Madras to Trichinopoly, January 19, 1854. Left wing from Madras to Trichinopoly, arrived March 17, 1854. Head-quarters from Trichinopoly to Jackatalla, March 16, 1854. Head-quarters from Jackatalla to Bellary, July 22, 1857. Left wing from Trichinopoly to Jackatalla (date not known at Depôt). Left wing from Jackatalla to Cannanore, (date not known at Depôt). Left wing from Cannanore to Bellary, January 1858. Head-quarters from Bellary to Secunderabad, November 9, 1858, returned to Bellary, February 23, 1859.
	Apr. 1, 1854	828	7	—	—	78	
	" 1855	1,004	63	17	262	5	
	" 1856	994	25	36	1	59	
	" 1857	978	22	34	—	48	
	" 1858	972	18	41	—	63	
	" 1859	1,065	40	26	2	131	
	" 1860	911	27	90	6	33	
Average - -	" 1861	932	13	100	31	140	
	—	934 ² / ₅	26 ⁷ / ₅	49 ¹ / ₇	60 ³ / ₅	69 ⁵ / ₈	

Portions of the Regiment on field service during Indian Mutiny; strength and dates not known at the Depôt.

H. W. PALMER, Capt., commanding Depôt 74th Highlanders.

27TH INNISKILLING REGIMENT OF FOOT, arrived in India, October 12, 1855; the regiment remains in India.	April 1, 1855	770	7	—	20	—	Allahabad, and on march.
	Mar. 31, 1856	718*	50	2	7	255	Sealkote.
	" 1857	930	33	14	2	111	Sealkote, Peshawur, and Nowshera.
	" 1858	988	140	30	1	105	Peshawur, Nowshera, and march from Nowshera to Attock and Rawul Pindi.
	" 1859	935	34	82	7	240	Umballa.
	" 1860	1,040	12	11	28	—	Umballa.
	" 1861	1,042	22	82	75	135	Umballa and Morar Gwalior.
	June 30, 1861	1,107	4	24	2	—	Morar Gwalior.
Average - -	—	941	37	30	17	105	

* 62 men drowned at Algoa Bay, Port Elizabeth, Cape of Good Hope, not noticed in this return.

EDWD. N. MOLESWORTH, Brevet Major, commanding Depôt 24th Regiment.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
35TH REGIMENT OF FOOT, arrived in India, November 14, 1854.	Nov. 14, 1854 April 1, 1855 " 1856 " 1857 " 1858 " 1859 " 1860 " 1861	642 681 655 656 933 934 959 1,162	— 14 52 66 66 187* 38 19	— 3 15 1 64 35 62 56	— 66 — — — 20 72 183	— — 44 75 365 204 104 100	Dum Dum. Dum Dum, 4 months. Dum Dum, 5 months; Calcutta, 6 months; Moulmein, 1 month. Moulmein, 12 months. Moulmein, 3 months; on march, 2 months; Barrackpore, 7 months. Dinapore, 8 months; field service, 4 months. Dinapore, 6 months; on march as escort of Governor-General, 3 months; Meerut, 3 months. Meerut, 12 months.
Average - -	—	946	63·18	33·71	48·71	127·42	

* 101 killed in action.

A. TISDALL, Brevet Major, commanding Depôt 35th Regiment.

6TH (CARABINEERS) DRAGOON GUARDS, arrived in India, November 22, 1856; left India, March 18, 1861.	April 1, 1857	635	2	—	—	—	On line of march from Calcutta to Meerut, arrived March 11, 1857.
	" 1858	632	71	—	3	65	Meerut when in quarters. On field service.
	" 1859	661	28	45	2	100	Meerut. On field service. Muttra, February 5, 1859.
	" 1860*	659	13	34	14	42	Muttra to January 9, 1860. Meerut.
	Mar. 18, 1861†	510	9	43	5	50	Meerut. On line of march for Calcutta from January 20, 1861.
Average - -	—	619	30	30	7	64	

* 11 men discharged in India not noted in the above.

† 15 men discharged in India, 3 men transferred, 134 men volunteered to corps in India, not counted in the above numbers.

H. RICHMOND JONES, Colonel, commanding 6th Carabineers.

12TH REGIMENT ROYAL LANCERS, arrived in India, December 11, 1856.	Apr. 1, 1857	610	3	—	—	—	Head Quarters and Right Wing, Bangalore and Secunderabad; Left Wing, Kirkee, Se- cunderabad, Saugor. Employed on field service in Central India from December 1857 to April 1859.
	" 1858	644	20	4	—	61	
	" 1859	608	52	41	—	57	
	" 1860	404	34	45	23	89	
	" 1861	404	—	—	—	—	
Average - -	—	534	27 $\frac{1}{4}$	22 $\frac{1}{2}$	5 $\frac{3}{4}$	51 $\frac{3}{4}$	

T. OAKES, Lieut.-Col., commanding 12th Royal Lancers.

37TH REGIMENT OF OF FOOT, arrived in India, June 13, 1857; left India, March 7, 1861.	Apr. 1, 1858	841	121	15	—	27	Left Wing served at Calcutta and Ghazeepore; Right Wing at Dinapore, on field service, and on the March. Right Wing at Dinapore and Ghazeepore; Left Wing and a part of the Right at Azim- gur, on field service, and on the march. Ghazeepore. Calcutta and Hazareebaugh. On embarkation. Not included in average.
	" 1859	705	36	52	—	279	
	" 1860	862	37	25	8	215	
	Mar. 7, 1861	998	84	82	—	13	
	—	539	—	—	—	—	
Average - -	—	851·5	69·5	43·5	2	133·5	

EGERTON MILMAN, Colonel.

1ST BATT. 5TH REGT. FUSILIERS, arrived in India, July 4, 1857; left India, March 9, 1861.	Apr. 1, 1858	856	165	2	1	1	Chinsurah, Allumbagh, and Cawnpore. Calpee and Allahabad. Allahabad and Calcutta. Calcutta. Strength on March 9, 1861, on leaving India.
	" 1859	663	88	48	3	298	
	" 1860	828	104	76	6	150	
	Mar. 9, 1861	805	38	419*	3	211	
	—	562	—	—	—	—	
Average - -	—	782 $\frac{2}{3}$	98 $\frac{3}{4}$	136 $\frac{1}{4}$	3 $\frac{1}{4}$	165	

* In this number is included 328 volunteers to other Regiments on the departure of the Battalion from Calcutta.

The men who were discharged are included in the column "Number of Men sent from India to England."

The Battalion was on field service from July 1857 to April 1858, from June to August 1858, and from October 1858 to February 1859. On the March from January to March 1860 from Allahabad to Calcutta.

W. C. MASTER, Lieut.-Col., commanding 1st Batt. 5th Regt. Fusiliers.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
90TH REGIMENT OF LIGHT INFANTRY, arrived in India, July 21, 1857.	Apr. 1, 1858	1,036	149	34	—	—	Incomplete in consequence of several of the Monthly Returns having been destroyed en route to the Dépôt.* Lucknow and in camps in various parts of Oudh. On field service. Seetapore, Oude. Seetapore, and one month at Allahabad.
	” 1859	130	140	82	4	201	
	” 1860	858	32	48	10	184	
	” 1861	929	25	51	7	131	
Average - -	—	738 $\frac{1}{4}$	86 $\frac{1}{2}$	53 $\frac{3}{4}$	5 $\frac{1}{4}$	129	

* During the first year the Regiment was on active service, and upwards of 90 men out of the 149 were killed or died of wounds.

L. H. IRBY, Captain, commanding Depôt 90th Light Infantry.

33RD REGIMENT OF FOOT, arrived in India, August 7, 1857.	Aug. 7, 1857	855	—	—	—	—	Colabah, Bombay, from August 7, 1857, to October 4, 1857. Arrived at Poona Octo- ber 9, 1857, to December 4, 1858. Arrived at Deesa January 25, 1859, to present time. Detachments several times on field service.
	Apr. 1, 1858	859	8	16	1	31	
	" 1859	1,233	12	19	9	376	
	" 1860	1,162	41	13	13	27	
	" 1861	991	64	68	4	—	
	Aug. 1, 1861	979	1	9	7	—	
Average - -	—	1,013 $\frac{1}{6}$	21	20 $\frac{5}{6}$	5 $\frac{2}{3}$	72 $\frac{1}{3}$	

J. TRENT, Captain, commanding Depôt 33rd Regiment.

89TH REGIMENT OF FOOT, arrived in India, September 11, 1857.	Sept. 11, 1857	700	7	6	9	—	Ahmedabad. The regiment suffered very much on the march from Gogo to Ahmeda- bad, and on arrival was employed on field service and marching. Ahmedabad, Deesa, Neemuch, Serouge, field service, and continually under canvas and on march. Jhansi, Gwalior. Umballa. Umballa.
	Apr. 1, 1858	724	25	—	2	300	
	" 1859	979	38	48	17	162	
	" 1860	1,058	81	83	18	112	
	" 1861	992	9	4	23	—	
	Aug. 1, 1861	1,000	—	—	—	—	
Average - -	—	908 $\frac{5}{6}$	32	28 $\frac{1}{5}$	13 $\frac{4}{5}$	114 $\frac{4}{5}$	

R. F. HOLMES, Brevet Major, commanding Depôt 89th Regiment.

1ST BATTALION, 23RD REGIMENT OF ROYAL WELSH FUSILIERS, arrived in India, October 1, 1857.	Apr. 1, 1858	947	31	21	—	20	Fort William, Calcutta. Allahabad, line of march. Camp Cawnpore, field service. Camp Goora Gunge, field service. Camp Ramgunge, field service. Camp Bunteerah, field service. Lucknow, field service. Lucknow, field service. Camp Newabgunge, field service. Camp on the Gogra, field service. Cantonments, Lucknow, field ser- vice. Lucknow, field service. Old cantonments, Lucknow. Lucknow. New cantonments, Lucknow. New cantonments, Lucknow. Lucknow.
	" 1859	1,191	107	58	15	391	
	" 1860	1,046	53	61	18	1	
	" 1861	1,166	23	53	232	72	
	—	1,087·50	53·50	48·25	66·25	121·0	
Average - -	—	1,087·50	53·50	48·25	66·25	121·0	

C. MONSELL, Capt., commanding Depôt, 1st Battalion, 23rd R. W. Fusiliers.

1ST BATT. 13TH REG. LT. INFANTRY, arrived in India, 1st Div. Oct. 3, 1857 2nd " Jan. 18, 1858 3rd " Jan. 20, 1858	—	764	—	—	—	—	Field service, Allahabad. Field service, Benares and Goruckpore. Goruckpore. Goruckpore and Gondah.
	Apr. 1, 1858	779	3	2	—	20	
	" 1859	1,058	98	65	12	430	
	" 1860	917	61	152	7	65	
	" 1861	989	36	54	39	123	
Average - -	—	935	49	68	14	159	

R. B. MONTGOMERY, Capt., 13th Light Infantry, commanding Depôt 1st Battalion.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
82ND REGIMENT OF FOOT, arrived in India, October 12, 1857.	Apr. 1, 1858 " 1859 " 1860 " 1861	950 1,112 1,039 1,153	55 104 31 27	10 33 32 55	1 2 22 87	— 311 2 115	On the march, and Futtghur. Shahjehanpore and Mahomdee. Shahjehanpore. Shamjehampore and Delhi.
Average -	—	1,086	54½	32½	28	107	

E. M. PALLISER, Capt., commanding Depôt 82nd Regt.

34TH REGT. FOOT, arrived in India, October 17, 1857.	Apr. 1, 1858	754	55	11	2	540	Cawnpore, &c., field service.
	" 1859	730	83	42	5	73	Azinghur, &c., field service
	" 1860	1,175	58	98	6	9	Fyzabad.
	Aug. 1, 1861	1,008	37	17	7	74	Fyzabad.
Average -	—	916 $\frac{3}{4}$	58 $\frac{1}{4}$	42	5	174	

G. W. PUGET, Capt., commanding Depôt 34th Regt.

1ST BATT. 1ST ROYAL REGT. FOOT, arrived in India, October 30, 1857.	Apr. 1, 1858	1,087	9	—	1	—	Secunderabad.
	" 1859	1,079	120	29	45	306	2 men transferred in India. Secunderabad.
	" 1860	1,279	43	146	6	8	88 men transferred in India. 3 men dis- charged in India. Secunderabad.
	" 1861	1,013	18	63	10	81	1 re-admitted on strength in India. 2 men discharged in India. 41 transferred in India. Secunderabad.
	Aug. 1, 1861	981	3	12	3	—	Secunderabad.
Average -	—	1,087·80	38·60	50·00	12·80	79·00	

W. F. J. RUDD, Capt., commanding Depôt 1st Batt. 1st Foot

42ND ROYAL HIGHLAND REGT. OF FOOT, arrived in India, November 1, 1857.	Nov. 1, 1857	876	—	—	—	—	Barielly. Thilleebheet. Camp Madho Thanda.
	Apr. 1, 1858	771	20	1	—	—	Barielly. Agra.
	" 1859	961	123	22	19	238	
	" 1860	1,009	20	76	12	166	
	" 1861	990	23	40	11	100	
Average -	—	932·75	46·5	34·75	10·5	126	

FRAN. E. H. FARQUHARSON, commanding Depôt 42nd Royal Highland B. W.

95TH REGT. FOOT, arrived in India, 1st Division, Sep- tember 27, 1857; 2nd Division, Nov- ember 1, 1857.	—	725	—	—	—	—	Stationed at Bombay November and part of December 1857. Remainder on field ser- vice. On field service. Field service to May 1859. Stationed at Nee- much to April 1860. Neemuch to November 1860. March to Poona from 1860 to January 1861. Poona February to April 1861.
	1 Apr. 1858	714	8	3	—	—	
	" 1859	1,047	50	24	—	408	
	" 1860	1,037	32	42	5	76	
	" 1861	985	38	39	3	96	
Average -	—	883 $\frac{3}{5}$	25 $\frac{3}{5}$	21 $\frac{3}{5}$	1 $\frac{3}{5}$	116	

GEORGE CARMICHAEL, Bt.-Major, commanding Depôt 95th Regiment.

88TH REGIMENT OF FOOT, arrived in India, November 2, 1857.	Apr. 1, 1858	960	31	13	—	4	On march, on field service, Bhithoor, Akbar- pore.
	" 1859	916	118	41	8	211	Akbarpore, Cawnpore, on field service, Luck- now.
	" 1860	961	43	35	37	79	On march, Delhi.
	" 1861	$\left\{ \begin{array}{l} 925 \\ 1,048 \end{array} \right\}$	25	49	47	168	Delhi.
Average -	—	962·2	62	41·1	30·2	152·2	

Men transferred to other corps, discharged in India, deserted, and rejoined from desertion, are not shown in this Return, no column being provided for them.

GEORGE BROWNE, Bt. Major, commanding Depôt 88th Regiment.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
2ND BATTALION, RIFLE BRIGADE, arrived in India, November 1857.	Nov., 1857 Apr. 1, 1858 " 1859 " 1860 " 1861	847 886 1,043 1,106 1,133	— 20 113 48 18	— 12 29 80 68	— — 2 99 9	— 72 299 120 146	— Cawnpore, field service, period not known. Newabgunge, Sultanpore, field service, period not known. Baraitch, Lucknow, field service, period not known. Marched to Subathoo. Subathoo.
Average - -	—	1,003	49·75	47·25	27·50	159·25	

A. F. WARREN, Bt.-Major, commanding Depôt, 2nd Bat. Rifle Brigade.

3RD BATTALION, RIFLE BRIGADE, arrived in India, November 1857.	Apr. 1, 1858 " 1859 " 1860 " 1861	966 945 1,069 1,156 1,047	— 21 141 29 79	— — 30 32 30	— 18 10 8 1	— 282 112 38 —	Field service. Field service to September. At Agra from September 1859. Agra till April 1861. Marched to Bareilly.
Average - -	—	1,036	67·5	23	9·3	108	

CLAUDE T. BOURCHIER, Bt. Maj., commanding Depôt, 3rd Bat. Rifle Brigade.

3RD REGIMENT OF DRAGOON GUARDS, arrived in India, November 9, 1857.	Apr. 1, 1858 " 1859 " 1860 " 1861	553 701 663 657	4 16 30 14	— 25 36 15	— — 18 3	— 131 15 25	Kirkee. Camp Burhampore. Mhow. Mhow.
Average - -	—	643	16	19	5	43	

C. HAGART, Col., commanding Cavalry Depôt, Canterbury.

1ST REGT. DRAGOON GUARDS, arrived in India, November 10, 1857.	Apr. 1, 1858 " 1859 " 1860 " 1861	503 605 704 699	8 9 11 25	— 9 39 21	— 1 62 2	— 116 90 50	} Bangalore and China.
Average - -	—	628	13	17	16	64	

C. HAGART, Col., commanding Cavalry Depôt, Canterbury.

38TH REGIMENT OF FOOT, arrived in India, November 16, 1857.	Apr. 1, 1858 Mar. 31, 1859 " 1860 " 1861 Apr. 1, 1861	1,005 982 1,059 1,014 1,089	21 176 40 22 —	3 38 82 59 —	2 4 26 32 —	— 294 61 131 —	Calcutta, Allahabad, &c. On the march. Lucknow, on field service. Rae-Bareilly can- tonments. Rae-Bareilly, Allahabad. On march to Dinapore. Dinapore.
Average - -	—	1,015	85	61	21	162	

1ST BATTALION, 19TH REGT. FOOT, arrived in India, November 18, 1857.	Apr. 1, 1858 " 1859 " 1860 " 1861	1,023 1,108 965 905	10 87 65 40	4 60 64 97	— 14 — 16	33 257 3 60	Calcutta, on march, Barrackpore. Barrackpore, on march, Dinapore, field service, Muttaharee. Muttaharee, field service, Dinapore, on march, Benares. Benares.
Average - -	—	1,000 $\frac{1}{4}$	50 $\frac{1}{2}$	56 $\frac{1}{4}$	7 $\frac{1}{4}$	88 $\frac{1}{4}$	

AMES GOREN, Captain 1st Batt., 19th Regt., commanding Depôt.

1ST BATT. 20TH REGT. FOOT, arrived in India, November 19, 1857.	Nov. 19, 1857 Apr. 1, 1858 " 1859 " 1860 " 1861	816 796 1,015 964 975	— 19 123 56 17	— 1 58 82 68	— — — 3 8	— — 407 97 125	Field service and on march. Lucknow and Nawabgungee. Gondah. Gondah. Gorruckpore.
Average - -	—	838·5	59·4	42·3	3·3	151·2	

W. D. NUNN, Capt. commanding Depôt 1st Batt., 20th Regt.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
97TH REGT. FOOT, arrived in India, November 22, 1857.	Apr. 1, 1858	816	5	—	—	—	Calcutta and on march.
	Mar. 31, 1859	799	139	39	4	445	Lucknow, on field service and on march,
	„ 1860	1,013	93	68	14	66	Banda, and on March.
	„ 1861	986	35	70	21	140	Jubbulpore.
	July 31, 1861	979	6	2	1	—	Jubbulpore.
Average - -	—	918·6	55·6	35·8	8·0	130·2	

C. K. JONES, Capt., commanding Dépôt 97th Regiment.

1ST BAT. 7TH REGT. ROYAL FUSILIERS, arrived in India, November 24, 1857.	Apr. 1, 1858	1,062	6	—	1	52	The regiment proceeded from Kurrachee to Mean Meer in December 1858. At Mean Meer from December 1858 to April 1859 the right wing at Dera-Ishmael Khan from September 1858 to April 1859. The regiment marched from Mean Meer to the Jheelum in April 1859. At the Jheelum from May to October 1859, a strong detachment, consisting of six companies, were sent to Rawl Pindi. The regiment marched from the Jheelum to Peshawur in November 1859. At Peshawur from November 1859 to April 1861.
	" 1859	1,222	68	9	7	234	
	" 1860	1,182	30	17	19	—	
	" 1861	1,254	19	104	215	7	
	—	1,180	30·75	32·50	60·50	73·10	
Average - -	—	1,180	30·75	32·50	60·50	73·10	

RIC. HARBORD, Capt., commanding Dépôt 7th Royal Fusiliers.

93RD REGIMENT OF HIGHLANDERS, arrived in India,	—	1,078	80	9	—	3	} In the field during the Indian mutiny (Bengal). On the march to Subathoo. Rawul Pindi, East Indies. Rawul Pindi, East Indies.
	Apr. 1, 1858	992	97	66	6	76	
	" 1859	911	42	42	22	220	
	" 1860	1,069	41	70	27	113	
	" 1861	1,098	1	14	—	—	
Average - -	—	1,009 $\frac{3}{5}$	52 $\frac{1}{5}$	40 $\frac{1}{2}$	18 $\frac{1}{3}$	98	

F. G. DAWSON, Bt. Maj., commanding Dépôt 93rd Highlanders.

2ND REGIMENT OF DRAGOON GUARDS, arrived in India, November 26, 1857.	*Apr. 1, 1859	604	112	29	13	144	Lucknow.
	" 1860	605	22	14	8	97	Lucknow.
	" 1861	585	29	35	5	41	Lucknow.
	—	598	54	26	9	94	

* No casualty return received from the Senci troops, from one dated December 10, 1857, until one dated January 1, 1859.

C. HAGART, Col., commanding Cavalry Dépôt, Canterbury.

44TH REGT. FOOT, arrived in India, November 28, 1857; left India, March 3, 1860.	Nov. 28, 1857	809	—	—	—	—	— Madras. Madras, one deserted, four transferred to other corps, one rejoined from desertion. Madras, eight discharged, eight transferred to other corps, one deserted, one rejoined from desertion, nine joined as recruits. Embarked for China March 3, 1860.
	Apr. 1, 1858	832	5	—	—	29	
	" 1859	1,139	33	48	34	358	
	" 1860	1,176	18	77	129	10	
Average - -	—	988·75	1,866	62·5	82·5	198·5	

ALEX. W. COBHAM, Capt., commanding Dépôt 44th Regiment.

7TH REGT. HUSSARS, arrived in India, November 30, 1857.	Nov. 30, 1857	515	—	—	—	—	— On field service to April 1859. Umballa. Umballa. Umballa.
	Apr. 1, 1858	507	14	1	—	6	
	" 1859	546	112	13	4	161	
	" 1860	723	19	6	21	189	
	" 1861	737	19	27	68	—	
Average - -	—	628 $\frac{1}{2}$	41	11 $\frac{3}{4}$	23 $\frac{1}{4}$	89	

JOHN C. H. GIBSONE, Col., Commandant Cav. Dépôt, Maidstone.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
79TH REGIMENT OF FOOT, arrived in India, December 1, 1857.	Apr. 1, 1858	973	11	—	—	—	Calcutta, and on the march <i>via</i> Allahabad to Lucknow.
	„ 1859	949	165	55	11	215	Field service, Oude, and Rohilcund (hot weather campaign).
	„ 1860	967	25	49	27	129	Lahore, Punjab. Arrived April 1859.
	„ 1861	1,016	12	48	19	133	Lahore and Ferozepore.
	Aug. 1, 1861	1,041	6	12	29	—	Ferozepore.
Average - -	—	989	44	33	17	95	

G. T. SCOVELL, Capt., 79th Highlanders, Commanding Dépôt.

3RD BATTALION, 60TH ROYAL RIFLES, arrived in India, December 2, 1857.	Apr. 1, 1858	1,044	7	2	—	102	Bangalore, Madras. Bangalore, Madras, April 1858 to February 1859; Jackatalla, Neilgherry Hills, from February 1859. Jackatalla, Madras. Jackatalla (name of station changed to "Wellington" in May 1860).
	" 1859	1,178	24	22	20	164	
	" 1860	1,176	13	51	4	1	
	" 1861	934	23	44	7	—	
	—	1,083	16.75	29.75	7.75	66.75	
Average - -	—	1,083	16.75	29.75	7.75	66.75	

THOMAS BIGGS, Capt., commanding Dépôt 3rd Batt. 60th Rifles.

72ND REGIMENT OF HIGHLANDERS, arrived in India, December 10, 1857.	Dec. 10, 1857	883	—	—	—	—	On march from date of arrival to May 1858 ; at Neemuch to September 1858 ; on march to January 1859 ; at Mhow from January 1859 until the present date. Several detach- ments have been from time to time marching, and on field service. The dates are not known at the dépôt.
	Apr. 1, 1858	877	6	—	—	—	
	" 1859	1,061	48	11	4	242	
	" 1860	892	23	100	6	28	
	" 1861	968	15	47	2	180	
Average - -	—	936 $\frac{2}{3}$	23	52 $\frac{1}{3}$	4	150	

T. BEST, Capt., commanding Dépôt 72nd Highlanders.

66TH REGT. OF INFANTRY, arrived in India, December 14, 1857.	Apr. 1, 1858	854	6	—	—	76	Cannanore. Cannanore. Cannanore. Cannanore.
	Mar. 31, 1859	1,270	18	67	34	360	
	" 1860	1,204	25	119	10	—	
	" 1861	1,036	9	—	6	—	
	—	1,091	14.50	46.50	12.50	109	
Average - -	—	1,091	14.50	46.50	12.50	109	

A. TORRENS, Capt., commanding Dépôt 66th Regt.

8TH REGT. HUSSARS, arrived in India, December 18, 1857.	Apr. 1, 1858	486	2	—	—	—	Camp near Kotah. Camp Sukutpore. Nusseerabad. Meerut.
	" 1859	559	41	6	—	120	
	" 1860	711	24	20	55	128	
	" 1861	704	19	24	35	—	
	—	615	21	12	22	62	
Average - -	—	615	21	12	22	62	

C. HAGART, Col., commanding Cavalry Dépôt, Canterbury.

SERVICE COMPANY, 69TH FOOT, arrived in India, December 26, 1857.	—	779	—	—	—	—	Sowgher, Burmah.
	Apr. 1, 1858	790	3	—	—	—	
	" 1859	969	29	1	—	212	
	" 1860	974	38	62	17	92	
	" 1861	1,010	9	76	4	124	
	July 1, 1861*	966	1	41	1	—	
Average - -	—	921 $\frac{1}{3}$	11 $\frac{2}{3}$	30	3 $\frac{2}{3}$	71 $\frac{1}{3}$	

* Date of latest return received from India.

R. FITZGERALD, Capt., commanding Dépôt 69th Regt.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
51ST REGIMENT OF LIGHT INFANTRY,	Apr. 1, 1858	769	4	—	—	—	Kurrachee.
	„ 1859	1,188	33	19	3	469	2 deserters joined, 2 transferred to other corps, and one discharged in India. Mean Meer.
arrived in India, January 1, 1858.	„ 1860	1,148	46	8	17	16	19 transfers to other corps and discharged in India. Mean Meer.
	„ 1861	1,070	19	49	19	35	64 transfers to others corps and discharged in India. Mean Meer.
Average - -	—	1,043	25	19	9	130	

G. B. McQUEEN, Capt., commanding Depôt 51st Lt. Infantry.

7TH DRAGOON GUARDS, arrived in India, January 7, 1858.	Apr. 1, 1858	473	3	—	—	—	Mean Meer.
	" 1859	568	39	8	3	143	Sealkote.
	" 1860	601	9	23	12	60	Sealkote.
	" 1861	645	15	47	16	100	Sealkote.
Average - -	—	572	16	19	8	76	

C. HAGART, Col., commanding Cavalry Depôt, Canterbury.

94TH REGIMENT OF FOOT, arrived in India, January 14, 1858.	Jan. 14, 1858	865	—	—	—	—	Strength on arrival in India, January 14, 1858.
	Apr. 1, 1858	880	7	—	—	43	Marched from Kurrachee to Rawul Pindi.
	" 1859	1,081	46	15	7	257	At Rawul Pindi. Marched from Rawul Pindi to Peshawur.
	" 1860	1,125	31	1	20	73	At Peshawur. Marched from Peshawur to Nowshera.
	" 1861	1,023	15	111	18	60	At Nowshera. Marched from Nowshera to Mean Meer.
Average - -	—	1,027.25	24.75	31.75	11.25	108.25	At Mean Meer.

W. W. J. BRUCE, Capt., commanding Depôt 94th Regiment.

98TH REGIMENT OF FOOT, arrived in India, January 1858.	Apr. 1, 1858	769	44	17	9	298	Nowshera and Campbellpore.
	" 1859	991	17	20	42	87	Nowshera and Peshawur.
	" 1860	1,046	17	77	84	110	Peshawur.
	" 1861	1,112	—	—	—	—	Peshawur.
Average - -	—	979*	26†	38†	45†	165†	

* Average of 4 Years.

† Average of 3 Years.

E. GRANTHAM, Capt., commanding Depôt 98th Regiment.

80TH REGIMENT OF INFANTRY, arrived in India, January 18, 1858.	Jan. 18, 1858	826*	1	—	—	—	Whole Regiment on line of march from Calcutta to Allahabad, January and February 1858. Head Quarters and Left Wing marched to Futtyghur in March 1858; Right Wing on field service in Futtypore District during March 1858.
	Apr. 1, 1858	808†	174	42	22	249	Right Wing on field service in Futtypore District, April and May 1858; Head Quarters and left Wing on field service in Futtyghur and Rohileund, and Oude Districts during April, May, and June 1858. Whole Regiment stationed at Cawnpore from July to September 1858; Head-Quarters and Right Wing on field service in Oude from October 1858 to January 1859; Left Wing at Cawnpore, October 1858 to January 1859; whole Regiment stationed at Cawnpore, February and March 1859.
	" 1859	858‡	67	63	10	117	Whole Regiment stationed at Cawnpore from April to December 1859; on line of march from Cawnpore to Saugur January 1860. Stationed Head Quarters and Right Wing at Saugur, Left Wing at Nowgong, from February to March 1860.
	" 1860	838§	22	57	16	282	Stationed Head Quarters and Right Wing at Saugur, Left Wing at Nowgong, from April 1860 to March 1861.
	" 1861	1,038	—	—	—	—	
Average - -	—	873.6	81.12	49.80	14.76	197.52	

* By all other causes, increase 0, decrease 17

†	"	"	4,	"	9
‡	"	"	1,	"	18
§	"	"	4,	"	23

1.76 " 21.52

F. MILLER, Brevet Major, commanding Depôt 80th Foot.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
SERVICE COMPANIES, 56TH REGIMENT OF INFANTRY, arrived in India, Head-quarters, Jan. 20, 1858, Left Wing, Dec. 31, 1857.	Apr. 1, 1858	794	3	—	1†	—	On march from Bombay to Belgaum from January 29, 1858, to March 1, 1858. Belgaum. On march from Belgaum to Poona from February 21, 1860, to March 16, 1860. Marched from Poona to Colaba in the month of December 1860. Colaba.
	„ 1859	792	21	12	9	214	
	„ 1860	976	51	60	27	102	
	„ 1861	924	30	110	7	152	
	July 31, 1861	936	17	10	3	—	
Totals - -	—	4,222	122	292	47	468	
	—	5†	3 $\frac{7}{12}$ †	3 $\frac{7}{12}$ †	3 $\frac{7}{12}$ †	3 $\frac{7}{12}$ †	
Average - -	—	884.4	34.04	81.48	13.11	130.6	

* This column includes 5 men sent to the Cape of Good Hope for discharge in the year ended March 31, 1860, and 3 in that ended March 31, 1861.

† Rejoined from desertion; surrendered while serving in another corps in India.

‡ By these numbers the totals have been divided in the determination of the average.

In addition to the increase and decrease of the regiments above shown, 4 recruits have been enlisted at the head-quarters of the Service Companies in the year ended March 31, 1861; 6 men transferred to other corps in India in the year ended March 31, 1859; 64 in that ended March 31, 1860, and 5 in that ended March 31, 1861; and 6 men discharged in India in the year ended March 31, 1860, and 6 in that ended March 31, 1861.

W. G. MARGESSON, Capt., commanding Dépôt 56th Regiment.

54TH REGT. FOOT, arrived in India, January 28, 1858.	Jan. 28, 1858	905	—	—	—	—	Allahabad, and on the march. Camp, Sultanpore, on field service. Cawnpore. Cawnpore.
	Apr. 1, 1858	841	29	52	1	16	
	" 1859	1,057	141	42	1	403	
	" 1860	1,004	47	50	8	52	
	" 1861	1,011	52	63	32	93	
Average - -	—	963.60	67.25	51.75	10.50	141.00	

F. G. C. PROBART, Capt. commanding Dépôt 54th Regiment.

17TH REGIMENT OF LANCERS, arrived in India, January 1858.	Jan., 1858	486	—	—	—	—	Kirkee. Kirkee, to September 1, 1858. On field ser- vice to April 1859. On field service to June 1, 1859. At Morar to January 1860. On march to Secun- derabad from February 1860. Secunderabad.
	Apr. 1, 1858	486	—	—	—	—	
	" 1859	568	21	8	—	110	
	" 1860	599	74	23	4	131	
	" 1861	632	28	36	21	70	
Average - -	—	571	30 $\frac{3}{4}$	16 $\frac{3}{4}$	6 $\frac{1}{4}$	7 $\frac{3}{4}$	

JOHN C. H. GIBSON, Col., Commandant Cavalry Dépôt, Maidstone.

71ST HIGHLAND LIGHT INFANTRY, arrived in India, February 5, 1858.	Feb. 5, 1858	833	—	—	—	—	— Field service with Central India F. F. Gwalior. Sealkote. Marched from Gwalior on Decem- ber 20, 1860, and arrived at Sealkote on February 22, 1861.
	Apr. 1, 1858	832	1	—	—	—	
	" 1859	967	65	19	1	218	
	" 1860	907	40	110	9	118	
	" 1861	868	106	76	4	150	
Average - -	—	893	53	51.4	3.2	121.2	

15 men have been discharged, 32 transferred to other corps, and 1 man deserted in India.

W. F. SEGRAVE, Capt., 71st, commanding Dépôt.

1ST BATTALION, 18TH R. I. REGIMENT OF FOOT, arrived in India, February 6, 1858.	Apr. 1, 1858	846	12	26	9	380	Landed at Bombay, and after a month pro- ceeded to Poona. Stationed at Poona from April 1858 to No- vember 1858. Marched from Poona via Jaulnah and Sholapore into Secunderabad in July 1859.* The regiment has been stationed at Secun- derabad from July 1859 to the present date.
	" 1859	1,179	61	66	22	1	
	" 1860	1,031	18	54	6	79	
	" 1861	992	4	7	1	1	
	Average - -	1,012	23 $\frac{1}{4}$	38 $\frac{1}{4}$	9 $\frac{1}{2}$	115 $\frac{1}{4}$	

* The regiment furnished detachments to Nassick, Asseerghur, Mulligaum, Mahableshwur and Jaulnah during the mutiny from April 1858 to April 1860.

Discharged, deserted, and transfers given:—To April 1, 1858, 17; to April 1, 1859, 44; to April 1, 1860, 54; to April 1, 1861, 5. Average 30.

W. H. GRAVES, Capt., commanding Dépôt, 1st Bat., 18th R. I. Regt.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
1ST BATTALION, 6TH REGT. OF FOOT,	Apr. 1, 1858 Mar.31, 1859	690 679	9 148	— 121	— 4	— 340	Calcutta and on march. Sesseram. On field service. Benares.
arrived in India, February 20, 1858.	„ 1860 „ 1861 July 31, 1861	798 951 863	43 32 6	53 87 —	7 6 3	268 40 —	Azimghur. Benares. Benares. Barrackpore, Barrackpore.
Average - -	—	796·2	47·6	52·2	4·0	129·6	

RICHARD THOMPSON, Capt., 6th Foot, commanding Depôt 1st Bat.

92ND REGIMENT OF HIGHLANDERS, arrived in India, March 6, 1858.	Apr. 1, 1858	1,029	20	12	—	343	Bombay, Mhow (on field service). Mhow, Camp Jhansi. Camp Matha, Dugshai, Camp Umballa. Camp Umballa, Camp Dugshai.
	" 1859	1,150	65	60	13	20	
	" 1860	991	22	44	1	95	
	" 1861	1,019	—	—	—	—	
Average - -	—	1,063	35	38	4	152	

F. MACBEAN, Bt.-Major, 92nd Highlanders, commanding Depôt.

68TH REGIMENT OF LIGHT INFANTRY, arrived in India, March 23, 1858.	Apr. 1, 1858	821	—	—	—	17	} Rangoon.
	" 1859	1,261	13	18	—	477	
	" 1860	1,202	25	60	35	—	
	" 1861	1,112	9	79	10	1	
Average - -	—	1,099	11 $\frac{3}{4}$	39 $\frac{1}{4}$	11 $\frac{1}{4}$	123 $\frac{3}{4}$	

J. CASSIDY, Capt., commanding Depôt 68th Lt. Infantry.

2ND BATTALION, 60TH REGIMENT OF ROYAL RIFLES, 396 men on May 15, 1858, and 347 men on Nov. 14, 1858 ; left India, February 28, 1860.	Apr. 1, 1859	743	72	44	1	76	Calcutta 1 month, on march and in the field 2 months, Arrah 6 months, Benares 1 month. Benares 9 months, on march 1 month. Strength on departure.
	Feb. 28, 1860	742	58	108	72	278	
	" 1860	942	—	—	—	—	
Average per cent. -	—	730	9	10	5	25	

ATHOLL LIDDELL, Capt., commanding Depôt 2nd Batt. 60th Rifles.

57TH REGT. FOOT, arrived in India, June 8, 1858 ; left India, November 26, 1860.	Apr. 1, 1859	833	17	10	6	79	Bombay, Ahmednugger. Ahmednuggur, Poona. Poona.
	Mar. 31, 1860	886	30	71	28	148	
	Nov. 26, 1860	884	*21	12	6	80	
Average - -	—	867	23	31	13	102	

* There are 5 men included in this number who died at the depôt at Poona after the departure of the Service Companies for New Zealand.

T. W. J. LLOYD, Capt., commanding Depôt 57th Regt.

77TH REGIMENT OF INFANTRY, arrived in India, July 1, 1858.	July 1, 1858	574	—	—	—	—	At Calcutta 9 months. At Sessaram 6 months. At Benares 15 months. At Hazareebagh 11 months.
	Apr. 1, 1859	597	80	30	—	132	
	" 1860	934	51	27	—	441	
	" 1861	877	116	45	—	124	
Average - -	—	802·66	83·33	34	—	132·33	

F. J. BUTTS, Capt., commanding 77th Depôt.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of men sent from India to England.	Re-inforce- ments.		
					By Trans- fer.	By Drafts.	
46TH REGIMENT OF INFANTRY, arrived in India, October 5, 1858.	Apr. 1, 1859	878	2	—	—	—	Kurrachee, and a detachment of two companies at Hyderabad to February 1859. Conveyed by steamboat on Indus to Mooltan, and stationed there till 1st April 1859. One man transferred to other corps in India.
	„ 1860	875	18	11	10	245	Mooltan to January 1860. The regiment marched by wings from Mooltan to Jullundur in February 1860. Jullundur, and a detachment of one company at Phillour to 1st April 1860. Sixteen men transferred to other corps, and discharged in India.
	„ 1861	1,085	14	51	13	92	Jullundur, and a detachment of one company at Phillour to 1st April 1861. Thirteen men transferred to other corps and discharged in India.
	Average - -	—	946	13 $\frac{3}{5}$	24 $\frac{4}{5}$	9 $\frac{1}{5}$	134 $\frac{4}{5}$

H. F. SANDWICH, Capt., commanding 46th Depôt.

6TH REGIMENT OF DRAGOONS, arrived in India, October 1858.	Oct. 1858	615	—	—	—	—	A squadron of 115 men marched to Sattara on 22nd January 1859. Head-quarters at Kirkee. A squadron of 110 men rejoined regiment in February 1860. Head-quarters at Kirkee. Kirkee and Ahmednuggur ; the regiment pro- ceeded to the latter station in Nov. 1860.
	Apr. 1, 1859	607	5	2	—	—	
	„ 1860	686	13	8	5	107	
	„ 1861	702	5	25	2	56	
Average - -		665	7 ² / ₃	11 ² / ₃	2 ¹ / ₃	54 ¹ / ₃	

JOHN C. H. GIBSONE, Col., Commandant, Cavalry Depôt, Maidstone,

91ST REGT. FOOT, arrived in India, October 8, 1858.	Oct. 8, 1859	785	—	—	—	—	Kamptee. 2 transfers to other corps. Kamptee. 2 transfers to other corps. Kamptee. 94 transfers to other corps, and discharge in India.
	Apr. 1, 1859	783	1	—	1	—	
	„ 1860	893	27	33	10	163	
	„ 1861	1,090	30	38	15	273	
Average - -		922	19	23	8	145	

W. SQUIRL, Capt., commanding Depôt 91st Regiment.

48TH REGT. FOOT, arrived in India, October 21, 1858.	Apr. 1, 1859	798	4	2	2	—	Barrackpore and Calpee. Jheelum, Humeapore, Calpee. Cawnpore and Allahabad. Jheelum, Humea- pore, Orai, Allahabad. Detachments on march after rebels in Bundelcund. Allahabad and Seetapore. Orai. Seetapore and Roy Bareilly.
	Mar. 31, 1860	787	71	35	31	278	
	„ 1861	979	40	68	8	26	
	July 31, 1861	870	5	—	—	1	
Average - -		858	30	26	10	76	

J. R. LOVETT, Capt., commanding Depôt 48th Regiment.

31ST REGT. FOOT, arrived in India, December 1, 1858; left India, February 16, 1860.	—	864	—	—	—	—	—
	Apr. 1, 1859	831	3	3	2	—	Poona.
	„ 1859	831	9	62	268	172	Poona.
	Feb. 16, 1860	1,133	when the regiment embarked for China.				

Transfers given and deserters are not included in the above return.

C. PREVOST, Capt., commanding Depôt 31st Regiment.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments. By Trans- fer.	By Drafts.	
28TH REGIMENT OF INFANTRY, arrived in India, December 8, 1858.	Dec. 8, 1858	829	—	—	—	—	Bombay. Bombay and Poona. 1 field officer, 3 cap- tains, 10 subalterns, 500 non-commissioned officers and rank and file on field service at Dwarka with Okamundel Field Force, from September 29 to middle of November. Marched, from Poona for Nusseerabad, Feb- ruary 17; arrived April 10. Nusseerabad.
	Apr. 1, 1859	940	2	2	26	90	
	" 1860	1,013	*42	37	10	191	
	" 1861	1,026	29	27	3	142	
Average - -	—	952	24·33	22	13	141	

* Seventeen killed in action or died of wounds received in action at storming of Beyt Fort, and occupation of Dwarka, October 1859.

S. HACKETT, Capt., commanding Depôt 28th Regiment.

67TH REGIMENT OF INFANTRY, arrived in India, December 16, 1858.	Dec. 16, 1859	763	32	41	38	52	Barrackpore. Embarked for field service in China September 21, 1859. Strength 780 men.
	—	—	—	—	—	—	
Average - -	—	—	—	—	—	—	

H. COLLETTE, Bt. Major, 67th Regiment, commanding Depôt.

99TH REGT. OF FOOT, arrived in India, December 18, 1858; left India, March 24, 1860.	April 1, 1859	744	2	4	11	—	Calcutta the whole of the period.
	Mar. 24, 1860.	1,022	38	50	259	132	
	—	883	20	27	135	66	
Average - -	—	883	20	27	135	66	

L. J. NUNN, Capt., commanding Depôt 99th Regiment.

1ST BATT. 3RD REGT. OF FOOT (BUFFS), arrived in India, December 29, 1858; left India, November 14, 1859.	Dec. 29, 1858	715	—	—	29	168	Dum Dum.
	April 1, 1859	982	22	99	21	129	Dum Dum and Calcutta.
	Nov. 14, 1859	1,011	—	—	—	—	
	—	926	2·20	9·90	5	29·70	

G. J. AMBROSE, Lieut.-Col., commanding 1st Batt., 3rd Foot.

1ST BATT. 4TH KING'S OWN REGT. FOOT, arrived in India, January 30, 1859; at present in India.	Jan. 30, 1859	816	—	—	—	—	Ahmedabad, 2 months. Ahmedabad, 12 months. Ahmedabad, 10 months; Kurrachee, 2 months.
	Apr. 1, 1859	814	2	—	—	—	
	" 1860	991	37	67	1	293	
	" 1861	933	50	41	40	60	
	—	912·67	29·67	36	13·67	117·33	
Average - -	—	912·67	29·67	36	13·67	117·33	

AUG. E. H. ANSELL, Capt., commanding Depôt 1st Batt., 4th King's Own Regiment.

73RD REGIMENT OF FOOT, arrived in India, April 24, 1858; left India, April 20, 1861.	—	765	96	42	3	134	Calcutta to beginning of July, Benares to 29th September, field service from 29th September to end of year. April, May, and June, field service; July to end of October, Lucknow; November to March, Dinapore. Dinapore. Chinsurah. Strength on departure from India.
	Apr. 1, 1859	765	49	37	7	135	
	" 1860	765	34	8	3	259	
	" 1861	704	4	10	—	—	
	Apr. 20, 1861	616	—	—	—	—	
	—	999 $\frac{2}{3}$	61	32 $\frac{1}{3}$	4 $\frac{1}{3}$	176	
Average - -	—	999 $\frac{2}{3}$	61	32 $\frac{1}{3}$	4 $\frac{1}{3}$	176	

G. H. SMITH, Col., commanding 73rd Regiment.

Name of Regiment, with Date of Arrival in India, and of Departure from India.	Military Year.	Strength on Arrival, at the Beginning of each Year, and on Departure from India.	During the Military Year.				Stations at which the Regiment has served a Month or more in each Year, and Remarks.	
			Deaths in India.	Number of Men sent from India to England.	Re-inforce- ments.			
					By Trans- fer.	By Drafts.		
3RD REGIMENT OF HUSSARS.	This return cannot be filled up, there being no record in possession of the regiment at the present time giving the information; the documents that would have done so were given into the Adjutant-General's office in India, and the hospital records (64 vols.) sent to Fort Pitt, Chatham, on the return of the regiment from India in 1853.							
H. MONCKTON, Lieut.-Col. commanding 3rd (King's Own) Hussars.								
63RD REGT. FOOT.	The 63rd Regiment returned from India in 1847.							
C. A. HAND, Capt., 63rd Regiment, commanding Dépôt.								
62ND REGT. FOOT.	The 62nd Regiment arrived in England from India in 1847.							
S. G. CARTER, Capt., commanding Dépôt 62nd Foot.								
55TH REGT. FOOT.	Regiment at home since arrival from Gibraltar.							
R. HUME, Lieut.-Col., commanding 55th Foot.								
50TH REG. INFANTRY.	In consequence of the want of necessary documents, this return cannot be completed.							
C. F. YOUNG, Lieut., commanding Dépôt 50th Regiment. E. JEFFREYS, Col., 5th Dépôt Battalion.								
49TH REGT. OF FOOT.	The 49th Regiment has not been in India since 1843, and no records are with the Regiment from which this return could be filled up.							
CLEMENT A. EDWARDS, Col., commanding 49th Regiment.								
41ST REGT. OF FOOT.	The 41st Regiment returned from the East Indies in July 1843, and there are no documents now extant that can give the information required by this return.							
H. W. MEREDITH, Major, commanding 41st Welch Regiment.								
26TH OR CAMERONIAN REGIMENT OF FOOT.	26th Regiment has not been in India since 1843, this return is blank in consequence of there being no documents with the Regiment to give the information required.							
F. CAREY, Lieut.-Col., commanding 26th Cameronians.								
DEPÔT, 1ST BATT. 17TH REG. OF FOOT.	The 1st Battalion, 17th Regiment, has not served in India since the Year 1847.							
P. M'PHERSON, Captain, commanding Dépôt 1st Battalion 17th Regiment.								
1ST BATT. 9TH REG. OF FOOT.	The Regiment did not serve in India.							
J. E. MACDONNELL, Ensign, 1st Battalion, 9th Foot, commanding Dépôt.								
1ST BATTALION, 2ND QUEEN'S ROYAL REG. OF INFANTRY.	The Regiment not having been in India since the year 1846, there is no record in possession of the Dépôt companies to give the required information.							
F. CONNOR, Captain, commanding Dépôt, 1st Battalion, 2nd Queen's. T. ADDISON, Lieut.-Col., commanding 1st Battalion, 2nd Queen's Royal Regiment.								

TABLE showing the Admissions into and Deaths in Hospital among the Troops of the Line during Five Years, 1850-54. Prepared by Dr. Graham Balfour.

	Bengal Presidency, aggregate strength 84,281.				Peshawur, aggregate strength 8,178.				Kussowlic, Subathoo, and Dugshai, aggregate strength 6,896.			
	Admitted into Hospital.	Died in Hospital.	Ratio per 1,000.		Admitted into Hospital.	Died in Hospital.	Ratio per 1,000.		Admitted into Hospital.	Died in Hospital.	Ratio per 1,000.	
			Admitted.	Died.			Admitted.	Died.			Admitted.	Died.
By Fevers	75,535	918	896	10·9	20,017	195	2,448	23·8	3,705	15	538	2·2
" Eruptive Fevers	186	27	2	·3	11	2	1	·2	3	-	-	-
" Diseases of the Lungs	7,365	350	87	4·1	814	53	100	6·5	692	16	100	2·3
" " Liver	5,195	281	62	3·3	594	32	73	3·9	467	12	68	1·7
" " Stomach and Bowels	26,230	1,640	311	19·5	3,198	210	391	25·7	3,059	120	444	17·4
" Spasmodic Cholera	1,346	596	16	7·1	43	17	5	2·1	-	-	-	-
" Diseases of the Brain	2,320	370	28	4·4	282	50	34	6·1	217	6	31	·9
" Dropsies	165	36	2	·4	29	4	3	·5	12	4	2	·6
" Other class of Diseases	54,046	243	641	2·9	4,740	30	580	3·7	4,141	18	600	2·6
	172,888	4,461	2,045	52·9	29,728	593	3,635	72·5	12,296	191	1,783	27·7

With one exception all the Regiments came to the Hill Stations from Peshawur. The amount of Dysentery and Diarrhoea at Peshawur and the Hill Stations respectively, was as follows :—

	Dysentery rated per 1,000.				Diarrhoea rated per 1,000.			
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
Peshawur	1,402	171	171	20·9	1,221	32	149	3·9
Hill Stations	313	40	45	5·8	2,297	75	333	10·9*

* Of the deaths from Diarrhoea, 30 occurred in the 32nd Regiment in 1855. If the strength and deaths by Diarrhoea in that year are deducted, the ratio will be 7·5 instead of 10·9.

REPORT UPON THE METEOROLOGY OF INDIA IN RELATION TO THE HEALTH OF THE TROOPS THERE STATIONED,

By JAMES GLAISHER, Esq., F.R.S., &c., Secretary to the British Meteorological Society.

SIR,

Blackheath, May 9, 1863.

In the Report upon the meteorology of India, and its relation to the health of troops resident there, which I have the honour to submit to you, I have endeavoured to indicate at different seasons of the year the heights at which the English climate is most nearly approached, and the several investigations it was considered desirable to carry out.

On reducing all the observations I had at first at my command, I found the results too few, and too discordant to place any confidence in them; I then sought for additional observations, and first for all observations which have been made in fixed observatories in India, next for all others I could find in all the libraries at my command, and from every available source.

All the information possessed by the India Office, the Army Medical Department, were placed at my disposal, and my best thanks are due to many gentlemen, particularly to Dr. Gibson, C.B., Dr. Balfour, F.R.S., Dr. Logan, Sir Ranald Martin, C.B., F.R.S., and Colonel Sykes, M.P., who gave me all the assistance in their power, and placed all their MSS. in my hands.

When all the observations thus collected were reduced I had local information at many places, but which I found was scarcely available for the purposes of your Commission, I then sought to combine the results in various ways with the view of their general application, but generally failed to satisfy myself; but finally I determined the change of temperature for one degree of longitude, and for one degree of latitude, by means of which I was enabled to calculate, with a near approximation to the truth, the three most important elements of research of high day, low night, and mean temperature of the air in every month for every part of India, even where no observations had been made.

Having succeeded so far it became necessary to ascertain the effect of elevation upon temperature in every month of the year, in each of the three presidencies, and it was found that there was no certain difference in the law of decrease of temperature with height in one part of India from another in the same month, but that the law was different in the different months. In the winter months the decrease of mean temperature for elevations up to 1,000 feet are small, amounting to $1\frac{1}{2}^{\circ}$ only, but this difference increases from March to $4\frac{1}{2}^{\circ}$ in August, and then decreases gradually month by month to January.

The reduction of temperature at heights exceeding 1,000 feet are smaller in the winter months than in the summer months, the former being about two-thirds of the latter.

These results are remarkable and important; they do not confirm a constant decrease of temperature for a constant increase of elevation, but on the contrary give results varying both with the elevation and season of the year.

And these results are not in accordance with those I have recently obtained in the balloon experiments, in which a reduction of temperature of 1° is found for an average difference of height of 137 feet for the first 1,000 feet, the space gradually increasing to 400 feet for the same decline of temperature of 1° in the twelfth 1,000 feet. The law of decrease of temperature is therefore apparently very different in India from that found in England.

The general agreement of the results from different parts of India in the same season surprised, but enabled me, with some confidence, to calculate the extremes and mean temperature at any elevation with almost equal accuracy with those at low elevations.

The mountain climates throughout India include portions where the sun's direct heat, the extremes and mean temperature of the air, differ but little from those of England, and where doubtless the health of Europeans may certainly be preserved to a high degree.

The next important step was to determine the heights at which these temperatures would be reached.

For this purpose I first determined the average meteorological elements at Greenwich as a standard for England.

logical elements at Greenwich as a standard for England.

The next step was to determine the monthly excess of temperature in every part of India over that in England in every month, and then to ascertain the heights at which the excess would be counteracted.

These heights are calculated for high day, low night, and mean temperature. In some instances they will be found to be at a height not always attainable, but those nearest approaching would doubtless be attended with the greatest probability of continued health to the troops.

So far as I am able to judge from the discussion of all the observations, the climate of the hill stations in India is dry enough, the temperature low enough, and the sky clear enough, without any excess of rain for Europeans.

From the Tables in the Report it will be seen that at heights of 5,000 to 6,000 feet the mean annual temperature would be about 10° higher than England, with a smaller daily range, offering I think a healthy climate, except in exceptional cases where local circumstances exist to counteract the favourable meteorological conditions.

The observations of solar radiation have been too few and they are too discordant to be used safely; for the most part no mention has been made of the kind of instrument used, and no information given upon its situation. There is reason to believe that the instrument has been in some cases placed near the soil, others at some distance from it, and in others in close proximity to painted wood and highly heated bodies.

The best conclusions I can draw from the observations are that in the Madras Presidency the average solar radiation for the year is about 100° ; in Bombay it exceeds 100° , and in Bengal reaches 105° ; but at Fort William, Calcutta, the average for the year is 132° .

This certainly seems to be too high; these readings decrease from 15° to 20° for heights reaching to 5,000 feet, and is also less in the vicinity of the sea.

The observations for the humidity of the air have been far too few. There has been unfortunately a prejudice in India against the use of the dry and wet bulb thermometers, particularly in elevated districts, and there have been very few observations made on the dew point by any hygrometer. This is greatly to be regretted, as bearing in a most important degree on this question in India, I took a series of simultaneous observations of the dry and wet bulb thermometer with Daniell's and Regnault's hygrometers in the recent balloon experiments, and I find the results by the use of the dry and wet bulb thermometers are nearly identical with those as found by the direct use of either Daniell's or Regnault's hygrometer up to great heights in the atmosphere, and therefore the dry and wet bulb thermometers may be used with confidence in India to any height where man may be resident.

The observations upon the direction of the wind are limited and do not agree at the different stations, and I do not feel that the discussion of the observations enables me to add any additional information upon this head.

I have now to the utmost of my means collected every observation made in India, and discussed them with the view of rendering the results applicable for the purposes of this Commission.

The results derived are as decided as could possibly be expected, and may be used with some confidence, as the calculated temperature, when compared with the observed temperature at places where the longest and best series of observations have been made, are found to be accordant.

I cannot help expressing a hope that future meteorological observations in India may be carried out under some general system on a uniform plan, both with respect to instruments, their position, and general instructions.

I have, &c.

JAMES GLAISHER.

T. Baker, Esq.,
Secretary to the Commission of Inquiry into the
Sanitary State of the Army in India.

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REPORT UPON THE METEOROLOGY OF INDIA.

SECTION I.—On Atmospheric Pressure or corrected Reading of the Barometer.

Throughout India the daily increase and decrease in the reading of the barometer takes place with great regularity. At about 4 o'clock in the morning a minimum reading occurs, it then turns to increase, and at about 10 o'clock A.M. a maximum; it decreases till about 5 P.M. when a second minimum pressure takes place, and a second maximum pressure is attained at about 11 P.M. The maximum reading therefore occurs one or two hours before noon or midnight, and the minimum reading at about one or two hours before sunrise or sunset.

The actual reading is greater at its morning maximum than at its evening maximum, and generally lower at the evening minimum than at the morning minimum. The time of evening maximum remains pretty nearly constant.

The difference between the mean daily readings of the barometer on two consecutive days, seldom exceeds 0·2 inch, the whole daily range is generally less than 0·1 inch. The daily ranges are somewhat larger in winter than in summer.

The barometer reading is highest in January, and decreases gradually till June, and increases gradually from July to December all over India.

The decrease of readings from January to June is 0·26 inch in the Presidencies of Madras and Bombay, and about 0·44 inch in that of Bengal. The increase from July to December is about the same amount in the respective presidencies.

The mean atmospheric pressure is subjected to very little change from year to year, as will be seen from the two following series of observations taken at the Observatories of Madras and Bombay.

TABLE I. showing the Mean Monthly Reading of the Barometer at Madras.

MONTHS.	YEARS.												
	1796.	1797.	1798.	1799.	1800.	1801.	1802.	1803.	1804.	1805.	1806.	1807.	1813.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	30·11	30·07	30·14	30·10	30·13	30·10	30·09	30·12	30·15	30·15	30·5	29·94	29·92
February - -	30·13	30·09	30·06	30·11	30·11	30·08	30·09	30·08	30·13	30·11	30·08	29·96	29·89
March - -	30·06	30·01	30·05	30·04	30·04	30·01	30·03	30·06	30·14	30·04	30·03	30·53	29·85.
April - -	29·99	29·93	29·94	30·02	29·95	...	29·92	29·99	30·00	29·99	29·96	30·01	29·78
May - -	29·90	29·84	29·93	29·88	29·87	...	29·88	29·91	29·82	29·88	29·88	29·79	29·72
June - -	29·86	29·83	29·86	29·87	29·85	29·84	29·87	29·88	29·89	29·86	29·88	29·92	29·73
July - -	29·86	29·82	29·86	29·84	29·86	29·85	29·85	29·89	29·88	29·88	29·85	29·80	29·74
August - -	29·88	29·84	29·91	29·89	29·89	29·87	29·92	29·93	29·92	29·91	29·87	29·87	29·77
September - -	29·92	29·91	29·91	29·93	29·95	29·89	29·94	29·92	29·94	29·93	29·91	29·82	29·80
October - -	29·96	29·93	29·92	30·04	29·89	29·95	30·00	30·08	29·98	29·86	29·98	29·83	29·83
November - -	30·00	30·04	30·06	30·07	30·03	30·01	30·02	30·08	30·08	30·05	29·97	29·60	29·91
December - -	30·03	30·08	30·13	30·09	30·04	30·07	30·01	30·12	30·15	30·14	30·04	30·00	30·03
Means - -	29·97	29·95	29·98	29·99	29·96	...	29·96	30·00	30·00	29·98	29·96	29·92	29·83

(continued.)

MONTHS.	YEARS.												
	1814.	1815.	1816.	1817.	1818.	1819.	1820.	1821.	1822.	1823.	1824.	1825.	1826.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	29·91	30·07	30·13	30·17	30·12	30·08	30·04	30·10	30·15	30·17	30·18	30·19	30·01
February - -	30·00	30·00	30·10	30·13	30·10	30·11	30·06	30·15	30·15	30·16	30·13	30·15	29·94
March - -	29·97	29·95	30·01	30·04	30·04	30·00	29·87	30·08	30·08	30·07	30·10	30·10	29·92
April - -	29·87	29·90	29·95	30·02	30·04	29·82	29·98	30·06	30·08	30·00	30·04	30·04	29·80
May - -	29·83	29·85	29·86	29·94	30·09	29·86	29·38	29·93	29·90	29·92	29·92	29·96	29·77
June - -	29·79	29·83	29·84	29·90	29·85	29·89	29·91	29·94	29·91	29·89	29·87	29·91	29·75
July - -	29·80	29·79	29·85	29·90	29·87	29·83	29·95	29·93	29·88	29·89	29·93	29·92	29·75
August - -	29·80	29·88	29·86	29·89	29·80	29·88	29·94	29·94	29·91	29·92	29·96	29·93	29·67
September - -	29·85	29·87	29·90	29·90	29·89	29·90	30·05	29·94	29·93	29·94	29·99	29·99	29·82
October - -	29·88	29·95	30·03	29·98	29·68	29·93	30·03	30·06	30·00	30·06	30·03	30·03	29·90
November - -	29·98	29·90	30·04	29·99	30·02	29·99	30·12	30·12	30·06	30·12	30·07	30·05	29·94
December - -	30·01	30·05	30·10	30·11	29·89	30·11	30·07	30·17	30·11	30·12	30·20	30·12	30·01
Means - -	29·89	29·92	29·97	29·99	29·95	29·95	29·95	30·03	30·01	30·02	30·03	30·03	29·85

(continued.)

MONTHS.	YEARS.												
	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	30·00	30·01	29·99	30·10	30·08	30·03	30·07	29·99	30·00	30·07	30·03	29·92	29·99
February - -	29·95	29·99	29·97	30·02	29·97	29·97	29·97	29·96	29·98	30·03	30·00	29·99	29·97
March - -	29·97	29·91	29·96	29·93	29·96	29·90	29·91	29·92	29·92	29·98	29·92	29·92	29·92
April - -	29·90	29·86	29·84	29·90	29·82	29·84	29·86	29·87	29·91	29·98	29·72	29·84	29·84
May - -	29·79	29·79	29·74	29·82	29·70	29·73	29·66	29·78	29·76	29·79	29·81	29·77	29·72
June - -	29·70	29·72	29·72	29·63	29·67	29·66	29·75	29·72	29·76	29·75	29·77	29·71	29·69
July - -	29·74	29·73	29·76	29·75	29·70	29·68	29·72	29·72	29·77	29·76	29·74	29·74	29·72
August - -	29·78	29·75	29·79	29·78	29·71	29·75	29·77	29·75	29·78	29·75	29·76	29·72	29·74
September - -	29·81	29·81	29·81	29·81	29·70	29·79	29·78	29·80	29·84	29·81	29·82	29·77	29·79
October - -	29·92	29·86	29·85	29·82	29·76	29·87	29·88	29·83	29·88	29·95	29·85	29·90	29·85
November - -	29·97	29·94	29·96	29·93	29·87	30·01	30·00	29·99	30·01	29·94	29·87	29·92	29·92
December - -	30·02	30·02	30·00	30·02	30·05	...	29·96	30·01	30·06	29·97	29·99	29·98	30·05
Means - -	29·88	29·86	29·86	29·87	29·83	...	29·86	29·86	29·89	29·89	29·85	29·85	29·84

(continued.)

TABLE I. showing the Mean Monthly Reading of the Barometer at Madras—*continued*.

MONTHS.	YEARS											Means, 1796 to 1850.
	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	30·05	29·93	29·95	30·00	30·00	30·02	30·07	29·98	30·00	29·98	29·91	30·05
February - -	29·99	29·96	29·95	29·98	29·98	29·97	30·01	29·95	29·99	29·93	29·98	30·03
March - - -	29·95	29·84	29·84	29·89	29·91	29·92	29·92	29·92	29·88	29·89	29·93	29·98
April - - -	29·79	29·81	29·79	29·86	29·81	29·82	29·84	29·83	29·80	29·77	29·84	29·90
May - - - -	29·71	29·70	29·72	29·69	29·70	29·71	29·76	29·74	29·73	29·67	29·75	29·80
June - - - -	29·66	29·67	29·66	29·70	29·67	29·71	29·72	29·69	29·69	29·69	29·67	29·78
July - - - -	29·69	29·66	29·69	29·70	29·72	29·73	29·73	29·71	29·72	29·71	29·70	29·79
August - - -	29·72	29·75	29·72	29·76	29·73	29·74	29·75	29·74	29·74	29·74	29·76	29·82
September -	29·73	29·72	29·86	29·77	29·79	29·83	29·77	29·75	29·78	29·74	29·78	29·85
October - - -	29·84	29·82	29·87	29·85	29·87	29·85	29·81	29·85	29·82	29·84	29·82	29·91
November - -	29·88	29·86	29·94	29·94	29·96	29·98	29·93	29·93	29·92	29·92	29·89	29·98
December - -	29·95	29·88	30·01	29·98	29·93	29·97	29·96	29·92	29·96	29·94	30·00	30·03
Means - - -	29·83	29·80	29·75	29·84	29·84	29·84	29·85	29·83	29·83	29·81	29·83	29·91

TABLE II. showing the Mean Monthly Reading of the Barometer at Bombay.

MONTHS.		YEARS.											Means, 1847 to 1858.	
		1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.		1858.
		in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	
January	- -	29·92	29·93	29·95	29·89	29·96	29·93	29·94	29·94	29·94	29·29	29·93	29·92	29·93
February	- -	29·90	29·92	29·91	29·93	29·90	29·90	29·87	29·92	29·93	29·92	29·87	29·94	29·91
March	- -	29·87	29·83	29·87	29·89	29·86	29·83	29·86	29·89	29·85	29·14	29·83	29·85	29·86
April	- -	29·79	29·77	29·78	29·82	29·78	29·79	29·80	29·79	29·82	29·79	29·79	29·80	29·79
May	- -	29·72	29·74	29·71	29·76	29·74	29·75	29·78	29·76	29·78	29·72	29·74	29·67	29·74
June	- -	29·62	29·65	29·62	29·64	29·63	29·63	29·64	29·67	29·66	29·65	29·64	29·70	29·65
July	- -	29·65	29·65	29·67	29·65	29·60	29·66	29·67	29·62	29·66	29·61	29·65	29·67	29·65
August	- -	29·71	29·71	29·70	29·74	29·70	29·73	29·74	29·71	29·74	29·71	29·68	29·72	29·72
September	- -	29·75	29·81	29·73	29·79	29·78	29·76	29·79	29·72	29·79	29·80	29·81	29·78	29·77
October	- -	29·83	29·83	29·84	29·79	29·83	29·86	29·85	29·79	29·83	29·83	29·86	29·82	29·83
November	- -	29·89	29·91	29·89	29·89	29·84	29·91	29·86	29·92	29·94	29·90	29·92	29·93	29·90
December	- -	29·90	29·92	29·91	29·95	29·95	29·92	29·96	29·93	29·94	29·93	29·98	29·94	29·94
Means	-	29·80	29·81	29·80	29·81	29·80	29·81	29·81	29·80	29·82	29·81	29·81	29·81	29·81

The change in the atmospheric pressure from month to month is very constant in different years, and the mean annual pressure is subjected to but very little change from year to year as before remarked.

In the Appendix will be found the monthly readings of the barometer at different stations scattered over India, in Tables CVI. to CVIII. at pages 847 and 848; but, as I do not know the direct influence which the variations of atmospheric pressure can produce on human life, particularly where the changes are so limited in extent, and as the barometric observations bear no comparison to the immense influence of heat, it is scarcely requisite to dwell upon them at greater length in the present inquiry; I therefore proceed to consider the average temperature of the air over India, in relation to its maximum by day, its minimum by night, its daily range, and its mean value.

SECTION II.

On the observed high day temperature of the Air. Deduced effect of a change of 1° of latitude. Deduced effect of a change of 1° of longitude. Deduction of formulae to calculate high day temperature at low elevations over India. Law of decrease of high day temperature with elevation.

ON OBSERVED HIGH DAY TEMPERATURE OF THE AIR.

The mean monthly, quarterly, half-yearly, and yearly observed maximum temperatures of the air will be found in the Appendix in each presidency arranged in the order of latitude for all stations at which this element has been observed. See Tables CIX., CXIX., and CXXIX.

Determination of the effect of a change of 1° of Latitude on High Day Temperature of the Air.

Tables XLIII., XLIV., and XLV., pages 820 and 821, were formed of the results of this element from stations whose elevations above the level of the sea are less than 1,000 feet, in the presidencies of Madras, Bombay, and Bengal respectively. By taking the means of the numbers in each month of these groups of stations, the first three columns of the next table were formed, showing the mean of all the maximum temperatures of stations of low elevations in each presidency, with a corresponding mean longitude and latitude, and the numbers in the last three columns are found by taking the

successive differences between the numbers in the first three columns.

TABLE III. showing the Mean Monthly Maximum Temperature of the Air at different Latitudes.

MONTHS.	Mean Maximum Temperature of groups			Difference of Mean Maximum Temperature of groups		
				A and B	B and C	A and C
				Corresponding to a Difference of Latitude of		
	Lat.	Long.	Height	6° 33' and 7° 42' of Long.	5° 27' and 8° 49' of Long.	12° 0' and 1° 6' of Long.
	14° 49' N. 79° 28' E. 126 Feet.	21° 22' N. 71° 44' E. 215 Feet.	26° 49' N. 80° 33' E. 527 Feet.			
January -	82	81	73	- 1	- 8	- 9
February -	85	86	76	+ 1	- 10	- 9
March - -	89	91	85	+ 2	- 6	- 4
April - - -	91	96	93	+ 5	- 3	+ 2
May - - - -	94	99	98	+ 5	- 1	+ 4
June - - - -	92	95	97	+ 3	+ 2	+ 5
July - - - -	88	92	93	+ 4	+ 1	+ 5
August - - -	88	88	89	0	+ 1	+ 1
September -	87	88	89	+ 1	+ 1	+ 2
October - - -	86	90	87	+ 4	- 3	+ 1
November - -	83	87	79	+ 4	- 8	- 4
December - -	82	83	71	+ 1	- 12	- 11

The numbers in the fifth and sixth columns are affected by the influence of a great difference of longitude, whilst those in the last column show the effect of a difference of 12° in latitude and of one degree only in longitude; the effect of the latter may possibly be neglected, and, if so, the effect of an increase of one degree in latitude, is as follows in the different months:—

In January a decrease of 0°·7 for an increase of 1° of north latitude.

In February a decrease of 0°·7

In March a decrease of 0°·3

In April an increase of 0°·2

In May an increase of 0°·3

In June an increase of 0°·4

In July an increase of 0°·4

In August an increase of 0°·1

In September an increase of 0°·2

In October an increase of 0°·1

In November a decrease of 0°·3

In December a decrease of 1°·1

Determination of the effect of a change of 1° of Longitude on High Day Temperature in India.

Turning our attention to the influence of longitude on high day temperature, we find that in the presidency of Madras south of latitude 15° there are not sufficient stations available for this investigation; and, with the exception of Cannanore and Madras, which differ in latitude by 1° 12' and in longitude by about 5°, with 10 years' observations at the former, and 55 at the latter, there are no means of finding the monthly coefficient. In the other parts of India, the investigation was treated in every way as described in section for mean temperature, and the following tables formed.

TABLE IV. showing the effect of an Increase of 1° of East Longitude on High Day Temperature.

MONTHS.	Latitudes N.	
	As found by comparing Cannanore and Madras.	15° to 34°.
January	- 0.2	- 0.4
February	+ 0.1	- 0.4
March	+ 0.1	- 0.4
April	+ 1.2	- 0.5
May	+ 2.0	- 0.3
June	+ 2.8	0.0
July	+ 2.7	0.0
August	+ 2.6	0.0
September	+ 2.0	- 0.1
October	+ 1.5	- 0.4
November	+ 1.7	- 0.5
December	- 0.2	- 0.6

The values in the second column imply that the high day temperatures in the winter months are nearly alike at those stations in the presidency of Madras, but that they differ very much in the summer months, from each other, and indicate that those situated to the east are of higher temperature than those to the west. The numbers in this column have only been formed, however, from the observations at Cannanore and Madras; they are therefore of little value, and can be viewed as indications only; but as such they show that the higher temperature on the Coromandel coast over that on the Malabar coast in the summer months is due, if not entirely, to a very great extent, to excess of high day temperature.

The results from the other parts of Madras, were not very accordant; but I have no information for the most part on the instruments used, and their situation in observation.

The general result is, that the effect of longitude is insensible in the months from June to August; that in the other months, stations situated to the west have higher day temperature than those to the east, amounting in the winter months to a little more or less than $\frac{1}{2}$ a degree for 1° of longitude.

By combining the results an approximation to the high day temperature in India may be found as follows:—

At places south of 15° of north latitude.

From the very small range of daily temperature in the presidency of Madras, south of latitude 15° (see Section IV., page 788, and Table LXIII., page 827,) the high day

temperature may be readily found by applying additively the one half of the mean daily range (Section IV.) to the monthly mean temperature of the air for the latitude. (See Section VI., page 792.)

At places situated between the latitudes 15° and 20° the high day temperature may be approximately determined by the use of the following formulæ:—

January	81 - (lat. - 21 $\frac{1}{2}$) × 0.7 - (long. - 72) × 0.4
February	86 - (lat. - 21 $\frac{1}{2}$) × 0.7 - (long. - 72) × 0.4
March	91 - (lat. - 21 $\frac{1}{2}$) × 0.3 - (long. - 72) × 0.4
April	96 + (lat. - 21 $\frac{1}{2}$) × 0.2 - (long. - 72) × 0.5
May	99 + (lat. - 21 $\frac{1}{2}$) × 0.3 - (long. - 72) × 0.3
June	95 + (lat. - 21 $\frac{1}{2}$) × 0.4
July	92 + (lat. - 21 $\frac{1}{2}$) × 0.4
August	88 + (lat. - 21 $\frac{1}{2}$) × 0.1
September	88 + (lat. - 21 $\frac{1}{2}$) × 0.2 - (long. - 72) × 0.1
October	90 + (lat. - 21 $\frac{1}{2}$) × 0.1 - (long. - 72) × 0.4
November	87 - (lat. - 21 $\frac{1}{2}$) × 0.3 - (long. - 72) × 0.5
December	83 - (lat. - 21 $\frac{1}{2}$) × 1.1 - (long. - 72) × 0.6

At the places situated between the latitudes 20° and 25°, the high day temperature may be approximately determined by the use of the following formulæ:—

January	73 - (lat. - 27) × 0.7 - (long. - 80 $\frac{1}{2}$) × 0.4
February	76 - (lat. - 27) × 0.7 - (long. - 80 $\frac{1}{2}$) × 0.4
March	85 - (lat. - 27) × 0.3 - (long. - 80 $\frac{1}{2}$) × 0.4
April	93 + (lat. - 27) × 0.2 - (long. - 80 $\frac{1}{2}$) × 0.5
May	98 + (lat. - 27) × 0.3 - (long. - 80 $\frac{1}{2}$) × 0.3
June	97 + (lat. - 27) × 0.4
July	93 + (lat. - 27) × 0.4
August	89 + (lat. - 27) × 0.1
September	89 + (lat. - 27) × 0.2 - (long. - 80 $\frac{1}{2}$) × 0.1
October	87 + (lat. - 27) × 0.1 - (long. - 80 $\frac{1}{2}$) × 0.4
November	79 - (lat. - 27) × 0.3 - (long. - 80 $\frac{1}{2}$) × 0.5
December	71 - (lat. - 27) × 1.1 - (long. - 80 $\frac{1}{2}$) × 0.6

At places situated to the north of latitude 25°, the high day temperature may be approximately determined by the use of the following formulæ.

January	73 - (lat. - 27) × 0.7 - (long. - 80 $\frac{1}{2}$) × 0.4
February	76 - (lat. - 27) × 0.7 - (long. - 80 $\frac{1}{2}$) × 0.4
March	85 - (lat. - 27) × 0.3 - (long. - 80 $\frac{1}{2}$) × 0.4
April	93 + (lat. - 27) × 0.2 - (long. - 80 $\frac{1}{2}$) × 0.5
May	98 + (lat. - 27) × 0.3 - (long. - 80 $\frac{1}{2}$) × 0.3
June	97 + (lat. - 27) × 0.4
July	93 + (lat. - 27) × 0.4
August	89 + (lat. - 27) × 0.1
September	89 + (lat. - 27) × 0.2 - (long. - 80 $\frac{1}{2}$) × 0.1
October	87 + (lat. - 27) × 0.1 - (long. - 80 $\frac{1}{2}$) × 0.4
November	79 - (lat. - 27) × 0.3 - (long. - 80 $\frac{1}{2}$) × 0.5
December	71 - (lat. - 27) × 1.1 - (long. - 80 $\frac{1}{2}$) × 0.6

Determination of the Influence of Elevation on High Day Temperature in India.

For this purpose Tables XLVI. to LII., pages 821 to 823, were formed, of stations whose elevations are between 1,000 and 2,000 feet, and those between 2,000 and 3,000 feet, and of higher elevations in steps of 1,000 feet, in each presidency, from Tables CIX., CXIX., and CXXIX.: their means were taken corresponding to a mean height, latitude, and longitude, and these results were compared with either observed or calculated values in the same latitude and longitude at the level of the sea; a series of differences of temperature due to elevation were thus obtained, whose means are shown in the next table.

TABLE V. showing the observed Mean Decrease of High Day Temperature with Increase of Elevation.

Presidency, Number of Stations, and Mean Elevation.									
MONTHS.	Bombay. Mean of 9 Stations, 1,450 ft.	Madras. Mean of 3 Stations, 1,524 ft.	Bombay. Mean of 3 Stations, 2,176 ft.	Madras, Bangalore, 2,874 ft.	Bengal, Cherra- poongee, 3,591 ft.	Bombay. Mean of 3 Stations, 4,018 ft.	Madras, Wellington, 5,880 ft.	Bengal, Darjeeling, 6,473 ft.	
January	- 2	- 2	- 4 $\frac{1}{2}$	- 4 $\frac{1}{2}$	- 13	- 11	- 16 $\frac{1}{2}$	- 23	
February	- 2	- 1	- 2 $\frac{1}{2}$	- 3 $\frac{1}{2}$	- 12	- 11	- 21 $\frac{1}{2}$	- 25	
March	- 1	- 2	- 1	- 2	- 18 $\frac{1}{2}$	- 9 $\frac{1}{2}$	- 19	- 28	
April	0	- $\frac{1}{2}$	- $\frac{1}{2}$	- 4 $\frac{1}{2}$	- 20 $\frac{1}{2}$	- 11 $\frac{1}{2}$	- 23 $\frac{1}{2}$	- 33	
May	- 3	- 1	- 4	- 2	- 23 $\frac{1}{2}$	- 14 $\frac{1}{2}$	- 20	- 35	
June	- 6	- 7	- 8	- 7	- 25 $\frac{1}{2}$	- 14 $\frac{1}{2}$	- 17 $\frac{1}{2}$	- 32	
July	- 8	- 6	- 7	- 3	- 19 $\frac{1}{2}$	- 18 $\frac{1}{2}$	- 12 $\frac{1}{2}$	- 29	
August	- 5	- 5	- 7	- 7	- 18	- 17	- 13	- 24	
September	- 6	- 4	- 8	- 5	- 17	- 16	- 12	- 24	
October	- 5	- 5	- 6	- 4	- 14	- 16	- 12	- 26	
November	- 4	- 3	- 4	- 5	- 15 $\frac{1}{2}$	- 13 $\frac{1}{2}$	- 16 $\frac{1}{2}$	- 22	
December	- 3	- 1	- 8	- 4	- 14 $\frac{1}{2}$	- 14	- 10	- 19	

The results, as found for the same elevation in the different presidencies, are sufficiently accordant to show that the decrease for the same elevation is the same everywhere. The results from Chirrapoongee are, however, discordant, as was found to be the case with the mean temperature. By treating these values precisely the same as those for mean temperature (see Section V., page 789,) the following most probable values were found.

TABLE VI. showing the calculated Decrease of High Day Temperature in India with an Increase of Height up to 9,000 feet above the level of the sea, for every month.

MONTHS.		Height in Feet.								
		1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
January	-	0	0	0	0	0	0	0	0	0
February	-	1 $\frac{3}{4}$	4	8	11 $\frac{1}{2}$	15	19	23 $\frac{1}{2}$	27 $\frac{3}{4}$	32
March	-	2	4	6 $\frac{1}{2}$	11 $\frac{1}{2}$	16 $\frac{1}{2}$	21 $\frac{1}{2}$	26 $\frac{1}{2}$	32	37
April	-	1 $\frac{1}{2}$	3 $\frac{1}{2}$	7	11	17	23 $\frac{1}{2}$	28 $\frac{1}{2}$	34 $\frac{1}{2}$	40
May	-	1 $\frac{1}{2}$	3	8	13 $\frac{1}{2}$	21	27 $\frac{1}{2}$	34 $\frac{1}{2}$	41 $\frac{1}{2}$	47 $\frac{1}{2}$
June	-	1 $\frac{1}{2}$	4 $\frac{1}{2}$	10	15	20 $\frac{1}{2}$	27 $\frac{1}{2}$	36	44 $\frac{1}{2}$	53
July	-	1 $\frac{1}{2}$	4 $\frac{1}{2}$	13 $\frac{1}{2}$	18	23	27 $\frac{1}{2}$	33	38	43
August	-	3 $\frac{1}{2}$	8 $\frac{1}{2}$	13 $\frac{1}{2}$	18	22	26 $\frac{1}{2}$	30 $\frac{1}{2}$	34 $\frac{1}{2}$	38
September	-	4 $\frac{1}{2}$	7	10 $\frac{1}{2}$	14 $\frac{1}{2}$	18	21	25	29 $\frac{1}{2}$	33
October	-	3 $\frac{1}{2}$	6 $\frac{1}{2}$	10 $\frac{1}{2}$	13 $\frac{1}{2}$	17	20 $\frac{1}{2}$	24 $\frac{1}{2}$	28 $\frac{1}{2}$	32 $\frac{1}{2}$
November	-	3 $\frac{1}{2}$	6 $\frac{1}{2}$	10 $\frac{1}{2}$	14 $\frac{1}{2}$	18 $\frac{1}{2}$	22	26	30	34 $\frac{1}{2}$
December	-	1 $\frac{1}{2}$	5	8	11 $\frac{3}{4}$	15 $\frac{3}{4}$	18 $\frac{1}{2}$	21	23 $\frac{1}{2}$	26

From these the approximate high day temperature may be determined at any elevation in India, when the same element is known at a lower elevation.

SECTION III.

On observed low night temperature in India. Deduced effect of a change of 1° of latitude. Deduced effect of a change of 1° of longitude. Deduction of formulæ to calculate low night temperature at low elevations over India. Law of decrease of low night temperature with elevation.

ON THE OBSERVED LOW NIGHT TEMPERATURE
OF THE AIR IN INDIA.

The mean monthly, &c., and yearly observed minima temperatures of the air will be found in the Appendix, arranged in the order of latitude, in each presidency, for all stations where this element has been determined. See Tables CX., CXX., and CXXX.

*Determination of the effect of a change of 1° of Latitude
on Low Night Temperature of the Air.*

Tables LIII. to LV. contain the results from those stations in each presidency, whose elevations are below 1,000 feet. Their means have been taken and treated exactly as in the case of the maximum temperature, and thus the next table was formed.

TABLE VII. showing the Mean Monthly Minimum Temperature of the Air at different Latitudes.

MONTHS.		Mean Minimum Temperature of groups			Difference of Mean Minimum Temperature of groups		
					D and E, E and F, D and F		
		D	E	F	Corresponding to a Difference of Latitude of		
Lat. -	14° 49' N.	21° 22' N.	26° 49' N.	6° 33'	5° 27'	12° 0'	
Long. -	70° 28' E.	71° 44' E.	86° 33' E.	and	and	and	
Height	126 Feet.	215 Feet.	527 Feet.	7° 42'	8° 49'	1° 6'	
				of Long.	of Long.	of Long.	
January -	-	70	59	53	-11	-6	-17
February -	-	73	62	59	-11	-3	-14
March -	-	76	69	65	-7	-4	-11
April -	-	80	75	74	-5	-1	-6
May -	-	82	81	81	-1	0	-1
June -	-	81	81	83	0	+2	+2
July -	-	80	79	82	-1	+3	+2
August -	-	79	78	79	-1	+1	0
September -	-	78	77	79	-1	+2	+1
October -	-	77	73	71	-4	-2	-6
November -	-	73	64	60	-9	-4	-13
December -	-	70	59	55	-11	-4	-15

The effect of latitude upon low night temperature is here shown to be very decided, and large in amount in the winter months. It is small in amount, and almost insensible, in the summer months. It seems to be uniform in each month all over India; and the following are the most

probable changes in this element for an increase of one degree of north latitude in each month :—

In January a decrease of 1.4° for an increase of 1° of north latitude.

In February a decrease of 1.2°

In March a decrease of 1.0°

In April a decrease of 0.5°

In May

In June

In July

In August
In September

In Septe
In Octe

In October a decrease of 0.5° for an increase of 1° of north latitude.

In November a decrease of 1.0°

In December a decrease of 1.2°

From these values, which from their general agreement in all latitudes must be near the truth, it appears that, from November to March, the nights at northern stations are much colder than at southern stations, generally exceeding a degree of temperature in amount for every degree of greater north latitude. In the months of April and October they are still colder, but to about one-half of the amount in the other months. Whilst in the remaining period of the year, viz., from May to September, there seems to be no sensible difference in the low night temperature throughout the whole of India.

Determination of the effect of a change of 1° of Longitude on the Low Night Temperature.

I now proceed to determine the effect of a change of 1° of longitude upon the low night temperature.

For this purpose the investigation was proceeded with in precisely the same way as in the analogous investigations of the maximum temperature, and the following are the results obtained.

TABLE VIII. showing the effect of an increase of 1° of East Longitude on Low Night Temperature.

MONTHS.	Latitudes N.			
	South of 15°.	15° to 20°.	20° to 25°.	25° to 30°.
January - - -	— 1·6	+ 0·2	+ 0·2	+ 0·2
February - - -	— 1·7	+ 0·2	+ 0·4	+ 0·4
March - - -	— 1·4	+ 0·1	+ 0·2	+ 0·2
April - - -	— 0·8	+ 0·3	+ 0·2	+ 0·2
May - - -	— 0·3	+ 0·1	+ 0·1	+ 0·1
June - - -	+ 0·3	+ 0·1	+ 0·1	+ 0·1
July - - -	+ 0·5	+ 0·2	+ 0·2	+ 0·2
August - - -	+ 0·3	+ 0·1	+ 0·1	+ 0·1
September - -	0·0	+ 0·1	+ 0·2	+ 0·1
October - - -	-- 0·2	+ 0·1	+ 0·1	+ 0·1
November - - -	— 0·5	+ 0·2	+ 0·2	+ 0·2
December - - -	— 1·0	+ 0·3	+ 0·3	+ 0·3

From the agreement in these results, I think much confidence may be placed in them.

The greatest changes are in those latitudes south of 15° , amounting to a decrease of low night temperature to more than $1\frac{1}{2}^{\circ}$ for each degree of greater east longitude in the months of January and February; decreasing to a little less than $1\frac{1}{2}^{\circ}$ in March, to $\frac{3}{4}^{\circ}$ in April, and to $\frac{1}{4}^{\circ}$ in May: a change then takes place, and, for the months from June to September, those places with greater east longitude are from $\frac{1}{4}^{\circ}$ to $\frac{1}{2}^{\circ}$ warmer for each degree of longitude. In September, longitude seems to exercise no influence on this element, and in October, the lower night temperature, as at the beginning of the year sets in, and which by December amounts to 1° of lower temperature for one degree of east longitude. These results, however, can be looked upon as indications only.

The same general laws prevail in higher parallels of latitude, viz., north of 15° ; and the results agree very well together, and the same coefficient may be used in the different parallels of latitude.

As both the coefficients in latitude and longitude at stations north of 15° are moderately satisfactory, the mean monthly low night temperature at stations within a few hundred feet of the surface may be calculated from the following formulae :—

An approximation to the low night temperature at any place in India may be found as follows :—

At places south of 15° north latitude.

From the very small range of temperature in the presidency of Madras south of parallel of 15° of north latitude, the low night temperature may be readily found by applying subtractively to the monthly mean temperature the one half of the monthly daily range.

At places situated between the latitudes 15° and 20°, the low night temperature may be approximately determined by the use of the following formulæ :—

In January	59—	(lat.—21½) × 1·4	+ (long.—72) × 0·2
In February	62—	(lat.—21½) × 1·2	+ (long.—72) × 0·2
In March	69—	(lat.—21½) × 1·0	+ (long.—72) × 0·1
In April	75—	(lat.—21½) × 0·5	+ (long.—72) × 0·3
In May	81		+ (long.—72) × 0·1
In June	81		+ (long.—72) × 0·1
In July	79		+ (long.—72) × 0·2
In August	78		+ (long.—72) × 0·1
In September	77		+ (long.—72) × 0·1
In October	73—	(lat.—21½) × 0·5	+ (long.—72) × 0·1
In November	64—	(lat.—21½) × 1·0	+ (long.—72) × 0·2
In December	59—	(lat.—21½) × 1·2	+ (long.—72) × 0·3

At places situated between the latitudes 20° and 25°, the low night temperature may be approximately determined by the use of the following formulæ :—

In January	53—	(lat.—27) × 1·4	+ (long.—80½) × 0·2
In February	59—	(lat.—27) × 1·2	+ (long.—80½) × 0·4
In March	65—	(lat.—27) × 1·0	+ (long.—80½) × 0·2
In April	74—	(lat.—27) × 0·5	+ (long.—80½) × 0·2
In May	81		+ (long.—80½) × 0·1
In June	83		+ (long.—80½) × 0·1
In July	82		+ (long.—80½) × 0·2
In August	79		+ (long.—80½) × 0·1
In September	79		+ (long.—80½) × 0·2
In October	71—	(lat.—27) × 0·5	+ (long.—80½) × 0·1
In November	60—	(lat.—27) × 1·0	+ (long.—80½) × 0·2
In December	55—	(lat.—27) × 1·2	+ (long.—80½) × 0·3

At places situated to the north of latitude 25°, the low night temperature may be approximately determined by the use of the following formula :—

In January	53—	(lat.—27) × 1·4	+ (long.—80½) × 0·2
In February	59—	(lat.—27) × 1·2	+ (long.—80½) × 0·4
In March	65—	(lat.—27) × 1·0	+ (long.—80½) × 0·2
In April	74—	(lat.—27) × 0·5	+ (long.—80½) × 0·2
In May	81		+ (long.—80½) × 0·1
In June	83		+ (long.—80½) × 0·1
In July	82		+ (long.—80½) × 0·2
In August	79		+ (long.—80½) × 0·1
In September	79		+ (long.—80½) × 0·1
In October	71—	(lat.—27) × 0·5	+ (long.—80½) × 0·1
In November	60—	(lat.—27) × 1·0	+ (long.—80½) × 0·2
In December	55—	(lat.—27) × 1·2	+ (long.—80½) × 0·3

Determination of the influence of Elevation on Low Night Temperature in India.

For this purpose Tables LVI. to LXII., pages 825 and 826, were formed of results from stations whose elevations exceed 1,000 feet, and less than 2,000 feet ; and the remainder for each increase of 1,000 feet.

The means of each of these groups were collected together, corresponding to a mean geographical position, and these results combined with those calculated for the same latitude and longitude at the level of the sea ; and the difference between these gave a series of numbers showing the individual effect of elevation on low night temperature. The means of groups of these were taken in each presidency, and the results are shown in the next table.

TABLE IX. showing the observed Mean Decrease of Low Night Temperature with Increase of Elevation.

MONTHS.					Presidency, Number of Stations, and Mean Elevation.							
					Bombay. Mean of 9 Stations, 1,450 feet.	Madras. Mean of 3 Stations, 1,524 feet.	Bombay. Mean of 3 Stations, 2,176 feet.	Madras. Bangalore, 2,874 feet.	Bengal. Cherra- poongee, 3,591 feet.	Bombay. Mean of 3 Stations, 4,018 feet.	Madras. Wellington, 5,880 feet.	Bengal. Darjeeling, 6,473 feet.
January	-	-	-	-	0	- 0½	- 3½	- 14	- 3	- 5	- 13½	- 14
February	-	-	-	-	0	- 4	- 3	- 12½	- 10¾	- 5	- 16	- 20
March	-	-	-	-	+ 0¼	- 3½	- 5	- 8	- 10¾	- 5	- 16	- 19
April	-	-	-	-	+ 1	- 4	- 5	- 10	- 10¾	- 9½	- 20	- 24
May	-	-	-	-	- 4	- 2	- 6	- 10	- 15	- 14	- 17	- 28
June	-	-	-	-	- 6	- 4	- 7	- 12	- 17	- 16	- 16	- 25
July	-	-	-	-	- 4	- 6	- 6	- 10	- 14	- 15	- 18	- 24
August	-	-	-	-	- 5	- 6	- 7	- 10	- 12	- 14	- 14	- 21
September	-	-	-	-	- 5	- 5	- 8	- 8	- 12	- 13	- 19	- 23
October	-	-	-	-	- 2	- 5	- 7	- 9	- 16¾	- 10½	- 14	- 21
November	-	-	-	-	+ 0¼	- 0½	- 5	- 8	- 13½	- 6	- 12½	- 16
December	-	-	-	-	0	- 1	- 4	- 10½	- 9¾	- 7	- 8½	- 16

These values, as in both the other elements, are evidently the same at different parts of India, or, in other words, the effect of elevation on the low night temperature is the same in all latitudes, and lessens those at low elevations by the same amount. The values at Bangalore in the winter months are too large.

The numbers in the preceding table were treated precisely as those in the preceding section, and the following are the final results.

TABLE X. showing the calculated Decrease of Low Night Temperature in India, with an Increase of Height up to 9,000 feet above the level of the sea, for every month.

MONTHS.	Height in Feet.								
	1,000.	2,000.	3,000.	4,000.	5,000.	6,000.	7,000.	8,000.	9,000.
January	0½	3½	6½	8½	10½	13	15	17	19
February	1½	4½	7½	10½	13½	16½	20	23½	26½
March	1½	4½	6½	9½	13	16½	19½	23½	26½
April	1½	4½	8	12	16½	21	25½	29½	33½
May	2½	6½	9½	13½	17½	22½	29	35	41
June	3	6½	10½	14½	18	21	26	30½	34½
July	3	6½	9½	13½	16½	20½	24½	28	31½
August	3½	6½	9½	13	16	19	22	25	28
September	3½	6½	10	13½	16½	20	23½	27	30½
October	2½	6	9½	12½	15½	19	22	25	28
November	0½	3	5½	8½	12½	15	17½	20	22½
December	0½	3½	6	8½	11	13½	16	18½	21

These numbers are satisfactory, and leave but little doubt on the mind as to their general accuracy, and may be used with some confidence in deducing the low night temperatures all over India.

SECTION IV.

Determination of the Mean Daily Range of Temperature of the Air at different Elevations in each of the Presidencies of Madras, Bombay, and Bengal.

Determination of the Mean Daily Range of Temperature of the Air at different Elevations in each of the Presidencies of Madras, Bombay, and Bengal.

The monthly and other periodic range of temperature at all the stations will be found in the Appendix, arranged in the order of latitude, for all the stations in each presidency. See Tables CXI., CXXI., and CXXXI.

Tables LXIII. to LXV. contain the mean daily range of temperature at stations in each presidency, arranged in the order of latitude, of less than 1,000 feet elevation, and Tables LXVI. to LXXI. at stations whose elevation exceeds 1,000 feet. The means of each these tables, with the corresponding mean latitude and longitude, have been taken, and in this way the following table has been formed.

TABLE XI. showing the Mean Daily Range of Temperature of the Air, in the three Presidencies of Madras, Bombay, and Bengal, at different Elevations.

Presidency.	Madras.				Bombay.						Bengal.					
Latitude -	14° 49' N.	17° 14' N.	12° 27' N.	11° 25' N.	21° 22' N.	20° 35' N.	16° 27' N.	24° 45' N.	18° 12' N.	17° 59' N.	26° 49' N.	30° 32' N.	25° 12' N.	29° 20' N.	27° 2' N.	
Longitude -	79° 26' E.	77° 46' E.	77° 38' E.	77° 5' E.	71° 44' E.	75° 3' E.	74° 38' E.	72° 49' E.	73° 54' E.	73° 30' E.	80° 33' E.	74° 55' E.	91° 45' E.	79° 30' E.	88° 18' E.	
Height -	126 feet.	1650 feet.	3000 feet.	6000 feet.	215 feet.	1665 feet.	2354 feet.	4000 feet.	4200 feet.	4500 feet.	527 feet.	1128 feet.	4118 feet.	6100 feet.	7000 feet.	
MONTHS.	Mean of 9 Stations.	Mean of 2 Stations.	Bangalore.	Wellington.	Mean of 11 Stations.	Mean of 10 Stations.	Mean of 3 Stations.	Mount Aboo.	Poorundhur.	Mahabuleshur.	Mean of 10 Stations.	Mean of 4 Stations.	Cherra-poongee.	Nynce Thal.	Darjeeling.	
January -	12	12	20	8	22	19	22	28	9	11	20	19	9	36	11	
February -	12	16	20	6	24	20	22	31	10	13	17	20	15	34	12	
March -	13	16	18	8	22	20	22	22	11	16	20	19	11	34	11	
April -	11	16	15	5	21	20	22	26	12	15	19	24	8	33	10	
May -	12	14	19	8	18	18	17	26	10	14	17	20	8	31	10	
June -	10	9	15	8	14	15	10	26	15	6	14	16	5	24	7	
July -	8	9	14	12	13	9	8	16	6	4	11	15	5	18	6	
August -	9	9	12	10	10	9	8	12	4	4	10	16	4	18	7	
September -	9	10	12	16	11	10	10	16	8	2	10	17	5	22	9	
October -	9	10	13	9	17	13	15	18	7	7	16	19	8	30	11	
November -	10	10	12	4	23	18	17	24	8	13	19	22	16	33	13	
December -	12	12	8	10	23	20	20	30	11	12	16	19	11	32	13	
Means -	10	12	15	8	18	16	16	23	9	9	15	19	9	29	10	

From these values, it seems that the daily range of temperature in the presidency of Madras is always small, in the winter months being but little more than one-half of that in the other presidencies, the variations in which are from 19° to 22°. In Madras in the summer months the daily range is somewhat smaller than in the winter months; in the other presidencies it becomes much smaller, till, in the months of July, August and September, the variation of daily temperature is nearly alike, and from 9° to 12° only at all parts of India. By comparing the daily range at different elevations together in the same presidency no certain difference is shown. In Madras at Bangalore, at 3,000 feet, they are larger, whilst at Wellington, at 6,000 feet, they are smaller; but no information is given as to the position of the instruments. In Bombay the results at 1,665 feet seem to be a little smaller than those at 214 feet, whilst those at 2,320 feet, are very nearly the same as those at the lowest elevation. The numbers in the next two columns, at 4,500 and 4,200 feet respectively, agree with each other; but then those at Mount Aboo, at 4,000 feet, are twice as large. The same remark applies to the numbers in the last three columns. Upon the whole it seems that the range of temperature at the higher elevations differs but little from those at the lower elevation in the same parallel of latitude.

SECTION V.

On the observed mean temperature of the Air. Monthly mean temperature at Madras for 55 years. Monthly mean temperature at Bombay for 12 years. Deduced effect of a change of one degree of latitude. Deduced effect of a change of one degree of longitude. Deduction of formulæ to calculate mean temperature at low elevations over India. Law of decrease of mean temperature with elevation.

ON THE OBSERVED MEAN TEMPERATURE OF THE AIR.

In Madras the highest temperature of the day occurs about 0^h 30^m P.M. in the months of April and May; be-

tween 1^h P.M. and 1½^h P.M. in the months of January, February, March, August, September, October, November, and December; and at nearly 2^h P.M. in the months of June and July. The average maximum temperatures are as follows: January 82°, February 85°, March 89°, April 93°, May 96°, June 97°, July 94°, August 93°, September 92°, October 88°, November, 84°, and December 82°. The annual mean is 89½°.

The highest temperature in the presidency of Madras, reaches sometimes, though rarely, nearly to 110°; at Madras Observatory it was 107¾° on the 18th of May 1849, and it was 108° on the 10th of June of the same year. These high readings are very rare, and at such times a very hot land wind is blowing. The Thermometer at Madras seldom exceeds 98°.

The lowest temperature of each day takes place between 5½^h A.M. and 6^h A.M. in the months from April to November, and between 6^h A.M. and 6½^h A.M. in the remaining months. The times of minimum temperature thus precede sunrise by a few minutes.

The average minimum temperatures in each month are as follows: January 70°, February 73°, March 74½°, April 80°, May and June 82°, July 80½°, August and September 80°, October 77¾°, November 75°, and December 73°.

The lowest temperature sometimes falls to 63°; it was at this reading at Madras on the 28th of January 1850. This low reading is of rare occurrence, as the temperature seldom falls below 67°.

The hottest day is about the 15th of June, when the mean temperature of the 24 hours, from several years' observations at Madras observatory, is but little short of 90°; this value has varied in different years between 82° and 95°. The coldest is about the 9th of January; the mean temperature of this day is about 74½°, the individual means varying from 72° to 77°. On the 20th of March and the 20th of October the thermometer is at its mean reading for the year.

The mean monthly temperatures in India at the same place do not undergo great variation.

The following tables show the monthly temperature of the air at the observatories at Madras and Bombay for 55 years and 12 years respectively.

TABLE XII. showing the Mean Monthly Temperature of the Air at Madras.

MONTHS.				YEARS.																
				1796.	1797.	1798.	1799.	1800.	1801.	1802.	1803.	1804.	1805.	1806.	1807.	1813.	1814.	1815.	1816.	1817.
				°	°	°	°	°	°	°	°	°	°	°	°	°	°	°		
January	-	-	-	75	..	75	75	76	76	76	79	76	75	76	77	74	73	73	74	
February	-	-	-	78	..	80	77	78	77	79	78	81	78	76	74	78	76	78	76	
March	-	-	-	80	81	81	81	81	84	84	82	82	81	80	73	80	78	78	78	
April	-	-	-	83	84	..	83	85	..	85	84	86	82	83	80	85	83	87	80	81
May	-	-	-	87	88	..	88	86	..	86	86	89	88	86	83	90	80	90	88	87
June	-	-	-	85	89	89	88	87	87	90	88	90	89	85	89	87	91	85	89	88
July	-	-	-	83	86	87	83	83	84	87	86	89	84	86	88	87	89	84	85	87
August	-	-	-	82	87	84	85	84	86	85	87	85	84	84	84	84	86	85	83	85
September	-	-	-	83	84	84	83	83	83	87	86	85	83	86	84	83	83	85	82	82
October	-	-	-	81	81	83	83	82	82	83	83	83	81	83	80	82	82	80	81	81
November	-	-	-	78	79	78	75	80	78	79	79	81	0	81	78	78	78	77	79	77
December	-	-	-	75	76	76	76	75	76	75	77	77	77	76	77	74	75	74	75	77
Means	-	-	-	81	..	..	81	81	..	83	82	84	82	82	80	84	81	81	80	81

(continued.)

TABLE XII. showing the Mean Monthly Temperature of the Air at Madras—continued.

MONTHS.				YEARS.														
				1818.	1819.	1820.	1821.	1822.	1823.	1824.	1825.	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.
				°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	-	-	-	76	71	74	78	77	78	78	78	79	77	77	73	74	76	75
February	-	-	-	77	74	77	79	80	80	81	79	77	79	77	79	76	78	78
March	-	-	-	78	78	78	82	84	82	82	83	81	80	79	80	81	82	80
April	-	-	-	82	82	84	79	85	85	85	86	85	84	82	84	83	86	81
May	-	-	-	90	88	84	88	89	88	89	89	87	84	85	86	82	89	88
June	-	-	-	90	90	87	88	88	90	90	90	83	85	87	87	85	90	85
July	-	-	-	83	87	86	87	85	88	90	88	84	85	84	83	83	87	81
August	-	-	-	80	87	85	87	84	86	88	85	82	83	83	84	83	84	81
September	-	-	-	83	83	84	84	84	84	88	85	83	83	82	84	84	82	81
October	-	-	-	81	82	83	82	81	84	81	84	84	82	82	84	83	82	81
November	-	-	-	77	80	80	79	79	81	81	82	80	80	81	80	79	78	77
December	-	-	-	75	76	77	76	80	79	79	76	78	79	78	78	77	77	76
Means	-	-	-	81	81	81	82	83	84	84	84	84	81	82	82	81	81	80

(continued.)

MONTHS.	YEARS.																Means, 1796 to 1850.
	1835.	1836.	1837.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	
January - - -	73	73	74	74	77	76	77	76	76	76	77	76	76	75	77	77	76
February - - -	75	75	77	77	79	77	78	77	77	78	79	79	79	78	79	78	78
March - - -	77	76	79	80	81	80	81	81	80	82	83	82	82	82	82	81	80
April - - -	79	80	80	84	84	85	83	84	84	86	87	86	86	86	86	86	83
May - - -	85	86	82	86	87	88	85	88	84	87	89	87	88	89	90	88	87
June - - -	83	85	84	86	87	88	86	87	85	89	87	88	86	90	88	89	87
July - - -	81	82	..	86	85	85	87	86	85	86	86	85	85	87	86	88	85
August - - -	81	79	..	85	82	85	82	84	85	85	86	85	85	86	86	87	84
September - - -	81	81	..	85	82	83	84	82	84	83	84	86	85	85	86	85	84
October - - -	79	81	..	82	84	82	80	81	80	81	83	82	81	83	83	84	82
November - - -	76	76	..	77	78	77	78	78	79	79	79	79	79	79	81	79	79
December - - -	74	74	..	76	78	77	77	76	76	77	78	77	76	77	78	77	77
Means - - -	79	79	..	81	82	82	81	82	82	82	83	83	83	83	83	83	82

From this table we gather that the lowest and highest monthly temperatures at Madras in 55 years—
In January were 71° in 1819, and 79° in 1804 & 1828, showing a variation in this month of 8°.
In February were 73° in 1816, and 81° in 1804 & 1825, showing a variation in this month of 8°.
In March were 73° in 1807, and 84° in 1801, 1802, & 1822, showing a variation in this month of 11°.
In April were 79° in 1821, & 1835, and 87° in 1815 & 1845, showing a variation in this month of 8°.
In May were 80° in 1814, and 90° in 1813, 1815, 1818, 1849, showing a variation in this month of 10°.
In June were 83° in 1826 & 1835, and 91° in 1814, showing a variation in this month of 8°.

In July were 81° in 1834 & 1835, and 90° in 1824, showing a variation in this month of 9°.
In August were 78° in 1832, and 88° in 1824, showing a variation in this month of 10°.
In September were 81° in 1834, 1835, & 1836, and 88° in 1824, showing a variation in this month of 7°.
In October were 79° in 1835, and 84° in 1823, 1825, 1826, 1829, 1839, 1850, showing a variation in this month of 5°.
In November were 75° in 1799, and 81° in 1804, 1806, 1823, 1824, 1828, 1829, showing a variation in this month of 6°.
In December were 74° in 1813, 1815, 1835, 1836, and 80° in 1822, showing a variation in this month of 6°.

TABLE XIII. showing the Mean Monthly Temperature of the Air at Bombay.

MONTHS.	YEARS.												Means, 1847 to 1858.
	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	
January - - -	75	76	73	72	72	72	72	76	75	76	75	73	74
February - - -	74	75	76	75	76	76	76	75	77	77	78	75	76
March - - -	79	79	79	79	80	80	82	80	79	82	82	80	80
April - - -	82	83	82	82	83	83	84	84	82	85	83	84	83
May - - -	84	85	85	84	85	86	87	87	86	86	86	86	86
June - - -	81	82	81	84	83	84	84	84	84	83	83	85	83
July - - -	80	81	80	82	80	82	81	80	82	81	82	81	81
August - - -	80	80	80	81	80	80	81	81	82	81	79	81	81
September - - -	79	81	79	81	80	81	81	81	81	80	79	81	80
October - - -	82	81	81	83	82	82	82	82	83	81	81	81	82
November - - -	76	79	81	80	80	80	81	80	81	79	77	79	79
December - - -	76	77	77	76	75	76	77	77	78	75	74	76	76
Means - - -	79	80	80	80	80	80	81	81	81	81	80	80	80

And from the Bombay table we learn that the variation in temperature—
In January in 12 years amounted to 4°.
In February " " 4°.
In March " " 3°.
In April " " 3°.
In May " " 3°.

In June in 12 years amounted to 4°.
In July " " 2°.
In August " " 3°.
In September " " 2°.
In October " " 2°.
In November " " 5°.
In December " " 3°.

ON OBSERVED MEAN TEMPERATURE OF THE AIR AT DIFFERENT STATIONS.

The mean monthly, quarterly, and other periodic values of this element will be found in the Appendix, for all the stations in each presidency, arranged in the order of latitude. See Tables CXII., CXXII., and CXXXII.

Determination of the effect of a change of 1° of Latitude on the observed Mean Temperature.

Tables LXXII. to LXXIV. contain the monthly mean temperature of the air at stations less than 1,000 feet in elevation above the level of the sea, in each presidency. The mean of all in each month has been taken, a mean geographical position, and mean elevation determined and the results are contained in the first three columns of the following table.

The numbers in the 4th column are the differences between those in the 1st and 2nd columns; those in the 5th column, the differences between those in the 2nd and 3rd columns; and those in the last column are formed from the numbers in the 1st and 3rd columns.

TABLE XIV. showing the Mean Monthly Temperature of the Air at different Latitudes.

MONTHS.	Mean Temperature of Groups			Difference of Mean Temperature of Groups		
				G and H, H and K, G and K		
	G	H	K	Corresponding to a Difference of Latitude of		
Lat. -	13° 30' N.	21° 32' N.	26° 18' N.	8° 2' and 7° 21'	4° 46' and 9° 17'	12° 48' and 1° 56'
Long. -	79° 3' E.	71° 42' E.	80° 59' E.			
Height -	126 feet.	290 feet.	509 feet.			
January -	76	70	63	-6	-7	-13
February -	79	73	69	-6	-4	-10
March -	82	80	76	-2	-4	-6
April -	85	85	85	0	0	0
May -	87	89	91	+2	+2	+4
June -	86	87	91	+1	+4	+5
July -	83	87	87	+4	0	+4
August -	83	83	85	0	+2	+2
September -	82	82	84	0	+2	+2
October -	81	81	79	0	-2	-2
November -	78	77	71	-1	-6	-7
December -	77	72	63	-5	-9	-14

From the agreement in the numbers in the last three columns of this table, it is evident that one general law prevails throughout the whole extent of India; but from the difference of signs in the different months, as well as the different amounts with the same sign, it is evident that the difference of temperature for difference of latitude is very different at different seasons of the year.

The following are the most probable values for an increase of one degree of north latitude.

In January	a decrease of 1° 0.
In February	a decrease of 0° 8.
In March	a decrease of 0° 5.
In April	no change.
In May	an increase of 0° 3.
In June	an increase of 0° 4.
In July	an increase of 0° 3.
In August	an increase of 0° 2.
In September	an increase of 0° 1.
In October	a decrease of 0° 2.
In November	a decrease of 0° 5.
In December	a decrease of 1° 1.

From these results it appears that from October to March the temperature is lower at northern stations than at southern, and from May to September they are warmer. In April the temperature seems to be very nearly the same at all stations, and there is but little difference in this respect in September. The greatest differences are in December and January, and which exceed 30° in amount, between the extreme south of the presidency of Madras, and north of that of Bengal.

Determination of the Change of Mean Temperature in India in every Month for a difference of 1° of Longitude in different parallels of Latitude.

The next investigation necessary is to determine the effect of longitude on the mean temperature: for this purpose the mean temperatures month by month of all those stations situated in or near the same latitude were compared together; in other cases, where the difference of latitude would make a sensible difference in the result, the preceding corrections for latitude have been applied to the results of one station to reduce them to the latitude of the other, and in this way a series of differences in almost every latitude were found, which were wholly due to longitude.

These were grouped together, their means taken, the results laid down on a diagram, and a curved line made to pass through or near them, giving weights proportionate to

the number of results from which each point was found, and in this way the following series of values were obtained.

TABLE XV. showing the Effect of an Increase of 1° of East Longitude, in the different parallels of Latitude in India.

MONTHS.	Latitudes N.			
	South of 15°.	15° to 20°.	20° to 25°.	North of 25°
January -	0° 7	0° 3	0° 2	0° 1
February -	0° 7	0° 3	0° 1	0° 1
March -	0° 6	0° 3	0° 1	0° 1
April -	0° 2	0° 3	0° 1	0° 1
May -	+ 0° 3	0° 1	0° 2	0° 0
June -	+ 0° 8	0° 0	0° 1	0° 2
July -	+ 1° 2	0° 0	0° 1	0° 2
August -	+ 1° 2	0° 1	0° 1	0° 2
September -	+ 0° 8	0° 2	0° 1	0° 1
October -	+ 0° 3	0° 3	0° 1	0° 1
November -	0° 2	0° 2	0° 1	0° 2
December -	0° 7	0° 3	0° 2	0° 2

From the general accordance of the individual results, I think considerable confidence may be placed in these values. The numbers in the column applicable to places situated south of 15°, are remarkable, and show that the stations on the Malabar coast differ very much from those on the Coromandel coast in their monthly values, the former being of much higher temperature in the winter months, and of lower in the summer months, the change taking place between the months of April and May, and again between October and November.

In the next parallel, viz., between 15° and 20°, these particulars are much modified, those stations situated to the west being of higher temperature in winter, and differing but little from each other in the summer. In latitudes exceeding 20° the effect of longitude seems to be small, the western stations being of somewhat higher temperature.

With the knowledge we possess of the mean temperatures at moderate elevations, as found in groups G, H, and K, in Table XIV., and with the coefficients in latitudes and longitudes, as found from Table XIV., and as contained in Table XV., we are enabled to calculate the mean temperature of all places in India at the same elevations, dependent upon their geographical position, by the following formulæ:—

Formulæ for calculating the mean temperature of places situated south of 15° of north latitude, in the presidency of Madras, at moderate elevations.

January	76 - (lat. - 13½) × 1° 0 - (long. - 79) × 0° 7
February	79 - (lat. - 13½) × 0° 8 - (long. - 79) × 0° 7
March	82 - (lat. - 13½) × 0° 5 - (long. - 79) × 0° 7
April	85 - (long. - 79) × 0° 2
May	87 + (lat. - 13½) × 0° 3 + (long. - 79) × 0° 3
June	86 + (lat. - 13½) × 0° 4 + (long. - 79) × 0° 8
July	83 + (lat. - 13½) × 0° 3 + (long. - 79) × 1° 2
August	83 + (lat. - 13½) × 0° 2 + (long. - 79) × 1° 2
September	82 + (lat. - 13½) × 0° 1 + (long. - 79) × 0° 8
October	81 - (lat. - 13½) × 0° 2 + (long. - 79) × 0° 3
November	78 - (lat. - 13½) × 0° 5 - (long. - 79) × 0° 2
December	77 - (lat. - 13½) × 1° 1 - (long. - 79) × 0° 7

Formulæ for calculating the mean monthly temperature at places situated in India, between the parallels of 15° and 20° of north latitude, at moderate elevations.

January	70 - (lat. - 21) × 1° 0 - (long. - 72) × 0° 3
February	73 - (lat. - 21) × 0° 8 - (long. - 72) × 0° 3
March	80 - (lat. - 21) × 0° 5 - (long. - 72) × 0° 3
April	85 - (long. - 72) × 0° 3
May	89 + (lat. - 21) × 0° 4 - (long. - 72) × 0° 1
June	87 + (lat. - 21) × 0° 3
July	87 + (lat. - 21) × 0° 3
August	83 + (lat. - 21) × 0° 2 - (long. - 72) × 0° 1
September	82 + (lat. - 21) × 0° 1 - (long. - 72) × 0° 2
October	81 - (lat. - 21) × 0° 2 - (long. - 72) × 0° 2
November	77 - (lat. - 21) × 0° 5 - (long. - 72) × 0° 2
December	72 - (lat. - 21) × 1° 1 - (long. - 72) × 0° 3

Formulæ for calculating the mean temperature of places situated in India, between the parallels of 20° and 25° of north latitude, at moderate elevations.

January	70 - (lat. - 21) × 1° 0 - (long. - 72) × 0° 2
February	73 - (lat. - 21) × 0° 8 - (long. - 72) × 0° 1
March	80 - (lat. - 21) × 0° 5 - (long. - 72) × 0° 1
April	85 - (long. - 72) × 0° 1
May	89 + (lat. - 21) × 0° 4 - (long. - 72) × 0° 2
June	87 + (lat. - 21) × 0° 3 - (long. - 72) × 0° 1
July	87 + (lat. - 21) × 0° 3 - (long. - 72) × 0° 1
August	83 + (lat. - 21) × 0° 2 - (long. - 72) × 0° 1
September	82 + (lat. - 21) × 0° 1 - (long. - 72) × 0° 1
October	81 - (lat. - 21) × 0° 2 - (long. - 72) × 0° 1
November	77 - (lat. - 21) × 0° 5 - (long. - 72) × 0° 1
December	72 - (lat. - 21) × 1° 1 - (long. - 72) × 0° 2

Formulae for calculating the mean temperature in India north of 25° of north latitude, at moderate elevations.

January	63	— (lat. —26)	× 1.0	— (long. —81)	× 0.1
February	69	— (lat. —26)	× 0.8	— (long. —81)	× 0.1
March	76	— (lat. —26)	× 0.5	— (long. —81)	× 0.1
April	85			— (long. —81)	× 0.1
May	91	+ (lat. —26)	× 0.3	— (long. —81)	× 0.1
June	91	+ (lat. —26)	× 0.4	— (long. —81)	× 0.2
July	87	+ (lat. —26)	× 0.3	— (long. —81)	× 0.3
August	85	+ (lat. —26)	× 0.2	— (long. —81)	× 0.2
September	84	+ (lat. —26)	× 0.1	— (long. —81)	× 0.1
October	79	— (lat. —26)	× 0.2	— (long. —81)	× 0.1
November	71	— (lat. —26)	× 0.5	— (long. —81)	× 0.3
December	63	— (lat. —26)	× 1.1	— (long. —81)	× 0.2

Determination of the Influence of Elevation on Mean Temperature of the Air in India.

The determination of the correction for elevation is very important: for this purpose all the stations in each presidency were collected together whose elevations above the sea were from 1,000 to 2,000 feet in one group, from 2,000 to 3,000 in another group, and of higher elevations, step by step of 1,000 feet, in Tables LXXV. to LXXXII.; the mean of each group was taken and compared with the mean temperature for each geographical position at the level of the sea; and in this way a series of differences between these results were found due to each separate elevation; these were again grouped, and their means are shown in the following tables.

TABLE XVI. showing the observed Decrease of Mean Monthly Temperature of the Air, with Increase of Elevation.

MONTHS.	Presidency, Number of Stations, and Mean Elevation.															
	Bombay.	Madras.	Bombay.	Madras.	Madras.	Bengal.	Bombay.	Bengal.	Bengal.	Madras.	Madras.	Bengal.	Bengal.	Bengal.	Madras.	Madras.
	Mean of 9 Stations.	Mean of 3 Stations.	Mean of 3 Stations.	Secunderabad.	Bangalore.	Cherrapoonjee.	Mean of 2 Stations.	Uttra Mullay.	Khatmandu.	Mercara.	Wellington.	Nynsee Thal.	Kotguruh.	Darjeeling.	Ootacamund.	Doda-betta.
	1,373 ft.	1,584 ft.	2,176 ft.	2,286 ft.	2,874 ft.	3,609 ft.	3,960 ft.	4,091 ft.	4,141 ft.	4,374 ft.	5,880 ft.	5,891 ft.	6,125 ft.	6,491 ft.	7,235 ft.	8,614 ft.
January	— 1½	— 1	— 5	— 6	— 6	— 7	— 10	— 2	— 14	— 10	— 12	— 14	— 18	— 17	— 24	— 26
February	— 0½	— 2	— 2	— 3	— 6	— 10	— 9	— 5	— 16	— 9	— 17	— 19	— 20	— 25	— 25	— 29
March	— 0	— 2	— 3	— 2	— 3	— 14	— 9	— 9	— 17	— 9	— 16	— 20	—	— 24	— 23	— 27
April	— 1	— 2	— 2	— 1	— 6	— 17	— 11	— 17	— 18	— 12	— 21	— 23	—	— 29	— 22	— 29
May	— 2	— 2	— 4	— 2	— 7	— 21	— 16	— 24	— 20	— 14	— 18	— 24	— 25	— 33	— 25	— 29
June	— 4	— 5	— 6	— 6	— 10	— 20	— 15	— 26	— 18	— 16	— 16	— 24	— 21	— 30	— 26	— 32
July	— 7	— 6	— 8	— 7	— 8	— 17	— 19	— 22	— 11	— 16	— 15	— 20	— 18	— 26	— 25	— 29
August	— 5	— 5	— 7	— 9	— 9	— 16	— 17	— 20	— 11	— 17	— 12	— 19	— 19	— 24	— 25	— 30
September	— 4	— 5	— 7	— 5	— 7	— 14	— 15	— 18	— 12	— 16	— 15	— 19	— 20	— 23	— 24	— 29
October	— 3	— 5	— 6	— 4	— 8	— 11	— 12	— 15	— 14	— 14	— 12	— 18	— 22	— 23	— 23	— 28
November	— 3	— 2	— 6	— 4	— 6	— 14	— 12	— 7	— 15	— 11	— 13	— 15	— 18	— 19	— 23	— 27
December	— 2	— 1	— 7	— 6	— 7	— 12	— 12	— 2	— 15	— 14	— 9	— 9	—	— 17	— 25	— 28

From these numbers it is very clear that there is no marked difference in the effect of elevation in different parts of India, or in other words, whatever may be the mean temperature due to the latitude and longitude on the plains; the effect of elevation is to depress this by the same amount. By looking over these numbers, the results in the summer months at Cherrapoonjee seem to be too large, and those at Uttra Mullay are wholly discordant, being much too small in the winter, and much too large in the summer months.

By taking the means of these results below 2,000 feet, in one group, those between 2,000 and 3,000 feet in another, and so on, another table of mean values was formed. These were laid down on a diagram, with feet as abscissæ, and degrees of temperature as ordinates, and a curved line was made to pass through or near every point, and the value for every 1,000 feet of elevation was read from the curved line; and thus the next table was formed, giving the most probable amount of depression of temperature with elevation, as can be found from the observations.

TABLE XVII. showing the calculated Decrease of Mean Monthly Temperature of the Air with an Increase of Elevation up to 9,000 feet.

MONTHS.	Height in Feet.								
	1,000.	2,000.	3,000.	4,000.	5,000.	6,000.	7,000.	8,000.	9,000.
January	1½	4	6½	10	12½	16½	20½	25	28½
February	1½	3½	6½	10½	14½	19	24	27½	30½
March	1½	3½	6½	10½	15	19	23½	26½	29
April	2	4	8	12½	18½	22	24½	27½	30
May	2	5	10½	15	19½	23	25½	27½	30
June	3	6	11	15	19½	23	26	30	33
July	3	6½	10	13½	17	20½	23½	27½	30½
August	4	7½	10½	14	17½	20½	24½	27½	31½
September	3½	6½	9½	13	16½	20	23	26	30
October	3	6	9	12½	15½	19	22½	25½	29
November	2½	6	8½	12	15	18½	21½	24½	28
December	2	4	7½	11½	14½	18½	22	25½	29½

These numbers I cannot but think are satisfactory, and better than at one time I thought possible to be found. By their application to the numbers in the general table the mean temperature of every month, in every place in India can be approximately determined, and I think with sufficient accuracy for the purposes of this Commission. If the height of the place whose temperature is desired be not exactly an even 1,000 feet, the amount can be taken out at sight.

The next table is formed by dividing the numbers on the top of each column by every number under it, and thus determining the number of feet of elevation required in every month, for the different heights, for a decrease of 1° of mean temperature. From this table the corrections to any particular altitude can be found by dividing the altitude in feet by the numbers in this table.

TABLE XVIII. showing the Average Increase of Elevation for a Decrease of 1° of Mean Temperature.

MONTHS.	1,000 feet.	2,000 feet.	3,000 feet.	4,000 feet.	5,000 feet.	6,000 feet.	7,000 feet.	8,000 feet.	9,000 feet.
January	667	500	414	400	408	364	337	320	319
February	570	572	480	391	339	308	292	291	298
March	570	572	462	381	333	316	298	305	311
April	500	500	375	296	274	273	283	291	300
May	500	400	286	258	254	261	272	289	300
June	333	333	273	254	256	261	262	267	273
July	286	296	300	296	294	296	295	294	293
August	235	267	279	286	286	289	288	289	286
September	286	308	308	308	303	300	304	308	300
October	333	333	333	320	318	316	315	314	311
November	363	333	343	333	333	324	326	323	321
December	500	500	387	356	339	324	318	311	305

SECTION VI.

On the calculated mean temperature of the Air. Comparison of the observed and calculated mean temperature. Meteorological elements of the climate of England. Excess of the mean monthly temperatures of India over that of England. Elevation necessary to have the same temperature month by month in India as in England, in different parts of India. Calculated high day temperature in India, its excess over that in England, and elevation necessary in India, to have the same as that in England. Calculated low night temperature in India, its excess over that in England, and elevation necessary in India, to have the same as in England.

In Section V., page 791, the formulæ for calculating the mean temperature of the air at any place in India are deduced, so far as it is dependent upon geographical position alone, and at low elevations; and the following three tables have been calculated from them.

TABLE XIX. showing the Calculated Mean Monthly and Annual Temperature of the Air in India, for every Two Degrees of Latitude from 8° North to 34° North, and for every Degree of East Longitude, in the Presidency of Madras, South of Latitude of 15° at low elevations.

MONTHS.	Latitudes North.																											
	8°		10°				12°						14°						15°									
	Longitudes E.		Longitudes E.				Longitudes E.						Longitudes E.						Longitudes E.									
	77°	78°	76°	77°	78°	79°	75°	76°	77°	78°	79°	80°	74°	75°	76°	77°	78°	79°	80°	73°	74°	75°	76°	77°	78°	79°	80°	81°
January - - -	84	83	83	82	81	80	81	80	79	79	78	77	80	79	78	77	77	76	75	78	78	77	76	75	75	74	73	72
February - - -	85	84	85	84	83	82	83	82	81	81	80	79	83	82	81	80	80	79	78	82	82	81	80	79	79	78	77	76
March - - -	87	86	86	85	85	84	86	84	84	84	83	82	85	84	84	83	83	82	81	85	84	83	82	82	82	81	80	79
April - - -	85	85	86	86	85	85	86	86	86	85	85	84	86	86	86	85	85	85	85	86	86	86	86	85	85	85	84	84
May - - -	85	85	87	87	86	86	86	86	86	87	87	87	85	86	86	86	87	87	87	85	86	86	86	87	87	87	88	89
June - - -	82	83	81	82	83	84	82	83	84	84	85	85	82	83	84	85	85	86	87	82	83	84	85	86	86	87	88	89
July - - -	79	80	77	79	81	82	78	79	81	82	83	83	77	79	81	82	83	84	84	77	78	79	80	82	83	84	85	86
August - - -	80	81	76	79	82	83	78	79	81	82	83	83	77	79	81	82	83	84	84	77	78	79	81	82	83	84	85	86
September - -	80	81	78	79	81	82	79	80	81	81	82	82	78	79	80	80	81	82	83	77	78	79	80	81	81	82	83	84
October - - -	82	82	78	78	79	80	80	80	80	81	81	82	79	80	80	80	81	81	81	79	80	80	80	80	80	81	81	82
November - -	82	82	81	81	80	80	80	80	79	79	79	79	79	79	79	78	78	78	78	78	78	78	78	78	77	77	77	77
December - -	85	84	84	83	82	81	82	81	80	80	79	79	81	79	79	76	77	77	77	79	78	77	76	75	75	74	73	73
Mean annual temperature of the air.	83	83	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	82	82	80	81	81	81	81	81	81	81	81
Difference between the hottest and coldest Months.	8	6	11	9	7	6	8	7	7	8	9	10	9	7	8	10	10	11	12	10	9	9	10	11	12	13	15	17

TABLE XX. showing the Calculated Mean Monthly and Annual Temperature of the Air for every Two Degrees of North Latitude from 16° to 26°, and every Four Degrees of Longitude between 72° and 92° East.

MONTHS.	Latitudes North.																														
	16°				18°				20°				22°				24°				26°										
	Longitudes E.				Longitudes E.				Longitudes E.				Longitudes E.				Longitudes E.				Longitudes E.										
	72°	76°	80°	84°	72°	76°	80°	84°	72°	76°	80°	84°	88°	92°	72°	76°	80°	84°	88°	92°	72°	76°	80°	84°	88°	92°					
January	75	74	73	71	73	71	70	69	71	70	69	68	66	68	68	67	67	66	65	65	65	64	63	63	61	64	63	63	62	62	
February	77	76	75	74	75	73	72	71	74	73	72	71	69	72	72	72	72	71	71	70	71	71	70	70	69	69	69	68	68	68	
March	82	81	80	78	82	81	79	78	81	80	79	78	76	78	78	78	78	77	77	76	77	77	76	76	75	76	76	75	75	75	
April	85	84	83	81	85	83	82	81	85	84	83	82	80	85	85	85	85	84	84	85	85	85	84	84	83	85	85	85	84	84	84
May	87	87	86	86	88	88	87	87	89	89	89	88	87	90	90	90	89	88	88	90	90	90	89	89	89	90	90	90	89	89	89
June	85	85	85	85	86	86	86	86	87	87	87	87	87	89	89	89	88	88	88	91	91	90	90	89	89	92	92	91	90	89	89
July	85	85	85	85	86	86	86	86	87	87	87	87	87	86	86	86	85	85	85	86	86	86	85	85	85	86	86	87	86	85	85
August	82	82	81	81	82	82	81	81	83	83	83	82	82	84	84	84	83	83	83	85	85	85	84	84	84	85	85	85	84	84	83
September	81	80	79	79	82	82	81	80	82	82	81	80	79	83	83	83	82	82	82	83	84	84	83	83	83	84	84	84	83	83	83
October	82	81	80	78	82	80	79	78	81	80	79	78	76	80	80	80	79	79	79	80	79	79	79	78	78	79	79	79	78	78	78
November	80	79	78	78	79	78	77	77	78	78	77	76	75	76	75	75	75	75	75	74	74	74	73	73	72	74	73	71	70	69	69
December	78	76	75	74	75	73	72	71	73	72	71	70	68	68	68	67	66	65	65	65	65	64	63	62	61	62	62	63	62	61	61
Mean Annual Temperature of the Air	82	81	80	79	81	80	79	79	81	80	80	79	78	80	80	80	79	78	78	79	79	79	78	78	78	79	79	79	78	77	77
Difference between the hottest and coldest Months	12	13	13	15	15	17	17	18	18	19	20	20	22	22	22	23	23	23	23	26	26	25	26	26	31	30	28	28	28	28	28

TABLE XXI. showing the Calculated Mean Monthly and Annual Temperature of the Air for every 2° of North Latitude from 28° to 34°, and every four degrees of Longitude from 72° to 92°.

MONTHS.		Latitudes North.																	
		28°						30°				32°			34°				
		Longitudes E.						Longitudes E.				Longitudes E.			Longitudes E.				
		72°	76°	80°	84°	88°	92°	72°	76°	80°	84°	72°	76°	80°	70°	74°	78°		
January	-	-	-	63	62	61	61	60	60	60	59	59	58	58	57	57	56	55	55
February	-	-	-	68	68	67	67	66	66	67	66	66	66	65	64	64	64	63	63
March	-	-	-	75	75	75	74	74	74	75	75	74	74	74	73	73	73	72	72
April	-	-	-	85	85	85	84	84	84	86	85	85	85	86	85	85	86	85	85
May	-	-	-	89	90	91	91	90	90	93	92	92	92	94	93	93	94	93	93
June	-	-	-	92	92	91	91	90	89	95	94	93	93	95	94	93	96	95	94
July	-	-	-	87	87	87	86	86	85	90	89	88	88	91	90	89	91	90	89
August	-	-	-	85	85	85	84	84	83	88	87	86	86	88	87	86	89	88	87
September	-	-	-	84	84	84	83	83	83	85	85	84	84	86	85	85	86	85	85
October	-	-	-	79	79	79	78	78	78	79	79	78	78	79	78	78	78	77	77
November	-	-	-	73	72	70	69	69	68	71	70	69	69	70	69	68	69	68	67
December	-	-	-	60	60	61	61	60	59	61	60	59	59	58	57	56	56	55	54
Mean Annual Tempera- ture of the Air - - }		78	78	78	77	77	77	78	78	78	78	79	78	77	78	77	77	77	77
Difference between the hottest and coldest Months - - - }		32	32	30	30	30	31	35	35	34	35	37	37	37	40	40	40	40	40

The numbers in these tables are under the influence of aspect, the effect of soil, and difference of geological condition; and it is very likely, indeed almost certain, that the above numbers at the low latitudes, owing to the aspect of the stations situated at the southern extremity of Madras, are too small; and it is very likely also that at stations situated within the influence of the sea, they may be somewhat too great in the summer, and too small in the winter

months. It is probable that the inland stations may be nearly true; it is however necessary before using the numbers to determine what confidence can be placed in them, and for this purpose I have selected some of the places where it is known observations have been taken with great care, as at the observatories of Madras, Bombay, and at Calcutta, with a few other places in different parallels of latitude. The comparisons are shown in the following table.

TABLE XXII. showing the Observed and Calculated Mean Monthly Temperatures of the Air, and the Difference between them, at different Stations in India, between Latitudes 12° and 31°.

MONTHS.	Cannanore.			Madras.			Vingorla.			Bombay.			Calcutta.			Lucknow.			Ferozepore.		
	Observed.	Computed.	Difference.	Observed.	Computed.	Difference.	Observed.	Computed.	Difference.	Observed.	Computed.	Difference.	Observed.	Computed.	Difference.	Observed.	Computed.	Difference.	Observed.	Computed.	Difference.
January	82	81	- 1	76	76	0	78	75	- 3	74	72	- 2	70	65	- 5	66	63	- 3	59	59	0
February	82	83	+ 1	78	78	0	79	77	- 2	76	75	- 1	73	71	- 2	68	68	0	68	66	- 2
March	84	85	+ 1	80	81	+ 1	82	82	0	80	82	+ 2	83	77	- 6	79	76	- 3	76	74	- 2
April	86	86	0	83	84	+ 1	83	85	+ 2	83	85	+ 2	88	84	- 4	88	85	- 3	81	85	+ 4
May	85	86	+ 1	87	87	0	85	87	+ 2	86	88	+ 2	89	82	- 7	91	91	0	94	93	- 1
June	80	82	+ 2	87	86	- 1	81	85	+ 4	83	86	+ 3	87	82	- 5	90	90	0	95	95	0
July	79	72	- 7	85	84	- 1	79	85	+ 6	81	86	+ 5	85	85	0	82	87	+ 5	90	90	0
August	79	71	- 8	84	84	0	79	82	+ 3	81	82	+ 1	85	84	- 1	84	85	+ 1	86	87	+ 1
September	79	79	0	84	83	- 1	79	81	+ 2	80	82	+ 2	85	82	- 3	85	84	- 1	86	85	- 1
October	81	80	- 1	82	80	- 2	81	82	+ 1	82	82	0	84	79	- 5	79	79	0	79	79	0
November	82	80	- 2	79	79	0	79	80	+ 1	79	79	0	78	72	- 6	70	70	0	68	69	+ 1
December	81	82	+ 1	77	78	+ 1	78	78	0	76	74	- 2	72	65	- 7	60	62	+ 2	58	59	+ 1

By looking over the several columns of differences, it will be seen that those at Cannanore and Madras are small, and therefore that the calculated and observed values are very nearly accordant; at Vingorla and Bombay, the calculated values are somewhat too high in the summer months, a difference owing to some extent to the direct influence of the sea; at Calcutta the calculated numbers in the winter are too small; at the remaining two stations, viz., Lucknow and Ferozepore, the differences are generally small.

Upon the whole, however, the accordances are as good as could be expected, considering that the observations upon which the calculations are based are not equally good, in fact in some cases suspicion reigned over the observations, but there was not sufficient evidence to reject them, and where erroneous they have exercised an injurious influence

over the results. It seems to me upon the whole that they are sufficiently near for the purposes of the Commission, and more to be depended upon than any observations taken at any place for a short period, or where no information is given as to the character of the instruments, their position, or care and regularity in making the observations.

It now becomes necessary to determine those elevations, in the different parallels of latitude, where European troops could be placed with the greatest probability of continued health. These localities would be those whose meteorological conditions, particularly in temperature, approached most nearly those of England.

The following are the average value of meteorological elements as deduced from 20 years' observations at the Royal Observatory at Greenwich.

TABLE XXIII. showing the Monthly Means of Results for Meteorological Elements at the Royal Observatory, Greenwich, in the Years 1841-1860.

MONTHS.	Mean reading of the Barometer.	Temperature of the Air.							Mean Temperature of Dew-point.	Hygrometrical Deductions.					Rain.	
		Highest in Years.	Lowest in Years.	Range in Month.	Mean of all the Highest.	Mean of all the Lowest.	Mean daily Range.	Mean Temp.		Mean Elastic Force of Vapour.	Mean weight of Vapour in cubic foot of Air.	Mean additional weight required for saturation.	Mean degree of Humidity.	Mean weight of a cubic foot of Air.	Number of Rainy Days.	Amount collected on Ground.
January	29.757	57.0	4.0	53.0	43.2	35.7	9.5	38.3	35.1	in. .205	grs. 2.4	gr. 0.3	89	grs. 553	11	in. 1.8
February	29.787	62.3	7.7	54.6	44.7	33.2	11.5	38.1	34.4	in. .201	grs. 2.3	gr. 0.4	85	554	10	1.6
March	29.793	71.5	13.1	58.4	50.0	35.3	14.7	41.7	36.4	in. .216	grs. 2.5	gr. 0.6	82	550	10	1.5
April	29.735	79.0	25.3	53.7	56.8	38.6	18.2	46.3	39.9	in. .247	grs. 2.9	gr. 0.8	79	542	10	1.8
May	29.762	86.2	28.3	57.9	61.4	41.2	20.2	52.8	45.5	in. .300	grs. 3.4	gr. 1.1	76	538	11	2.1
June	29.793	94.5	36.2	58.3	71.2	50.2	21.0	59.2	50.8	in. .373	grs. 4.2	gr. 1.5	74	531	10	1.9
July	29.804	96.3	38.9	57.4	73.8	53.2	20.6	61.9	53.9	in. .417	grs. 4.6	gr. 1.6	76	528	11	2.7
August	29.788	92.0	40.0	52.0	72.8	53.4	19.4	61.3	54.1	in. .422	grs. 4.7	gr. 1.5	77	528	11	2.4
September	29.824	86.4	32.0	54.4	67.4	48.9	18.5	56.9	51.1	in. .382	grs. 4.2	gr. 1.0	81	534	11	2.1
October	29.806	81.0	26.5	54.5	58.3	43.7	14.6	50.2	46.0	in. .312	grs. 3.6	gr. 0.6	87	539	13	2.8
November	29.756	66.3	19.4	46.9	49.3	37.7	11.6	43.4	40.1	in. .255	grs. 2.9	gr. 0.4	89	547	12	2.1
December	29.805	62.8	8.0	54.8	45.0	35.5	9.5	40.1	36.9	in. .221	grs. 2.6	gr. 0.4	89	552	11	1.9
Means	29.775	77.6	23.2	54.4	58.0	42.3	15.7	49.2	43.7	in. .236	grs. 3.3	gr. 0.8	82	541	122	25.3

TABLE XXIV. showing the Excess of Mean Temperature in India over that at Greenwich.

MONTHS.	Mean Temperature of Air at Greenwich.	Excess of Mean Temperature over that at Greenwich.											
		Latitudes.											
		South of 15°.	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	
January	38	38	35	33	31	29	27	25	23	21	19	17	
February	38	41	37	35	34	34	33	31	29	28	26	25	
March	42	40	38	38	37	36	35	34	33	33	31	30	
April	46	39	37	37	37	39	39	39	39	39	39	39	
May	53	34	33	34	37	36	36	37	38	39	40	40	
June	59	27	26	27	28	30	31	31	32	35	35	36	
July	62	21	23	24	25	24	24	24	25	27	28	28	
August	61	22	20	20	22	23	24	24	24	26	26	27	
September	57	25	22	24	24	26	26	27	27	28	27	28	
October	50	31	30	30	29	30	29	29	29	29	28	27	
November	43	36	35	35	34	30	29	28	27	27	26	25	
December	40	37	35	33	31	27	25	23	21	20	17	15	

From this table we learn that at all places south of latitude 22° the excess of temperature from October to May is between 30° and 40°, and from June to September between 20° and 30°.

That between the latitudes 22° and 26° the greatest excesses are from February to May, being between 30° and 40°, and from June to January being generally between 20° and 30°.

From the latitude 28° to that of 34° the greatest excesses are from March to June, being between 30° and 40°, and from July to February the least, being for the most part between 20° and 30°, but at the extreme stations it is less than 20°.

In January the excess is as large as 38° south of 15°, decreasing gradually to 17° in latitude 34°, showing lower mean temperature at northern stations by 21°.

In February the excess is as large as 41° south of 15°, decreasing gradually to 25° in latitude 34°, showing lower mean temperature at northern stations by 16°.

In March the excess is as large as 40° south of 15°, decreasing gradually to 30° in latitude 34°, showing lower mean temperature at northern stations by 10°.

In April the excesses are very nearly the same in all places, showing mean temperature alike everywhere.

In May the excess is about 34° south of 18°, and increases going northwards to 40° in latitude 34°, showing higher mean temperature at northern stations by 6°.

In June the excess is about 27° south of 18°, and increases going northwards to 36° in latitude 34°, showing higher mean temperature at northern stations by 9°.

In July the excess is about 21° south of 18°, and increases going northwards to 28° in latitude 34°, showing higher mean temperature at northern stations by 7°.

In August the excess is about 22° south of 20°, and increases going northwards to 27° in latitude 34°, showing higher mean temperature at northern stations by 5°.

In September and October the excesses are nearly alike at all places, showing mean temperatures nearly alike everywhere.

In November the excess is about 36° south of 15°, and decreases going northwards to 25° in latitude 34°, showing lower mean temperature at northern stations by 11°.

In December the excess is about 37° south of 15°, and decreases going northwards to 15° in latitude 34°, showing lower mean temperature at northern stations by 22°.

The differences between the temperatures of stations in Madras and those situated north of Bengal are thus shown to be very great in the months of January and December, the former exceeding the latter by as much as 21° and 22°, whilst in summer the differences are the other way, those stations in Madras being of lower temperature than those in Bengal by 5° to 9°.

In Section V., Table XVIII., the difference of vertical height for a decrease of one degree is given, and if the numbers in Table XXIV. be multiplied into these differences, the heights would be found, which would give the same as the average temperature for the same month in England. These heights are shown in the next table.

TABLE XXV. showing the Height in Feet, at different parallels of Latitude in India, in every Month, where the Mean Temperature is the same as that of England.

MONTHS.	Elevation in Feet in India necessary to have the same Mean Temperature as in England.										
	Latitudes.										
	South of 15°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°
January - - -	ft. 12,100	ft. 11,200	ft. 10,500	ft. 9,900	ft. 9,300	ft. 8,600	ft. 8,000	ft. 7,300	ft. 6,700	ft. 6,100	ft. 5,400
February - - -	12,200	11,000	10,400	10,100	10,100	9,800	9,200	8,600	8,300	7,700	7,500
March - - -	12,400	11,800	11,800	11,500	11,200	10,900	10,600	10,300	10,300	9,600	9,300
April - - -	11,700	11,100	11,100	11,100	11,700	11,700	11,700	11,700	11,700	11,700	11,700
May - - -	10,200	9,900	10,200	11,100	10,800	10,800	11,100	11,400	11,700	12,000	12,000
June - - -	7,400	7,100	7,400	7,600	8,200	8,500	8,500	8,700	9,500	9,600	9,800
July - - -	6,100	6,700	7,000	7,300	7,000	7,000	7,000	7,300	7,900	8,200	8,200
August - - -	6,300	5,700	5,700	6,300	6,600	6,900	6,900	6,900	7,400	7,400	7,700
September - - -	7,500	6,600	7,200	7,200	7,800	7,800	8,100	8,100	8,400	8,100	8,400
October - - -	9,600	9,300	9,300	9,000	9,300	9,000	9,000	9,000	9,000	8,700	8,400
November - - -	11,600	11,200	11,200	10,900	9,600	9,300	9,000	8,700	8,700	8,300	8,000
December - - -	11,300	10,700	10,100	9,400	8,200	7,600	7,000	6,400	6,100	5,200	4,600
Means - - -	9,900	9,400	9,300	9,300	9,200	9,000	8,800	8,700	8,800	8,600	8,400

From these numbers it seems necessary that the heights above the sea be different in the different seasons, as well as in the different latitudes, to obtain the same approximate mean temperature month by month, as would be obtained in England.

By grouping the numbers together, we learn that the same approximate mean monthly temperature as in England would be obtained,—

South of Latitude 20°,

From October to May, at a height of about 11,000 ft.
From June to September, at a height of about 6,500 ft.

Between Latitudes 20° and 26°,

From February to May, at a height of about 11,000 ft.
From June to January, " 8,000 ft.

North of Latitude 28°,

In January and December, at a height of about 5,000 ft.
In February and from July to November, at a height of about 7,500 ft.

From March to June, at a height of about 11,500 ft.

In the lowest line of the Table the mean height is given at which the same mean annual temperature would be obtained as in England, though at this fixed height the monthly temperature would be somewhat differently distributed.

From them we find that the same mean annual temperature as in England would be obtained,—

South of Latitude 20°,

At an elevation of about 9,500 ft.

At this height the months from October to May would be somewhat warmer, and those from June to September somewhat colder than in England.

Between Latitudes 20° and 26°,

The same annual temperature would be obtained as in England, at a height of about 9,000 ft.

The months from October to January would be very nearly the same as in England, those from February to May somewhat colder, and those from June to September somewhat warmer.

Between the Latitudes 26° and 30°,

The same annual temperature as in England would be obtained, at the height of about 8,700 ft.

At this elevation the months of January, February, June, July, August, September, October, November, and December, would differ but little from those in England, whilst the remaining three months, viz., March, April, May, and June would be somewhat warmer.

North of Latitude 30°,

The same annual temperature as in England would be obtained at an elevation of 8,500 ft.

At this elevation January and December would be some degrees colder than in England; the months of February and those from July to November, would be nearly the same as in England, whilst those of March, April and May would be somewhat warmer.

As these heights cannot be everywhere attained, and other circumstances may prevent their use, the heights most desirable are those which approach the most nearly to those mentioned.

By reference to the following investigations it will be seen that the elevations necessary to obtain the same high day temperatures as in England are always less than those to obtain the same mean temperature, and the elevations necessary to obtain the same low night temperature as in

England are much greater in the southern latitudes than those for mean temperature in the same parallels; that at latitude 28° they are very nearly the same; and that in extreme north latitudes they are of less altitude.

If, therefore, the altitudes found be adopted as necessary for the mean temperature, they would answer quite well for the maximum temperature, which would be somewhat of lower high day temperature than in England; and the low night temperature would be somewhat of higher low night temperature than in England.

In Section II., page 786, are given formulæ for calculating high day temperature at different parts of India in every month, and the following table has been calculated from them.

TABLE XXVI. showing the Calculated Mean Monthly High Day Temperatures of the Air in India, for every two degrees of Latitude from 16° to 34°, and 80° of Longitude.

MONTHS.	Latitudes.									
	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°
	Longitudes.									
	80°	80°	80°	80°	80°	80°	80°	80°	80°	80°
January	82	80	79	77	75	74	72	71	69	68
February	87	85	84	80	78	77	75	74	73	72
March	90	89	88	87	86	85	85	84	83	83
April	93	93	93	93	93	93	93	94	94	94
May	95	96	96	97	97	98	98	99	99	100
June	93	94	94	95	96	97	97	98	99	100
July	90	91	91	91	92	93	93	94	95	96
August	87	88	88	89	89	89	89	90	91	92
September	86	86	87	88	88	89	89	90	90	90
October	86	87	87	87	87	87	88	88	88	88
November	85	84	83	81	80	79	78	78	77	77
December	84	82	80	77	75	72	70	68	65	63
Mean annual high day temperature of the air.	88	88	87	87	86	84	84	83	85	85
Difference between hottest and coldest months.	13	16	17	20	22	26	28	31	33	37

The high day temperature for other longitudes may be found from these—

By adding if longitude be less than 80°, and by subtracting if more than 80°,—

In January, February, March, and October 0·4° for every degree of longitude from 80°.

In November 0·5° for every degree of longitude from 80°.

In April 0·3° for every degree of longitude from 80°.

In September 0·1° for every degree of longitude from 80°.

In December 0·6° for every degree of longitude from 80°.

In the months of May to August there is very little difference in high day temperature in different longitudes.

By taking the difference between the high day temperature in England, and the numbers in the preceding Table, the next table is formed.

TABLE XXVII. showing the Excess of High Day Temperature in India, in every Month, over English High Day Temperature.

MONTHS.	Mean Maximum Temperature of the Air at Greenwich.	Excess of Maximum Temperature of the Air over that at Greenwich.									
		Latitudes.									
		16°	18°	20°	22°	24°	26°	28°	30°	32°	34°
January	43	39	37	36	34	32	31	29	28	26	25
February	45	42	40	39	35	33	32	30	29	28	27
March	50	40	39	38	37	36	35	35	34	33	33
April	57	36	36	36	36	36	36	36	37	37	37
May	64	31	32	32	33	33	34	34	35	35	36
June	71	22	23	23	24	25	26	26	27	28	29
July	74	16	17	17	17	18	19	19	20	21	22
August	73	14	15	15	16	16	16	16	17	18	19
September	67	19	19	20	21	21	22	22	22	23	23
October	58	28	29	29	29	29	29	29	30	30	30
November	49	34	35	34	32	31	30	30	29	29	28
December	45	39	37	35	32	30	27	25	23	21	18

The greater heat by day in India over England—

In January is 39° in latitude 16°, decreasing to 25° at latitude 34°.

In February is 42° in latitude 16°, decreasing to 27° at latitude 34°.

In March is 40° in latitude 16°, decreasing to 33° at latitude 34°.

In April is nearly alike at all places, amounting to 36°.

In May is 31° in latitude 16°, increasing to 36° at latitude 34°.

In June is 22° in latitude 16°, increasing to 29° at latitude 34°.

In July is 16° in latitude 16°, increasing to 22° at latitude 34°.

In August is 14° in latitude 16°, increasing to 19° at latitude 34°.

In September is 19° in latitude 16°, increasing to 23° at latitude 34°.

In October is nearly alike at all places.

In November is 36° in latitude 16°, decreasing to 28° at latitude 34°.

In December is 39° in latitude 16°, decreasing to 18° at latitude 34°.

In Section II., Table VI., the effect of elevation on high day temperature is given for every 1,000 feet, by means of which, combined with Table XXVII., the heights in the different months have been found, at which a close approximation to English high day temperature would be obtained. The results are shown in the next table.

TABLE XXVIII. showing the Height in Feet, at different parallels of Latitude in India, in every Month, where the Mean Maximum Temperature is the same as that of England.

MONTHS.	Latitudes.									
	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
January	11,000	10,400	10,100	9,500	9,000	8,700	8,200	8,000	7,500	7,300
February	10,200	9,700	9,400	8,700	8,200	8,000	7,600	7,400	7,200	7,000
March	9,000	8,800	8,600	8,500	8,300	8,100	8,100	8,000	7,800	7,800
April	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,400	7,400	7,400
May	6,400	6,500	6,500	6,700	6,700	6,800	6,800	6,900	6,900	7,000
June	4,800	5,000	5,000	5,200	5,400	5,600	5,600	5,800	6,000	6,200
July	3,600	3,900	3,900	3,900	4,100	4,400	4,400	4,600	4,800	5,000
August	3,900	4,100	4,100	4,500	4,500	4,500	4,500	4,800	5,000	5,300
September	5,600	5,600	5,800	6,100	6,100	6,300	6,300	6,300	6,600	6,600
October	7,500	7,700	7,700	7,700	7,700	7,700	7,700	8,000	8,000	8,000
November	10,300	10,100	9,800	9,300	9,100	8,800	8,800	8,600	8,600	8,300
December	14,000	13,400	12,700	11,400	10,600	9,400	8,600	7,800	7,000	5,900
Means	7,800	7,700	7,600	7,400	7,200	7,100	7,000	7,000	6,900	6,800

These heights follow closely, but are less than those required for Mean Temperature.

In Section III., pages 787 and 788, are given formulæ for calculating the low night temperature at different parallels of latitude in India. The following table has been calculated from them.

TABLE XXIX. showing the Mean Monthly Low Night Temperature of the Air in India, for every two degrees of Latitude, in Longitude 80°.

MONTHS.	Latitudes.									
	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°
	Longitudes.									
	80°	80°	80°	80°	80°	80°	80°	80°	80°	80°
January	69	66	63	60	57	54	52	49	46	43
February	70	68	66	65	63	60	58	55	53	51
March	75	74	72	70	68	66	64	62	60	58
April	80	79	78	77	76	75	74	72	71	70
May	82	82	81	81	81	81	81	81	81	81
June	82	82	82	83	83	83	83	83	83	83
July	81	81	81	82	82	82	82	82	82	82
August	79	79	79	79	79	79	79	79	79	79
September	78	79	79	79	79	79	79	79	79	79
October	77	76	75	74	73	72	71	70	69	67
November	72	70	68	65	63	61	59	57	55	53
December	68	65	63	61	59	56	54	51	49	47
Mean annual low night temperature of the air	76	75	74	73	72	71	70	68	67	66
Difference between hottest and coldest months	14	17	19	23	26	29	31	34	37	40

The low night temperatures may be inferred from these for other places, by adding if the longitude be less than 80°, or subtracting if greater than 80°—

In January, July, and November 0°·2
In February 0°·2 south of 20°, and 0°·4 north of 20°,
In March 0°·1 south of 20°, and 0°·2 north of 20°,
In April 0°·3 south of 20°, and 0°·2 north of 20°,
In May, June, August, September, and October, 0°·1,
In December 0°·3,

By taking the difference between the low night temperature in England, and the numbers in the preceding table, the next table is formed.

TABLE XXXI. showing the Height in Feet at different Parallels of Latitude in India, in every Month, where the Mean Minimum Temperature is the same as that of England.

MONTHS.	Latitudes.									
	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°
January	17,000	15,500	14,000	12,500	11,000	9,500	8,500	7,000	5,600	4,200
February	12,200	11,500	11,000	10,700	10,000	9,200	8,600	7,600	7,000	6,400
March	13,100	12,900	12,200	11,600	11,000	10,400	9,800	9,200	8,500	7,900
April	10,800	10,600	10,300	10,000	9,800	9,600	9,300	8,800	8,600	8,400
May	8,500	8,500	8,300	8,300	8,300	8,300	8,300	8,300	8,300	8,300
June	8,400	8,400	8,400	8,700	8,700	8,700	8,700	8,700	8,700	8,700
July	8,000	8,000	8,000	8,300	8,300	8,300	8,300	8,300	8,300	8,300
August	8,300	8,300	8,300	8,300	8,300	8,300	8,300	8,300	8,300	8,300
September	8,600	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800
October	10,700	10,300	10,000	9,700	8,900	9,000	8,700	8,300	8,000	7,300
November	13,600	12,800	12,000	10,800	10,000	9,600	8,400	7,600	6,800	6,000
December	13,400	12,800	11,400	10,600	9,800	8,200	7,800	6,600	5,800	5,000
Means	11,090	10,700	10,200	9,900	9,500	9,000	8,600	8,100	7,700	7,300

These heights are greater than those required to obtain English high day temperature in all cases, and much greater than required for English mean temperature at places situated south of 26°; very nearly the same at 28°, and are less at higher latitudes.

SECTION VII.—On the Hygrometrical States of the Air in India.

The trustworthy observations for determining the hygrometrical states of the atmosphere are but few in number. This is to be regretted, as the more or less moisture in the air exercises a very considerable influence upon the health of man. The observations which I have found available have been those of the dry and wet-bulb thermometers, and no direct determination of the temperature of the dew point has been met with, made either by Daniell's or Regnault's hygrometers. Our knowledge of the laws of the distribu-

TABLE XXX. showing the Excess of Low Night Temperature in India, in every Month, over English Low Night Temperature.

MONTHS.	Mean Minimum Temperature of the Air at Greenwich.	Excess of Minimum Temperature over that at Greenwich.									
		Latitudes.									
		16°	18°	20°	22°	24°	26°	28°	30°	32°	34°
January	34	35	32	29	26	23	20	18	15	12	9
February	33	37	35	33	32	30	27	25	22	20	18
March	35	40	39	37	35	33	31	29	27	25	23
April	39	41	40	39	38	37	36	35	33	32	31
May	44	38	38	37	37	37	37	37	37	37	37
June	50	32	32	32	33	33	33	33	33	33	33
July	53	28	28	28	29	29	29	29	29	29	29
August	53	26	26	26	26	26	26	26	26	26	26
September	49	29	30	30	30	30	30	30	30	30	30
October	44	33	32	31	30	29	28	27	26	25	23
November	38	34	32	30	27	25	23	21	19	17	15
December	36	32	29	27	25	23	20	18	15	13	11

The greater heat by night in India, over that in England, therefore,—

In January is 35° in latitude 16°, decreasing regularly to 9° in latitude 34°.

In February is 37° in latitude 16°, decreasing regularly to 18° in latitude 34°.

In March is 40° in latitude 16°, decreasing regularly to 23° in latitude 34°.

In April is 41° in latitude 16°, decreasing regularly to 31° in latitude 34°.

In May is 38° and nearly alike everywhere.

In June is 32°

In July is 28°

In August is 26°

In September is 29°

In October is 33° in latitude 16°, decreasing to 23° in latitude 34°.

In November is 34° in latitude 16°, decreasing to 15° in latitude 34°.

In December is 32° in latitude 16°, decreasing to 11° in latitude 34°.

In Section III., page 788, Table X., the effect of elevation on low night temperature is given for every 1,000 feet; by means of which, combined with Table XXX., the heights in the different parallels of latitude have been found at which low night temperature approximate to that of England may be obtained. The results are contained in the next table.

tion of water in the atmosphere is so limited, that at all elevated places some direct observations of this element should be taken, and not trust entirely to the inferential results derivable from the dry and wet-bulb alone. At moderate elevations it is possibly better to use the dry and wet thermometers than either of the above hygrometers; and it may prove to be so at great elevations, when sufficient simultaneous observations have been made of direct and inferential determinations.

The hygrometrical elements most desirable to be known are,—

The temperature of the dew point.

The amount of water mixed with a certain mass of air in the invisible shape of vapour.

The amount of water required to saturate a certain mass of air, and

The degree of humidity of the air.

Before treating of the observations to determine these elements, I will speak of each separately.

The temperature of the dew point, or that degree of temperature to which the temperature of the air must be reduced so that the air becomes saturated by the quantity of water mixed with it in the invisible shape of vapour.

If, therefore, the temperature of the air be higher than that of the dew point, the air is not saturated; if these temperatures be alike the air is saturated; and if the temperature should decline, some rain must fall.

The amount of water necessary to saturate a mass of air, say, one cubic foot, varies with its temperature. At 32° air is saturated by a little more than 2 grs.; at 42°, by 3 grs.; at 49°, by 4 grs.; at 56°, by 5 grs.; at 61°, by 6 grs.; at 66°, by 7 grs.; at 70°, by 8 grs.; and so on, till at about 100° the capacity of air for moisture is such that 20 grs. nearly can be held in solution before the air is saturated.

The difference between the amount of water in the air and that amount which could be in the air at that temperature shows the amount short of saturation.

The degree of humidity of the air expresses the ratio between the amount of water then mixed with it and the greatest amount possible to be held in solution at its then temperature, upon the supposition that the latter or saturated air is represented by 100, and when deprived of all

moisture by 0. Thus, suppose the water mixed with a certain mass of air to be one-half of the quantity which could be present in the same mass of air at its then temperature, the degree of humidity would in such a case be represented by 50, and would imply that there were present 50 hundredth-parts of the quantity of water which would then saturate the air. At the temperature of 32° the degree of humidity would be 50 when one grain of water was mixed with a cubic foot of air; whilst at 100° it would require 10 grs. to be present in the same mass of air to have the same degree of humidity.

The best series of hygrometrical observations in my possession made in India, are those at the observatories of Madras and Bombay.

From these it seems that the atmosphere is least moist upon the average of the whole year about two hours after noon, but this varies at different times of the year. The most moisture in the 24 hours is at a little before six in the morning, and the air is in a mean state about 9 or 10 o'clock both in the morning and evening. The daily curve of humidity is very nearly the opposite to that of temperature, the dryest time being about 1 or 2 p.m., at about the time of maximum temperature, and the wettest about sunrise, or minimum temperature; except in the months of June and July, when the moisture is greatest about midnight; and in August and September the increase of moisture after midnight is very small.

The monthly values of the hygrometrical elements at Madras for 18 years, and at Bombay for 12 years, are shown in the following tables:—

TABLE XXXII. showing the Mean Monthly Temperature of the Dew Point at Madras

MONTHS.	YEARS.																	Means, 18 Years.
	1833.	1834.	1835.	1836.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	
January -	64	65	70	68	—	69	66	70	73	71	66	67	66	66	65	67	67	67
February -	68	68	72	68	—	69	69	70	70	70	68	69	69	69	66	67	66	68
March -	69	68	75	69	—	73	72	74	74	73	72	73	72	70	70	70	68	71
April -	72	73	79	73	—	76	77	78	79	76	76	76	75	75	76	75	73	76
May -	73	77	78	71	—	76	75	78	77	77	76	73	76	73	73	74	73	76
June -	71	78	78	70	—	74	73	76	74	75	73	72	72	71	71	72	69	73
July -	71	79	78	72	—	73	73	74	73	73	73	71	72	72	71	71	70	73
August -	73	79	78	74	—	75	75	77	74	75	73	71	73	72	71	73	72	74
September -	74	79	79	74	—	77	76	77	79	77	73	74	73	70	73	71	72	75
October -	74	76	76	69	74	74	74	73	76	77	73	73	74	74	73	73	74	74
November -	71	74	74	—	74	71	72	73	73	72	67	69	69	71	71	71	69	71
December -	70	71	69	—	69	68	69	70	69	71	70	71	67	69	69	66	67	69
Means -	71	74	75	—	—	73	72	74	74	74	72	71	71	71	71	71	70	72

TABLE XXXIII. showing the Mean Monthly Temperature of the Dew Point, at Bombay.

MONTHS.	YEARS.												Means.
	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	
January -	65	64	63	62	60	56	56	62	63	66	65	64	64
February -	62	65	66	63	64	64	64	60	65	63	66	65	64
March -	71	69	69	69	68	68	67	68	69	70	70	70	68
April -	72	73	72	70	73	71	71	72	70	73	71	74	73
May -	76	75	73	74	73	73	74	74	76	75	76	78	75
June -	78	75	79	77	76	76	76	77	77	65?	76	75	76
July -	77	76	77	77	77	75	76	77	77	76	75	78	76
August -	75	75	75	76	75	75	74	76	74	74	76	76	74
September -	74	74	76	74	73	74	74	76	74	73	74	74	74
October -	75	76	74	75	74	74	74	74	75	73	73	74	74
November -	67	69	74	67	67	67	68	68	68	67	67	67	67
December -	64	67	62	66	63	64	62	67	64	65	62	66	64
Means -	71	72	72	71	70	70	70	71	71	70	71	72	71

TABLE XXXIV. showing the Mean Monthly Amount of Vapour in a Cubic Foot of Air at Madras.

MONTHS.	YEARS.																	Means.
	1833.	1834.	1835.	1836.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	
	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.
January -	6.1	6.6	7.8	7.4	—	7.2	6.8	8.0	8.6	8.2	6.8	7.1	6.8	6.8	6.6	7.1	7.1	7.2
February -	7.3	7.3	8.4	7.4	—	7.6	7.5	7.8	8.0	7.3	7.6	7.6	7.6	7.6	6.9	6.8	6.9	7.3
March -	7.6	7.4	9.5	7.7	—	8.6	8.8	9.1	9.1	8.8	8.4	8.6	8.4	7.9	7.9	7.9	7.2	8.1
April -	8.5	8.6	10.6	8.8	—	9.4	9.7	10.2	10.8	9.4	9.5	9.3	9.0	9.0	9.5	9.0	8.5	9.4
May -	8.5	9.6	10.3	8.1	—	9.3	9.1	10.3	9.1	10.0	9.3	8.4	9.3	8.6	8.4	8.7	8.6	9.3
June -	8.1	10.3	10.2	7.8	—	8.8	8.6	9.5	8.8	9.2	8.4	8.3	8.1	8.1	7.8	8.1	7.5	8.5
July -	7.9	10.7	10.1	8.4	—	8.7	8.7	8.8	8.5	8.7	8.5	8.1	8.3	8.3	7.9	8.1	8.1	8.7
August -	8.6	10.7	10.1	9.0	—	9.4	9.2	9.9	8.9	9.2	8.7	8.1	8.7	8.3	8.1	8.5	8.3	8.9
September -	8.9	10.7	10.7	9.1	—	9.9	9.7	10.0	10.5	10.0	8.6	8.9	8.5	7.8	8.7	8.1	8.3	9.1
October -	8.9	9.5	9.5	7.6	8.9	8.9	8.9	8.8	9.5	9.8	8.6	8.6	8.9	9.1	8.6	9.1	8.9	8.9
November -	8.2	8.9	9.2	—	8.9	8.2	8.4	8.7	8.7	8.5	7.2	7.6	7.6	8.0	8.0	8.1	7.6	8.2
December -	7.8	8.2	7.6	—	7.7	7.3	7.5	8.0	7.7	8.2	8.0	8.2	7.1	7.7	7.5	6.9	7.1	7.5
Means -	8.0	9.0	9.5	—	—	8.6	8.6	9.9	9.8	9.0	8.3	8.2	8.2	8.1	8.0	8.0	7.8	8.4

TABLE XXXV. showing the Mean Monthly Amount of Vapour in a Cubic Foot of Air, at Bombay.

MONTHS.	YEARS.												Means.
	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	
	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.
January -	6.6	6.4	6.2	5.9	5.6	5.0	5.0	6.1	6.2	6.8	6.6	6.6	6.4
February -	6.0	6.6	6.8	6.2	6.4	6.4	6.4	5.5	6.7	6.3	6.9	6.6	6.4
March -	8.0	7.6	7.6	7.6	7.4	7.4	7.1	7.4	7.6	7.9	7.9	7.8	7.4
April -	8.4	8.6	8.4	7.9	8.6	8.2	8.0	8.5	7.9	8.7	8.2	8.9	8.6
May -	9.4	9.2	8.7	8.9	8.7	8.5	8.8	8.8	9.5	9.0	9.5	10.1	9.0
June -	10.1	9.4	10.7	10.0	9.7	9.4	9.4	10.0	10.0	6.5	9.7	9.2	9.7
July -	9.8	9.5	9.8	9.9	9.8	9.4	9.5	9.8	9.9	9.5	9.4	10.1	9.5
August -	9.3	9.3	9.3	9.5	9.3	9.3	9.1	9.5	8.9	9.1	9.5	9.5	9.1
September -	9.0	9.1	9.5	9.1	8.8	9.1	9.1	9.5	9.1	8.8	9.0	9.1	9.1
October -	9.4	9.5	9.1	9.1	8.9	8.9	7.9	8.9	9.1	8.6	8.6	9.1	8.9
November -	7.2	7.6	8.6	7.0	7.4	7.0	7.2	7.2	7.2	7.2	7.1	7.2	7.2
December -	6.4	7.1	5.9	6.8	6.2	6.4	5.9	7.1	6.5	6.6	6.0	6.8	6.4
Means -	8.3	8.3	8.4	8.2	8.1	7.9	7.0	8.2	8.2	7.9	8.2	8.4	8.2

TABLE XXXVI. showing the Mean Monthly Amount of Vapour required to saturate a Cubic Foot of Air at Madras.

MONTHS.	YEARS.																	Means.
	1833.	1834.	1835.	1836.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	
	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.
January -	3.6	2.8	1.0	1.4	—	2.5	2.9	2.0	1.1	1.5	2.9	2.9	2.9	2.9	2.8	2.9	2.9	2.5
February -	3.0	3.0	1.0	2.0	—	3.0	2.5	2.5	2.0	2.0	3.0	3.0	3.0	3.0	3.4	3.4	3.4	3.0
March -	3.0	3.6	0.5	2.0	—	2.7	2.7	2.2	2.2	1.7	3.3	3.4	3.3	3.8	3.8	3.8	4.1	3.2
April -	3.9	2.7	0.0	2.2	—	3.0	3.1	1.8	1.9	3.0	3.7	4.3	4.2	4.2	3.7	4.2	4.7	3.0
May -	4.7	4.4	2.5	5.1	—	4.3	4.9	2.5	4.9	2.4	4.3	6.0	4.3	5.4	6.0	6.1	5.4	4.3
June -	5.1	2.5	1.8	5.0	—	4.8	5.4	3.7	4.8	3.6	6.0	5.3	5.9	5.1	7.0	5.9	6.9	4.7
July -	5.7	0.6	1.2	3.3	—	4.1	4.1	4.8	4.7	4.1	4.7	5.1	4.5	4.5	5.7	5.1	5.9	4.1
August -	3.4	0.6	1.2	1.6	—	2.3	3.6	1.8	3.5	3.6	4.1	5.1	4.1	4.5	5.1	4.7	5.3	3.5
September -	2.8	0.6	0.6	2.2	—	1.8	2.3	2.4	1.2	2.4	3.4	3.5	4.7	5.0	4.1	5.1	4.5	2.9
October -	2.8	1.8	1.1	3.7	2.8	3.5	2.8	2.2	1.8	1.2	2.7	3.4	2.8	2.2	3.4	3.4	3.5	2.8
November -	2.1	1.1	0.5	—	1.1	2.1	1.6	1.6	1.6	2.1	3.4	3.0	3.0	2.6	2.6	3.2	3.0	2.1
December -	2.5	1.5	1.5	—	2.0	3.0	2.5	2.0	2.0	1.5	2.0	2.1	2.9	2.0	2.5	3.4	2.9	2.5
Means -	3.5	2.1	1.0	—	—	3.1	3.2	2.5	2.6	2.4	3.6	4.0	3.8	3.7	4.1	4.2	4.3	3.2

TABLE XXXVII. showing the Mean Monthly Amount of Vapour required to saturate a Cubic Foot of Air at Bombay.

MONTHS.	YEARS.												Means.
	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	
	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.
January -	2.8	3.3	2.6	2.6	2.9	3.5	3.5	3.6	3.2	2.9	2.8	2.2	2.7
February -	3.1	2.8	2.9	3.2	3.3	3.3	3.3	3.9	3.3	3.7	3.4	2.8	3.3
March -	2.6	3.0	3.0	3.0	3.6	3.6	4.6	3.6	3.0	3.8	3.8	3.2	3.6
April -	3.3	3.4	3.3	3.8	3.4	3.8	4.4	3.9	3.8	4.1	3.8	3.5	3.4
May -	3.0	3.6	4.1	3.5	4.1	4.7	4.8	4.8	3.7	4.2	3.7	3.1	4.2
June -	1.2	2.3	0.6	2.4	2.3	3.0	3.0	2.4	2.4	5.5	2.3	3.6	2.3
July -	1.2	1.8	1.2	1.8	1.2	2.3	1.8	1.2	1.8	1.8	2.3	1.2	1.8
August -	1.7	1.7	1.7	1.8	1.7	1.7	2.2	1.8	2.8	2.2	1.1	1.8	2.2
September -	1.6	2.2	1.1	2.2	2.2	2.2	2.2	1.8	2.2	2.2	1.6	2.2	1.2
October -	2.3	1.8	2.2	2.9	2.8	2.8	3.8	2.8	2.9	2.7	2.7	2.2	2.8
November -	2.5	3.0	2.7	4.0	3.6	4.0	3.6	3.6	4.1	3.4	2.9	3.4	3.4
December -	3.3	2.9	4.1	2.9	3.2	3.3	4.1	2.9	3.8	2.8	3.1	2.9	3.3
Means -	2.4	2.7	2.5	2.8	2.9	3.2	3.4	3.0	3.1	3.3	2.8	2.7	2.9

TABLE XXXVIII. showing the Mean Degree of Humidity at Madras.

MONTHS.		YEARS.																	
		1833.	1834.	1835.	1836.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	Means.
January	-	63	70	89	84	—	75	71	79	89	84	71	71	71	71	70	71	75	
February	-	71	71	89	79	—	71	75	75	79	79	71	71	71	67	67	67	71	
March	-	71	67	94	79	—	76	75	80	80	80	72	72	72	68	68	68	72	
April	-	68	76	100	80	—	76	76	85	85	76	72	69	68	68	72	68	76	
May	-	64	69	80	61	—	69	65	80	65	80	69	58	69	61	58	59	61	
June	-	61	80	90	61	—	65	61	72	65	72	58	61	58	61	53	58	64	
July	-	58	95	90	72	—	68	68	65	64	68	64	61	64	64	58	61	68	
August	-*	72	95	90	85	—	80	72	85	72	72	68	61	68	64	61	64	72	
September	-	76	95	95	80	—	85	80	80	90	80	72	72	64	61	68	61	76	
October	-	76	85	90	68	76	72	76	80	85	90	76	72	76	80	72	72	76	
November	-	79	89	94	—	89	79	84	84	84	80	67	71	71	75	75	72	79	
December	-	75	84	84	—	79	71	75	79	79	84	79	79	71	79	75	67	75	
Means	-	69	81	91	—	—	74	73	79	79	78	69	68	67	68	66	65	72	

TABLE XXXIX. showing the Mean Degree of Humidity at Bombay.

MONTHS.	YEARS.												
	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	Means.
January -	70	67	70	69	65	57	57	63	66	71	70	74	70
February -	66	70	71	66	67	67	67	58	67	63	67	70	67
March -	75	71	71	71	67	67	60	67	71	68	68	71	67
April -	72	72	72	68	72	68	64	68	68	68	68	72	69
May -	76	72	68	72	68	64	65	65	72	68	72	76	68
June -	90	80	95	80	80	76	76	80	80	54	80	72	80
July -	90	85	90	85	90	80	85	90	85	85	80	90	85
August -	85	85	85	85	85	85	80	85	76	80	90	85	80
September -	85	80	90	80	80	80	80	85	80	80	85	80	83
October -	80	85	80	76	76	76	68	76	76	76	76	80	77
November -	75	71	76	63	67	63	64	67	64	67	71	67	67
December -	67	71	59	71	66	67	59	71	63	70	66	71	67
Means -	78	76	77	74	74	71	69	73	72	71	74	76	73

The monthly temperatures of the dew point have varied in—

January from 64° to 73° at Madras, and from 56° to 65° at Bombay.

February from 66° to 72° at Madras, and from 60° to 66° at Bombay.

March from 68° to 75° at Madras, and from 67° to 71° at Bombay.

April from 72° to 79° at Madras, and from 70° to 74° at Bombay.

May from 71° to 78° at Madras, and from 73° to 78° at Bombay.

June from 69° to 78° at Madras, and from 65° to 78° at Bombay.

July from 70° to 79° at Madras, and from 75° to 78° at Bombay.

August from 71° to 79° at Madras, and from 74° to 76° at Bombay.

September from 70° to 79° at Madras, and from 73° to 76° at Bombay.

October from 69° to 77° at Madras, and from 73° to 76° at Bombay.

November from 67° to 74° at Madras, and from 67° to 74° at Bombay.

December from 66° to 71° at Madras, and from 62° to 67° at Bombay.

Thus the change in this element one year with another—

In January amounts to 9° at both places.

In February " 6° " "

In March " 7° at Madras and 8° at Bombay.

In April " 7° " 4° "

In May " 7° " 5° "

In June " 9° " 13° "

In July " 9° " 3° "

In August " 8° " 2° "

In September " 9° " 3° "

In October " 8° " 3° "

In November " 7° at both places.

In December " 5° " "

The mean monthly amount of vapour in a cubic foot of air varied in—

January from 6.1 grs. to 8.6 grs. at Madras, and from 5.0 grs. to 6.8 grs. at Bombay.

February from 6.8 grs. to 8.4 grs. at Madras, and from 5.5 grs. to 6.9 grs. at Bombay.

March from 7.2 grs. to 9.5 grs. at Madras, and from 7.1 grs. to 8.0 grs. at Bombay.

April from 8.5 grs. to 10.8 grs. at Madras, and from 7.9 grs. to 8.9 grs. at Bombay.

May from 8.1 grs. to 10.3 grs. at Madras, and from 8.5 grs. to 10.1 grs. at Bombay.

June from 7.5 grs. to 10.2 grs. at Madras, and from 6.4 grs. to 10.7 grs. at Bombay.

July from 7.9 grs. to 10.7 grs. at Madras, and from 9.4 grs. to 10.1 grs. at Bombay.

August from 8.1 grs. to 10.7 grs. at Madras, and from 8.9 grs. to 9.5 grs. at Bombay.

September from 7.8 grs. to 10.7 grs. at Madras, and from 8.8 grs. to 9.5 grs. at Bombay.

October from 7.6 grs. to 9.8 grs. at Madras, and from 8.6 grs. to 9.5 grs. at Bombay.

November from 7.2 grs. to 9.2 grs. at Madras, and from 7.0 grs. to 8.6 grs. at Bombay.

December from 6.9 grs. to 8.2 grs. at Madras, and from 5.9 grs. to 7.1 grs. at Bombay.

Thus the change in this element one year with another—

In January amounts to 2.5 grs. at Madras, and to 1.8 gr. at Bombay.

In February amounts to 1.6 gr. at Madras, and to 1.4 gr. at Bombay.

In March amounts to 2.3 grs. at Madras, and to 0.9 gr. at Bombay.

In April amounts to 2.3 grs. at Madras, and to 1.0 gr. at Bombay.

In May amounts to 2.2 grs. at Madras, and to 1.6 gr. at Bombay.

In June amounts to 2.7 grs. at Madras, and to 4.3 grs. at Bombay.

In July amounts to 2.8 grs. at Madras, and to 0.7 gr. at Bombay.

In August amounts to 2.6 grs. at Madras and to 0.6 gr. at Bombay.

In September amounts to 2.9 grs. at Madras, and to 0.7 gr. at Bombay.

In October amounts to 2.2 grs. at Madras, and to 0.9 gr. at Bombay.

In November amounts to 2.0 grs. at Madras, and to 1.6 gr. at Bombay.

In December amounts to 1.3 gr. at Madras, and to 1.2 gr. at Bombay.

The mean monthly amount of vapour required to saturate a cubic foot of air varied in—

January from 1.0 gr. to 3.6 grs. at Madras, and from 2.2 grs. to 3.6 grs. at Bombay.

February from 1.0 gr. to 3.4 grs. at Madras, and from 2.8 grs. to 3.9 grs. at Bombay.

March from 0.5 gr. to 3.8 grs. at Madras, and from 2.6 grs. to 4.6 grs. at Bombay.

April from 0.0 to 4.7 grs. at Madras, and from 3.3 grs. to 4.4 grs. at Bombay.

May from 2.5 grs. to 6.1 grs. at Madras, and from 3.0 to grs. to 4.8 grs. at Bombay.

June from 1.8 gr. to 7.0 grs. at Madras, and from 0.6 gr. to 5.5 grs. at Bombay.

July from 0.6 gr. to 5.9 grs. at Madras, and from 1.2 gr. to 2.3 grs. at Bombay.

August from 0.6 gr. to 5.3 grs. at Madras, and from 1.1 gr. to 2.8 grs. at Bombay.

September from 0.6 gr. to 5.1 grs. at Madras, and from 1.1 gr. to 2.2 grs. at Bombay.

October from 1.1 gr. to 3.7 grs. at Madras, and from 1.8 gr. to 3.8 grs. at Bombay.

November from 0.5 gr. to 3.4 grs. at Madras, and from 2.5 grs. to 4.1 grs. at Bombay.

December from 1.5 gr. to 3.4 grs. at Madras, and from 2.8 grs. to 4.1 grs. at Bombay.

Thus the change in this element one year with another—

In January amounts to 2.6 grs. at Madras, and to 1.4 gr. at Bombay.

In February amounts to 2.4 grs. at Madras, and to 1.1 gr. at Bombay.

In March amounts to 3.3 grs. at Madras, and to 2.0 grs. at Bombay.

In April amounts to 4.7 grs. at Madras, and to 1.1 gr. at Bombay.

In May amounts to 3.6 grs. at Madras, and to 1.8 gr. at Bombay.

In June amounts to 5.2 grs. at Madras, and to 4.9 grs. at Bombay.

In July amounts to 5.3 grs. at Madras, and to 1.1 gr. at Bombay.

In August amounts to 4.7 grs. at Madras, and to 1.7 gr. at Bombay.

In September amounts to 4.5 grs. at Madras, and to 1.1 gr. at Bombay.

In October amounts to 2.6 grs. at Madras, and to 2.0 grs. at Bombay.

In November amounts to 2.9 grs. at Madras, and to 1.6 gr. at Bombay.

In December amounts to 1.9 gr. at Madras, and to 1.3 gr. at Bombay.

The mean monthly degree of humidity of the air has varied in—

January from 63 to 89 at Madras, and from 57 to 74 at Bombay.

February from 67 to 89 at Madras, and from 58 to 71 at Bombay.

March from 64 to 94 at Madras, and from 60 to 75 at Bombay.

April from 64 to 100 at Madras, and from 64 to 72 at Bombay.

May from 58 to 80 at Madras, and from 64 to 76 at Bombay.

June from 52 to 90 at Madras, and from 54 to 95 at Bombay.

July from 55 to 95 at Madras, and from 80 to 90 at Bombay.

August from 61 to 95 at Madras, and from 76 to 90 at Bombay.

September from 61 to 95 at Madras, and from 80 to 90 at Bombay.

October from 68 to 90 at Madras, and from 68 to 85 at Bombay.

November from 67 to 94 at Madras, and from 63 to 76 at Bombay.

December from 67 to 84 at Madras, and from 59 to 71 at Bombay.

Thus the change in this element one year with another.

In January amounts to 26 at Madras, and to 17 at Bombay.

In February „ 22 „ 13 „

In March „ 30 „ 15 „

In April „ 36 „ 8 „

In May „ 22 „ 12 „

In June „ 38 „ 41 „

In July „ 40 „ 10 „

In August „ 34 „ 24 „

In September „ 34 „ 10 „

In October „ 22 „ 17 „

In November „ 27 „ 13 „

In December „ 21 „ 12 „

Table XL. showing the Mean Monthly Hygrometrical Values at Madras and Bombay.

MONTHS.	Temperature of the Dew Point.				Weight of Vapour in a Cubic Foot of Air.		Weight of Vapour required to saturate a Cubic Foot of Air.		Degree of Humidity.	
	Madras.	Bombay.	Below the Tempe- rature of the Air.		Madras.	Bombay.	Madras.	Bombay.	Madras.	Bombay.
	°	°	°	°	grs.	grs.	grs.	grs.		
January - - -	67	64	9	10	7.2	6.4	2.5	2.7	75	70
February - - -	68	64	10	12	7.3	6.4	3.0	3.3	71	67
March - - -	71	68	9	12	8.1	7.4	3.2	3.6	72	67
April - - -	76	73	7	10	9.4	8.6	3.0	3.4	76	72
May - - -	76	75	11	11	9.3	9.0	4.3	4.2	69	68
June - - -	73	76	14	7	8.5	9.7	4.7	2.3	64	80
July - - -	73	76	12	5	8.7	9.5	4.1	1.8	68	85
August - - -	74	74	10	7	8.9	9.1	3.5	2.2	72	80
September - - -	75	75	9	5	9.1	9.3	2.9	1.7	76	85
October - - -	74	74	8	8	8.9	8.9	2.8	2.8	76	76
November - - -	71	67	8	12	8.2	7.2	2.1	3.4	79	67
December - - -	69	64	8	12	7.5	6.4	2.5	3.3	75	67
Means - - -	72	71	9.6	9.3	8.4	8.1	2.6	2.5	73	74

The numbers in the second and third columns show the monthly temperature of the dew point, and those in the fourth and fifth columns its depression below the temperature of the air at Madras and Bombay respectively; this depression is generally small. It is nearly uniform throughout the year at Madras, but differs at Bombay, where it is much larger in the winter than in the summer months. The numbers in the next two columns show the very large quantity of water mixed with the air, and which is differently distributed at the two places: the numbers in the next two columns show the amount of water needed to saturate a cubic foot of air; and a great difference exists between the amount at the two places in the summer months; and the last two columns show the monthly degree of humidity.

At Madras the driest month is June, and the most humid November. At Bombay the driest period of the year is from November to May, there being but little difference in the monthly degrees of humidity in the intervening months.

A great change takes place from April to May, and the air is very humid from June, the most so in July, and continues humid till October, when a considerable change takes place. The contrast in respect to the humidity between Madras and Bombay is very remarkable; in the summer months, at Madras the air is least moist, and is the most so in winter, while the reverse of this takes place at Bombay.

The average yearly results are shown in the bottom line of the several tables.

The variation of the mean annual temperature of the dew point is from 71° to 74° at Madras, and from 71° to 72° at Bombay.

Amount of water in a cubic foot of air, is from 7·8 grs. to 8·9 grs. at Madras, and from 7·0 grs. to 7·4 grs. at Bombay.

Amount required to saturate a cubic foot of air, is from 1·0 gr. to 4·3 grs. at Madras, and from 2·4 grs. to 3·4 grs. at Bombay.

Degree of humidity of the air, is from 65° to 79° at Madras, and from 69° to 78° at Bombay.

Thus the variations of the hygrometrical states of the air at the same place varies a good deal from year to year, and also varies very much at different places in the same year. Therefore no valuable deductions can be made from the observations I have collected. See Tables CXIV. to CXVII., CXXIV. to CXXVII., and CXXXIV. to CXXXVII.

The monthly and other periods of the several hygrometrical results will be found in the Tables LXXXIII. to LXXXVI. The monthly values are collected together in the following tables, arranged in the order of latitude, proceeding from south to north.

By looking over the results in these tables, there is no regular increase or decrease with either latitude or longitude in any section. The effect of elevation is everywhere clearly shown by the almost proportional lower reading of the dew point, less water present with the air, a nearer approach to saturation, and a higher degree of humidity; but very little can be inferred or used beyond these deductions. In no instance, as before remarked, has a direct determination of the dew point been made at high elevations; but in every case where such observations have been made, the dry and wet-bulb thermometers have alone been used.

TABLE XLI. showing the Average Hygrometrical State of the Air as deduced from 20 years' observation at the Royal Observatory, Greenwich.

MONTHS.	Dew Point Temperature.	Weight of Vapour in a Cubic Foot of Air.	Additional Weight required for Saturation.	Degree of Humidity.
January -	35	grs. 2·4	grs. 0·3	89
February -	34	2·3	0·4	85
March -	36	2·5	0·6	82
April -	40	2·9	0·8	79
May -	45½	3·4	1·1	76
June -	51	4·2	1·5	74
July -	54	4·6	1·6	76
August -	54	4·7	1·5	77
September -	51	4·2	1·0	81
October -	46	3·6	0·6	87
November -	40	2·9	0·4	89
December -	40	2·6	0·4	89
Means -	44	3·3	0·8	82

The average hygrometrical states of the air at different stations, or at small groups of stations near together, where their results have been accordant with each other, have been taken, and the general state of the moisture of the air over India will most readily be seen by glancing the eye over the following tables. At the same time their differences from England may also as readily be seen by comparing them with those of England, which are shown in the preceding table.

TABLE XLII. showing the Hygrometrical States of the Atmosphere at different Stations, or at small Groups of Stations near together.

MONTHS.	Dodabetta.				Madras.				Belgaum and Sattara.			
	Lat. 11° 25' N. Long. 77° 5' E.				Lat. 13° 6' N. Long. 80° 21' E.				Lat. 16° 46' N. Long. 73° 59' E.			
	8,640 feet.								2,290 feet.			
	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.
January -	40	grs. 2·8	grs. 1·6	64	67	grs. 7·2	grs. 2·5	75	57	grs. 5·0	grs. 3·6	58
February -	50	4·1	0·3	93	68	7·3	3·0	71	56	4·9	4·9	51
March -	45	3·4	1·5	70	71	8·1	3·2	72	59	5·4	5·3	50
April -	50	4·1	0·9	81	76	9·4	3·0	76	60	5·6	6·1	48
May -	53	4·5	0·7	87	76	9·3	4·3	69	66	6·8	4·1	61
June -	51	4·2	0·3	93	73	8·5	4·7	64	68	7·5	2·0	79
July -	51	4·2	0·3	93	73	8·7	4·1	68	67	7·3	1·9	80
August -	51	4·2	0·3	93	74	8·9	3·5	72	69	7·4	1·2	87
September -	51	4·2	0·3	93	75	9·1	2·9	76	67	7·3	1·6	80
October -	51	4·2	0·3	93	74	8·9	2·8	76	63	5·2	3·0	68
November -	50	4·1	0·3	93	71	8·2	2·1	79	61	5·9	3·3	64
December -	47	4·6	0·6	86	69	7·5	2·5	75	57	5·2	3·2	61
Means -	49	4·0	0·6	87	72	8·4	3·2	63	62	6·2	3·9	66

(continued.)

MONTHS.	Bellary and Secunderabad.				Mahableshwur.				Dapoolee and Bombay.			
	Lat. 17° 14' N. Long. 77° 46' E.				Lat. 17° 59' N. Long. 73° 30' E.				Lat. 18° 20' N. Long. 73° 4' E.			
	1,650 feet.				4,500 feet.				332 feet.			
	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.
January -	54	grs. 4·5	grs. 5·3	47	51	4·1	3·7	53	66	grs. 6·9	grs. 2·3	75
February -	56	4·8	6·2	44	47	3·5	4·5	44	67	7·2	2·6	73
March -	59	5·2	2·2	39	49	3·8	5·6	40	71	8·2	2·9	73
April -	64	6·4	6·9	49	53	4·3	6·0	41	75	9·5	2·9	76
May -	62	5·8	7·7	45	61	5·7	4·0	59	77	10·0	3·1	76
June -	67	7·0	6·2	54	66	6·9	1·4	83	73	8·7	4·0	69
July -	68	7·5	3·8	66	65	6·9	0·9	88	76	9·5	1·8	85
August -	69	7·4	3·8	66	65	6·8	0·5	94	75	9·3	1·6	85
September -	66	7·0	4·3	62	63	6·2	1·3	83	75	9·3	1·4	87
October -	66	7·0	3·6	65	64	6·6	0·9	88	73	8·7	2·4	78
November -	62	6·1	3·0	67	54	4·7	2·6	64	69	7·8	2·2	78
December -	57	5·0	3·6	58	53	4·4	2·9	60	64	6·4	3·0	69
Means -	63	6·2	4·6	55	57	5·3	2·8	66	71	8·4	2·5	77

(continued.)

TABLE XLII. showing the Hygrometrical States of the Atmosphere at different Stations—*continued*.

MONTHS.	Poona, Dhoolia, Ahmednuggur, and Seroor.				Rajcote Kurrachee, Deesa, and Hyderabad.				Thyet Myo.			
	Lat. 20° 27' N. Long. 74° 48' E.				Lat. 24° 28' N. Long. 72° 16' E.				Lat. 20° 18' N. Long. 92° 46' E.			
	1,613 feet.				244 feet.				240 feet.			
	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.
January -	55	4.6	3.6	57	48	3.7	3.7	50	46	3.4	4.9	41
February -	52	4.2	5.2	44	51	4.1	4.7	47	47	3.5	7.1	32
March -	50	3.9	7.3	36	56	4.8	6.8	42	45	3.2	8.5	27
April -	57	5.0	8.4	37	61	5.7	8.2	42	—	—	—	—
May -	63	6.3	7.0	48	69	7.3	7.8	48	69	7.4	5.4	58
June -	68	7.3	4.3	64	73	8.4	6.4	57	67	7.0	4.0	63
July -	70	7.8	2.5	76	75	9.0	4.5	67	75	9.4	2.3	80
August -	69	7.6	2.3	78	74	8.9	3.3	73	74	8.9	2.8	76
September -	69	7.7	2.1	78	71	8.1	4.0	67	75	9.1	2.9	76
October -	63	6.4	3.8	63	64	6.4	5.6	53	74	9.1	2.2	80
November -	55	4.8	4.5	52	50	3.9	6.1	39	65	6.6	2.8	70
December -	49	3.9	4.3	48	47	3.6	4.4	46	61	5.8	3.0	66
Means -	61	6.1	4.3	59	61	6.3	5.7	56	62	6.5	4.7	58

(continued.)

MONTHS.	Calcutta and Fort William.				Hazareebaugh and Kherwarrah.				Darjeeling.			
	Lat. 22° 34' N. Long. 88° 25' E.				Lat. 25° 21' N. Long. 82° 18' E.				Lat. 27° 2' N. Long. 88° 10' E.			
	1,550 feet.				7,000 feet.				7,000 feet.			
	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.
January -	62	5.9	2.5	69	50	4.1	3.0	58	38	2.6	0.7	77
February -	64	6.4	3.5	64	54	4.5	3.8	55	41	2.9	0.5	85
March -	72	8.3	3.9	68	57	4.9	4.8	50	45	3.4	0.8	80
April -	76	9.5	4.3	69	60	5.4	7.2	43	48	3.8	0.9	80
May -	79	10.4	3.5	75	67	7.1	6.8	55	54	4.7	0.7	87
June -	81	11.0	2.6	80	66	6.8	6.8	50	59	5.6	0.4	94
July -	80	10.7	1.9	85	69	7.4	5.2	60	60	5.8	0.4	94
August -	80	10.8	1.5	87	75	9.3	1.7	85	60	5.8	0.4	94
September -	81	11.0	1.6	87	71	8.2	2.9	74	58	5.4	0.4	94
October -	76	9.7	2.4	80	63	6.3	3.4	64	49	3.9	1.3	75
November -	69	7.7	2.6	75	52	4.5	3.1	59	43	3.1	1.1	74
December -	61	6.0	2.6	69	53	4.5	2.2	68	40	2.8	0.5	84
Means -	73	8.9	2.7	75	61	5.9	4.1	60	49	4.1	0.7	84

(continued.)

MONTHS.	Benares and Meerut.				Landour.				Peshawur.			
	Lat. 27° 8' N. Long. 80° 30' E.				Lat. 30° 27' N. Long. 78° 10' E.				Lat. 34° 20' N. Long. 71° 29' E.			
	585 feet.				7,000 feet.				1,056 feet.			
	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.	Temperature of Dew Point.	Mean Amount of Vapour in a Cubic Foot of Air.	Short of Saturation in a Cubic Foot of Air.	Degree of Humidity. Saturation = 100.
January -	51	4.2	2.3	65	27	1.7	1.6	49	39	2.7	1.3	67
February -	54	4.7	2.6	65	32	2.1	1.1	65	43	3.1	1.4	69
March -	58	5.3	4.9	55	36	2.4	2.8	45	56	4.9	1.5	77
April -	58	5.1	8.5	38	41	2.9	3.9	42	66	7.0	2.4	74
May -	71	8.1	6.8	54	53	4.4	3.9	53	62	6.0	6.4	48
June -	77	9.7	5.8	62	57	5.1	3.7	58	72	8.1	7.2	53
July -	82	11.7	2.0	86	63	6.3	1.7	78	74	8.8	6.9	56
August -	75	9.5	3.1	74	64	6.6	0.9	88	74	8.9	5.5	61
September -	77	10.1	2.1	82	59	5.5	1.5	78	65	6.4	6.8	49
October -	73	8.8	1.3	87	46	3.4	1.8	65	56	5.0	3.5	57
November -	61	5.8	2.3	72	34	2.3	1.7	57	45	3.3	2.5	58
December -	51	4.2	2.0	67	29	1.8	1.5	54	39	2.7	1.3	67
Means -	66	7.2	2.1	67	44	3.7	2.2	61	57	5.6	3.9	61

The places whose hygrometrical state seems to be the nearest to that of England are Dodabetta and Darjeeling. Landour, at the same elevation as Darjeeling, has the same annual temperature of the dew point, and the amount of water mixed with the air is nearly the same, but the amount of water required to saturate a cubic foot of air is three times as large as in England, and therefore the air is very much less humid than in England.

At all the other stations, the dew point is a great deal higher than in England, the water present in the air is everywhere greater, and the water required to saturate the air is also greater, so that the air is upon the whole year much less humid than in England, and particularly so in the winter months.

At some stations it is also less humid all the year round, as at Madras a little less; at Bellary and Secunderabad, always much less; and at Rajcote, Kurrachee, Deesa, Hyderabad, and the country intervening and adjacent, very much less: this part of India is the least humid of any, and at the extreme northern station of Peshawur.

At other stations, such as Belgaum and Sattara, Mahableshwur, Dapoolce, Bombay, Thyet Myo, Calcutta, and adjacent country, and so up to Benares and Meerut, the air is more humid in the summer months, and less humid in the winter months, than in England.

Upon the whole it seems that the heights ranging for the same hygrometrical states of the air as in England, differ but little if any from those ranging for the same temperature of the air as in England.

SECTION VIII.

On the Fall of Rain in India.

On the Fall of Rain in India.

The monthly, quarterly, half-yearly, and yearly falls of rain in the three presidencies, arranged in the order of latitude, will be found in the Tables CXXXIX. to CXLI., pages 920 to 943.

An inspection of the tables will show the fall of rain in every month: the most remarkable are at Mercara 55 inches in July; at Mahableshwur 92 inches in July, followed by 72 inches in August; at Malcolm Pait 72 inches in July. In the southern part of the coast rain seems to fall in every month; whilst in the northern parts, little or none falls in the months from November to April.

The following tables have been arranged in three divisions:—

1st. Those stations situated in the order of latitude on the west coast, forming Group I.

2nd. Those stations situated in the order of latitude on the east coast, forming Group II.

3rd. Groups of stations near to each other in the interior of the country, within certain limiting parallels of latitude and longitude, forming Groups III. to XIX.

By an inspection of the monthly falls of rain at stations in Group I., Table LXXXVII., it will be seen that generally the heaviest falls occur in June and July, but chiefly in the latter month. The largest fall in the table is 92 inches in July at Mahableshwur, with 42 inches in the preceding and 72 inches in the following months; thus in June, July, and August, the fall at this station is no less than 221 inches. At Malcolm Pait, in the same three months, the fall amounts to 187 inches, 72 of which fell in July. At several of the other stations the amount in this month is greater than 30 inches, at a few it exceeds 40 inches, and at Mercara in July the amount is 56 inches. These amounts exceed the annual fall at the extremity of the peninsula. In contrast, the fall of rain at Kotri and Kurrachee is exceedingly small; the largest in one month was $1\frac{1}{4}$ inch at Kotri; and $1\frac{3}{4}$ inch at Kurrachee.

In this group most singular differences therefore occur, starting from Cape Comorin and Vaurioor, at the southern extremity of Madras, the fall is small, amounting in the year only to 25 or 23 inches. Passing up the coast to Trevandrum the fall increases to 65 inches, to 85 at Quilon, to 105 at Cochín; then at all the stations on the coast south of 17° north latitude, the falls exceed 120 inches, excepting at Vingorla, which was about $1\frac{1}{2}$ inch less, whilst at Mercara the fall was as large as 143 inches. Passing still higher up the coast the falls exceeded 120 inches, till at Mahableshwur, the fall is no less than 254 inches. This station is at an elevation of 4,500 feet, in latitude $17^{\circ} 59'$ N. and longitude $73\frac{1}{2}^{\circ}$ E. Still passing northwards, at Bombay the fall is decreased to 73 inches, but at Tanna a little more north the fall is as large as 105 inches. Passing still more north the fall diminishes in amount; at Baroda it amounts to 35 inches only, at Rajcote to 27 inches, at Ahmedabad it is 24 inches; and following the same direction, we come to the driest part of India, where scarcely any

rain falls at all; at Kotri, for instance, in latitude $23^{\circ} 54'$ N., and longitude $68\frac{3}{4}^{\circ}$ E., less than 2 inches fall in the year, and at Kurrachee less than 5 inches.

We thus see that there are very remarkable discrepancies in the fall of rain on the Malabar coast, varying in amount from 28 inches at Cape Comorin to 143 inches at Mercara; and stations situated near together give very different results, so much so that no grouping of means can be taken, as applying to any extent of coast line.

An inspection of the tables forming Group II., Table LXXXVIII., will show the fall of rain monthly at several stations on the east coast of India. The largest in the table in one month is 32 inches in November at Nellore; the next in order $19\frac{1}{4}$ inches at Poonamallee, also in November; and south of latitude 14° the heaviest falls of rain seem to take place in this month; whilst on the opposite coast the heaviest falls occur in July: north of this parallel, viz., 14° , the heaviest falls occur in July and August, the largest of which, $14\frac{1}{4}$ inches, took place at Pooree.

Starting again from Cape Comorin, with its fall of 28 inches, and passing up the east or Coromandel coast, the fall of rain increases in amount, but to a much less extent than on the Malabar coast; at Palamecottah it amounts to 56 inches, at about Madras to 50 inches, reaching to 60 inches at Nellore: at more northern stations it varies between 34 inches and 50 inches; at Balasore, on the coast, in latitude $21\frac{1}{2}^{\circ}$ N. and longitude 87° E., the fall amounts to 31 inches only; and at a little higher up, and inland, at Midnapore to $22\frac{1}{4}$ inches.

These falls exhibit a great contrast to the very large falls on the opposite coast, but the same wide differences in the amount collected at adjacent places are shewn on this coast as was found to be the case on the western coast.

Group III., Table LXXXIX., includes all those stations from which I have returns, which are situated between the Malabar and Coromandel coasts, south of latitude 15° .

In this part of the country rain falls generally to small amounts in every month of the year, varying in amount from 20 $\frac{1}{2}$ inches at Combatore to 37 inches at Shenkottah. The average fall at the several stations, omitting that at Dodabetta is $28\frac{1}{4}$ inches. At Dodabetta, from two years' observations, at an elevation of 8,640 feet, the annual fall amounts to 101 inches, of which 20 fall in April, and about 12 inches in each of the last three months of the year.

By comparing the falls in this portion of the country with those at places on the adjacent coasts similarly situated with respect to latitude, we learn the following particulars:—

On the Malabar coast, with a mean longitude of about $75^{\circ} 50'$, the annual rain-fall varies from 105 to 143 inches, of which the greater part falls in the months from May to September.

In the central portion of the district, with a mean longitude of about $77\frac{1}{2}^{\circ}$, the annual fall varies from 21 to 37 inches, spread almost equally over the year.

On the Coromandel coast, with a mean longitude of about 79° , the annual fall varies from 42 to 56 inches, October and November being the wettest months.

Group IV., Table XC., includes stations in Bombay situated between latitudes $15^{\circ} 50'$ and $17^{\circ} 40'$ N., and longitudes 74° to 77° E.

The heaviest falls in this group, as in Group I., take place in the months of June, July, and August, but to a much less amount than in that group. The largest falls were at Belgaum; in the three months ending August the fall amounts to 31 inches, of which 15 inches were in July. The next in amount is Sattara, a station of very nearly the same elevation as Belgaum, in July nearly 12 inches, fall. Within this group rain generally falls during nine months of the year, the three months December to February being nearly free from rain.

The annual fall at Belgaum is about $51\frac{1}{2}$ inches, and the average of the other stations is about 30 inches.

Group V., Table XCI., is comprised between the latitudes $15^{\circ} 50'$ and $18^{\circ} 50'$ N., and longitudes 77° and $78\frac{1}{2}^{\circ}$ E.

At Kurnool, within this group, the largest monthly fall is in July, viz. 17 inches, and in the three months ending August at the same station 40 inches, the annual fall amounting to 72 inches nearly. At Bellary and Seroor the fall is about 21 inches, whilst at Secunderabad it amounts to $34\frac{1}{4}$ inches. The mean of these three stations gives $25\frac{3}{4}$ inches, as the average fall of rain over this part of the country.

Group VI., Table XCII., is comprised of stations in Bombay between latitudes 18° and $18\frac{1}{2}^{\circ}$ N., and longitudes $73\frac{3}{4}^{\circ}$ and $74\frac{1}{2}^{\circ}$ E.

The mean annual fall of rain at the two lower stations is $24\frac{1}{4}$ inches, whilst at the third station, Poorundhur, at the height of 4,200 feet, it amounts to $72\frac{1}{4}$ inches, of which 23 inches fall in July, and nearly 50 inches in the three months ending August.

Group VII., Table XCIII., consists of three stations only, between the latitudes $19\frac{1}{2}^{\circ}$ and 21° N., and longitudes $73\frac{1}{4}^{\circ}$ and $75\frac{1}{2}^{\circ}$ E.

These results differ very much, varying from $28\frac{1}{2}$ inches at Nassik to three times as much at Dhoolia, viz., $83\frac{1}{4}$ inches, whilst at Aurungabad the amount is intermediate, viz., 44 inches. The mean of the three is $52\frac{1}{4}$ inches nearly. The greatest monthly fall is 21 inches, in July, at Dhoolia; in the four months ending September the fall at this station amounts to 66 inches. At Malligaum, a station between Nassik and Dhoolia, but nearer to the latter than the former station, a small fall of rain in the year is reported to take place, but I have been unable to obtain sufficient information to speak decidedly upon this point.

Group VIII., Table XCIV., comprises stations situated to the east of Group VII., between the latitudes 21° and $23\frac{1}{4}^{\circ}$ N., and longitudes 78° and 80° E.

At all the six stations comprising this group, the heaviest falls occur in July. The four wet months are June to September. The results agree pretty well together. The mean annual fall is about 40 inches.

Group IX., Table XCV., is comprised of stations between the latitudes $23\frac{1}{2}^{\circ}$ and $25\frac{1}{2}^{\circ}$ N., and from longitudes 69° to 75° E.

This group of stations includes Mount Aboo, at the height of 4,000 feet, where the fall of rain in the four months ending September amounts to 62 inches, 26 of which fall in July.

The annual fall at the other stations varies from 16 to 34 inches, and averages 24 inches in the year. The fall at Mount Aboo in the year is 65 inches nearly, the excess of 41 inches is due to its elevation.

Group X., Table XCVI., is comprised of stations between latitudes 20° and $27\frac{1}{2}^{\circ}$ N., and longitudes $91\frac{1}{4}^{\circ}$ and 93° E.

The fall of rain throughout this extent of country is very large, and it includes that remarkable station at which, so far as I know, the heaviest falls of rain take place at any place in India, viz., Chirrapoongee, at an elevation of 4,500 feet: the fall of rain at this station in April is 22 inches, in May 62 inches, in June 195 inches, in July, 121 inches, in August $103\frac{1}{2}$ inches, in September 75 inches nearly, and in October 29 inches; within the seven amounting to a fall of no less than 608 inches: there, none falls in November and December, and less than 5 inches in the first three months of the year. Very heavy falls take place at some of the other stations: at Akyab $59\frac{1}{2}$ inches fell in June; at Sylhet the falls are very heavy, and but one month, viz., November, is free from rain.

The annual fall of rain at eight other stations, omitting Sylhet and Chirrapoongee, is 78 inches; at Sylhet the fall is 210 inches, and Chirrapoongee $612\frac{1}{2}$ inches in the year.

Group XI., Table XCVII., comprises stations situated W. of the last group, and nearly parallel to it, between latitude $23\frac{1}{2}^{\circ}$ and $26\frac{1}{4}^{\circ}$ N., and longitudes $89\frac{1}{4}^{\circ}$ and $91\frac{1}{4}^{\circ}$ E.

These stations yield results of a similar character to those of Group IX., Table XCV., the fall is large at all of them, and not differing very greatly from each other. The falls in June are the heaviest, varying from 19 inches to 43 inches. No rain falls in the last two months of the year, and but little in the first four months. The average fall from the six stations is $93\frac{1}{4}$ inches, and for the district of country between $91\frac{1}{4}$ and $91\frac{3}{4}$ may very fairly be assumed to have a fall varying from 78 to 92 inches; and if so, the very large area of 5° of longitude and 7° or 8° of latitude, partakes of these very heavy falls.

In Group XII., Table XCVIII., stations are situated to the west of the last group, and comprise the country between latitudes $22\frac{1}{2}^{\circ}$ and $23\frac{1}{4}^{\circ}$ N. and longitudes $88\frac{1}{2}^{\circ}$ and $89\frac{1}{4}^{\circ}$ E.

This space includes Calcutta, immediately round which rain falls heavily in the four months ending September, amounting to very nearly the annual fall. Some rain, however, seems to fall in every month at Calcutta, the average annual amount is about 60 inches. At two stations in the same longitude, a little to the N., the average annual fall is about 38 inches, and perhaps the mean fall within the above limits may be considered as about $49\frac{1}{2}$ inches. At Midnapore, a station nearly in the same parallel of latitude as Calcutta, but $1\frac{1}{2}^{\circ}$ W. of it, the fall of rain in one year 1851, was $22\frac{3}{4}$ inches only.

Group XIII., Table XCIX., consists of four stations only, between latitudes $24\frac{1}{4}^{\circ}$ and $26\frac{1}{4}^{\circ}$ N., and longitudes 85° to $85\frac{1}{2}^{\circ}$ E.

The fall of rain at these stations is small, amounting to an average in the year less than 30 inches: the fourth station, viz., Ultra Mullay, has a fall of 230 inches, but this increased amount is accounted for by its height of 4,600 feet. At this station rain falls in every month of the year, in October to the amount of 50 inches.

Group XIV., Table C., includes stations between latitudes $25\frac{1}{4}^{\circ}$ and $23\frac{3}{4}^{\circ}$ N., and longitudes 87° and $88\frac{3}{4}^{\circ}$ E.

The results of these four stations agree pretty well among themselves, and the average fall may be considered for this part of the country as 45 inches.

Group XV., Table CI., is comprised of three stations, situated a little to the north and west of Calcutta, between latitudes $23\frac{1}{4}^{\circ}$ and $25\frac{3}{4}^{\circ}$ N., and longitudes 87° and 88° E.

The results are accordant with each other, and about one-half only of the fall at Calcutta; the average annual fall is $30\frac{1}{2}$ inches.

Group XVI., Table CII., comprises five stations, situated N.E. and W. of Calcutta, between the latitudes $23\frac{1}{2}^{\circ}$ and $24\frac{1}{4}^{\circ}$ N., and longitudes $85\frac{1}{2}^{\circ}$ and $88\frac{1}{2}^{\circ}$ E.

The results, with the exception of that from Bauliah, the extreme north station of the group, are accordant with each other. The heaviest monthly falls are in June and July, and the average fall for the year from all the stations is $46\frac{1}{2}$ inches. At Darjeeling, a station some degrees N. of Bauliah, in latitude $22^{\circ} 25'$ N., and longitude $87^{\circ} 19'$ E., at an elevation of 7,000 feet, the fall of rain in the year amounts to 124 inches, a small amount for its elevation.

Group XVII., Table CIII., includes stations between latitudes 25° and $26\frac{3}{4}^{\circ}$ N., and longitudes $81\frac{3}{4}^{\circ}$ and $83\frac{1}{2}^{\circ}$ E.

There are five wet months within these limiting parallels; the largest fall, $61\frac{3}{4}$ inches, is at Goruckpore, the height of which I do not know; the mean of the five stations is 42 inches, and is probably near the truth for this part of the country.

Group XVIII., Table CIV., comprise those stations, within the latitudes 26° and $30\frac{1}{2}^{\circ}$ N., and longitudes $76\frac{3}{4}^{\circ}$ and $79\frac{3}{4}^{\circ}$ E.

Within these limits there are 12 stations, one of which, Nynee Tal, is 6,400 feet in height, and, as was to be expected, yields the largest rain-fall in the group. In the four wet months, June to September, at this station, the falls amount to $79\frac{1}{2}$ inches, of which 23 inches fall in July and 29 in August. The fall for the year is 96 inches.

The station Meerut, within this group, seems remarkable for its small fall of rain, 18 inches only in the year, but this result is entitled to but little weight, as the observations are for one year only, and I cannot learn anything about the position of the gauge, and the same remarks apply to Roorkee. The mean of all, excepting Nynee Tal, give $30\frac{1}{4}$ inches as the annual fall of rain for this district.

A little greater elevation than Nynee Tal, viz. 7,000 feet, and situated N.E. of it, in latitude $30^{\circ} 27'$ N. and longitude $78^{\circ} 10'$ E., the annual fall of rain at Landour is 93 inches nearly.

Group XIX., Table CV., is comprised of three stations, between the latitudes $30^{\circ} 34'$ and $30^{\circ} 57'$ N., and longitudes 74° and $78\frac{1}{4}^{\circ}$ E., and the four extreme north stations are added to the group.

The three stations are Mean Meer, Loodiana, and Ferozepore: rain falls in small amounts in the first nine months of the year, and none or to very small amounts in the remaining three months, the annual falls are $16\frac{1}{4}$ inches, $16\frac{1}{2}$ inches, and $18\frac{1}{4}$ inches, respectively, giving a mean annual fall of 17 inches only.

In nearly the same longitude as Mean Meer, but at a little more than a degree greater north latitude, the fall at Punjab amounts to nearly 57 inches in the year, 23 inches of which fall in July.

At Meera, which is in $32^{\circ} 37'$ N. and $70\frac{1}{2}^{\circ}$ E., the annual fall of rain is 50 inches nearly, 23 inches of which fall in July.

At the two extreme north stations, viz., Rawul Pindi, in latitude $33^{\circ} 34'$ N. and longitude $73^{\circ} 5'$ E., at an elevation of 1,500 feet, the fall returned for the year 1859 was $17\frac{1}{2}$ inches only; and at Peshawur, in latitude $34^{\circ} 20'$ N. and longitude $71^{\circ} 29'$ E., and at an elevation of 1,056 feet, the annual fall of rain is less than 14 inches.

REMARKS on the CLIMATE of STATIONS in the PRESIDENCY of BENGAL.

Bengal Presidency.

Lies between latitude 20° and 31° N., and longitude 74° and 91° E., and is within the basin of the Ganges. This presidency is much the largest of the three into which India is divided. It includes the districts of Assam, Cachar, Arakin, the Tenasserim provinces, and the possessions in the straits of Malacca, as Penang, Singapore, &c.: the most southern of which reaches within one degree of the Equator. The high table lands and high districts lie to the west and north. The climate presents every variety.

Straits Settlements.—Singapore.

Latitude, $1^{\circ} 16'$ N. Longitude, $103^{\circ} 53'$ E.

Height above sea, 30 ft.

The nearest hill of any height is Bukel Timee, 5 or 6 miles distant from the station, which is open and freely

exposed to the winds. A gentle breeze almost daily moderates the heat; the land or jungle wind is the coldest; the sea breeze being sensibly warmer, and often produces lassitude, and sometimes fever.

The climate is moist, moderately hot; not variable; and is damp from the constant rain and its proximity to the sea. Dust is seldom troublesome.

Straits Settlements.—Penang.

Latitude, between 5 14' and 5° 29'. N.

Longitude, 100° 25' E.

Height above sea, a few feet.

A hill 2,500 ft. in height, is 4 miles distant. The station, is exposed to the sea breeze only, which is generally light and healthy.

It rains frequently, though not constantly, all the year round, this, with the sea air, and occasional light breezes, renders the climate decidedly good. In comparison with India generally the thermometer averages 5° or 10° less. These good effects are somewhat counteracted by the relaxing nature of the climate, owing to a powerful sun converting the moisture into steam, and to the remarkable absence of motion in the air, particularly in the evening.

Merqui.

Latitude, 12° 27' N. Longitude, 98° 42' E.

Height above sea, 200 ft.

There are hills of some height on the opposite bank of the river.

The station is open to both land and sea breezes. The former blow from May to October, and the latter during the other months of the year.

The climate is considered the best in Burmah. The air is moist and the temperature variable. The nights are always cool, and hence sleep is refreshing.

Tavoy.

Latitude, 14° 7' N. Longitude, 98° 18' E.

Height above sea, 12 ft.

The nearest mountain is the Ox's Hump, between 30 and 40 miles east of the station, which is exposed to a sea breeze during the earlier months, and to a cold easterly land wind towards the end of the year.

Shway Gheen, Martaban, Province Burmah.

Latitudes, 18° 6' N.; 16° 30' N.

Longitudes, 96° 46' E.; 97° 40' E.

Height above sea, 125 ft.

There are mountains about 20 miles distant from the station, which is freely exposed to all winds. The sea breeze is occasionally felt.

The climate is dry only during the months of February, March, April, and the early part of May. It is very damp during the rest of the year, and being never very hot or very cold, its variability is not great. Fogs are rare. During the dry season the air is loaded with smoke and particles of burnt matter, from the jungles being on fire on all sides.

Tonghoo.

Latitude, 18° 57' N., 40 miles from Burmese frontier.

Longitude, 96° 30' E., 160 miles from the coast.

Height above sea 300 ft.

The nearest range of mountains are distant about 12 miles.

From November to February cold northerly land winds prevail. During the cold season dysentery cases are aggravated, and during the southerly winds fevers prevail.

The climate for a tropical one is good; from November to February the nights and mornings are cold; during the day it is dry and hot, with heavy dews at night, and fogs in the morning. From the 1st of March till the end of May it is hot and sultry. From June to October close and damp. During the hot season the station is enveloped in clouds of dust.

Rangoon. British Burmah.

Latitude, 26° 48' N. Longitude, 96° 10' E.

Height above sea varies from a few feet to 80 ft.

There are no mountains within 100 miles of the station, which is open and freely exposed; there are no ungenial cold, variable, or land winds; the sea breeze blows freely at certain seasons.

The climate is dry from the middle of October until the middle of May. Heavy dews and mists prevail during January, February, and March. The day heat is excessive from March till May, but a refreshing sea breeze generally sets in about 4 p.m.; the nights and mornings are cool. The temperature usually varies about 20° in the 24 hours.

Thyet Myo.

Latitude, 20° 18' N. Longitude, 92° 46' E.

Height above sea 240 ft.

There is a range of small hills, 3 miles S.S.W. of the station, which is open where houses are built, but the jungle grows close up to the confines, and therefore it is not freely exposed to the winds. There is no sea breeze.

The character of the climate, as compared with Indian stations generally, is that of greater moisture of atmosphere and more clouded state of sky.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 84° in December to 101° in April.

The low night temperature varies from 53° in January to 78° in May, August, and September.

The mean annual temperature of the air is about 80°; the mean daily range 19°.

The annual fall of rain is about 48 in., of which 17 in. fall in the month of June, and 33 in. in the three months, June, July, and August.

Cuttack.

Latitude, 20° 28' N. Longitude, 85° 55' E.

Height above sea, 80 ft.

A range of mountains extends within 20 miles of the station, which is, generally speaking, fully exposed to the winds. The land wind is prevalent during the N.W., and a sea breeze during the S.W. monsoon. The latter, by modifying the temperature during the hot season, exercises a salutary effect.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 76° in December to 96° in May.

The low night temperature varies from 61° in December to 81° in June.

The mean annual temperature is about 79°; mean daily range 13°.

Seetabuldee.

Latitude, 21° 10' N. Longitude, 79° 9' E.

Height above sea, 939 ft.

The nearest mountain is Ramakonah, 25 miles distant from the station, which is open and freely exposed to the winds.

The climate is good. It is hot from March 15 to June 15; wet till September 30, and during the remainder of the year moderately cool.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 74° in December to 99° in May.

The low night temperature varies from 61° in January to 92° in May.

The mean annual temperature is about 82°, mean daily range 8°.

The annual fall of rain is about 47 in., of which 13 in. fell in June, 12½ in. in July, and 11 in. in August, making 43½ in. in the three months.

Latitudes, 22° to 34°.

Dera Ismael Khan.

Latitude, 22° N. Longitude, 71° E.

This station is situated at the northern extremity of the Dera, and on the right bank of the Indus.

There is considerable variation of climate between the different seasons in this part of the trans-Indus country. During the warm weather, for five or six months of the year, the heat is generally intense, and of a dry character, while during the winter months the weather is sometimes extremely cold; a sharp cutting wind blowing from the W. over the snow-covered tops of the Saliman range. The rainy season is of very short duration, and but little rain falls during the year.

The following are the approximate mean monthly values of temperature.

The high day temperature varies from 81° in January to 97° in May.

The low night temperature varies from 62° in January to 84° in June.

The mean annual temperature is about 80°, mean daily range 14°.

Fort William, Calcutta.

Latitude, 22° 34' N. Longitude, 88° 25' E.

Height above sea, 18 ft.

Nearest elevation, the Rajmahal Hills, 130 miles distant, During the cold season the prevailing N. and N.W. winds are bracing and invigorating. In the hot weather

the prevailing S. and S.S.E. winds are from the sea, and their usual beneficial effect is much lower. The temperature of the station is high, but the extremes of heat are moderated by contiguity to the ocean, rivers, and lakes. The atmosphere is generally moist. The elevation of the thermometer during the hot, and depressions during the cold seasons, are not so great as up the country, and the climate is more equable though more humid.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 77° in December to 94° in May.

The low night temperature varies from 59° in December to 81° in June.

The mean annual temperature of the air is about 82°; mean daily range 13°.

The annual fall of rain is about 61 inches, of which 40 inches fell in three months ending August.

Dum Dum.

Latitude, 22° 38' N., 8 miles from Calcutta.

Longitude, 88° 30' E., 10 miles from Barrackpore.

Height above sea, 18 ft.

Nearest mountain is Parisnath, 121 miles from the station, which, as a general rule, is not exposed to cold or variable winds, but is under the influence of the N.E. and S.W. monsoons; the latter is the sea-breeze.

The climate of Dum Dum, as of all Lower Bengal, is very moist. The weather is not very cold, as in the N.W. provinces, and never so hot, dry, and trying, even in the hot season, as up the country. There is a thick mist nearly every morning, hanging over the station, for a month before the hot season commences. There is no dust at any time sufficient to render the air impure, or other admixture affecting the atmosphere unfavourably.

The temperature about Calcutta is more tropical than in several of the districts of India further south.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 72° in December to 97° in May.

The low night temperature varies from 58° in January to 82° in June and July.

The mean annual temperature of the air is about 78°; mean daily range 14°.

The fall of rain averages about 60 in. in the year.

Barrackpore.

Latitude, 22° 45' N. Longitude, 88° 23' E.

This station is situated on the left bank of the Hooghly, 16 miles above Calcutta.

The rainy season commences generally about the 20th of June.

The following are the approximate mean monthly values of temperature.

The high day temperature varies from 72° in December to 97° in May.

The low night temperature varies from 58° in January to 82° in June and July.

The mean annual temperature of the air is about 78°; mean daily range 14°.

Raneegunge.

Latitude, 23° 35' N. 126 miles N.W. of Calcutta.

Longitude, 87° 10' E.

Height above sea, 370 ft.

Nearest mountain 30 miles distant from the station, which is open and freely exposed to the prevailing winds.

The climate is good, with no great or unusual variability, but is subject to heavy storms of sand and dust.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 71° in December to 97° in May.

The low night temperature varies from 56° in January to 82° in June and July.

The mean annual temperature of the air 78°; mean daily range 14°.

The annual fall of rain is about 60 in.

Hazareebagh.

Latitude 24° N. Longitude, 85° 24' E.

Height above the sea, 1,900 feet. Elevated table land.

With the exception of the little detached hills from 300 to 600 feet high, there are no considerable mountains, or higher table-lands in the vicinity.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 72° in December to 97° in May.

The low night temperature varies from 56° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range 14°.

The annual fall of rain is about 53 in.

Berhampore.

Latitude, 24° 5' N. 118 miles from Calcutta.

Longitude, 88° 17' E.

Height above sea, 76 ft.

The Ragmahal range of hills are 40 miles distant from the station, which is exposed to land winds from the W. and N.W., from October to March, and to E. and S.E. from April to September. Squalls with rain from the N.W. frequently occur in April and May, and their effect is always beneficial.

The climate is damp. There are frequent fogs in the early mornings, especially during the cold weather. The heat is very oppressive during April, May, and June, but is often reduced for two or three days at a time, by squalls from the N.W.

The temperature of this station is recorded as low as 44° in January, but in June it is as high as 109°.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 75° in December to 100° in June.

The low night temperature varies from 51° in January to 77° in December.

The mean annual temperature of the air is 77°; mean daily range 22°.

The annual fall of rain is about 50 inches, of which 30½ inches fall in the three months ending August, and 11 inches in three months ending November, the wettest month is July, the rain fall amounting to 13½ inches.

Goonah.

Latitude, 24° 39' N. Longitude, 77° 17' E.

Height above sea, 1,800 ft.

450 miles from the sea.

192 " " Mhow.

179 " " Indore.

191 " " Agra.

During the hot season the wind blows from the S.W. generally; during the rainy season the S.E. is prevalent; and during the cold season, the N.W. The west wind is hot, the east wind damp, and the N.W. cold and dry. During the prevalence of the hot winds there is generally a lull from sunset to sunrise. Previous to the setting in of the rainy season calms often occur, and the heat then is oppressive.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 76° in January to 97° in May.

The low night temperature varies from 57° in January to 83° in June.

The mean annual temperature is about 79°; the mean daily range 14°.

The annual fall of rain is about 30 inches.

Chunar.

Latitude, 25° 5' N., 16 miles from Benares.

Longitude, 83° E.

Height above sea, 250 ft.

The nearest table-land is 1½ mile distant from the station, and is about 200 ft. above its level.

The fort in which the troops are mostly located, from its great elevation, is freely exposed to winds. The rest of the station is open to winds only from the river side. The station is very little exposed to cold or variable winds, or to land winds, except in the fort; it is, however, exposed to the river breeze, which is pleasant, and generally healthy; but sometimes induces colds and fevers at the termination of the rainy season.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 76° in January to 103° in June.

The low night temperature varies from 53° in December to 81° in June.

The mean annual temperature is 80°; mean daily range 22°.

The annual fall of rain is about 50 inches; of which 36 inches fall in three months, June, July, and August.

Hamirpore.

Latitude, 25° 10' N. Longitude, 74° 43' E.

Distant 40 miles from Cawnpore.

" 84 " Lucknow.

In the hot season the weather is very sultry indeed, but tempered to a great degree by the presence of trees. Dust

storms frequently occur; during the cold season the nights and mornings are sometimes very cold, fires being acceptable.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 77° in December to 96° in June.

The low night temperature varies from 57° in January to 83° in June.

The mean annual temperature is about 79° ; mean daily range 15° .

The annual fall of rain is about 30 inches.

Chirrapoongee; Khasia Hills.

Latitude, $25^{\circ} 14' N.$ Longitude, $91^{\circ} 45' E.$

Height above sea, 4,118 ft.

The station is open, and freely exposed to every wind.

The climate is healthy, but the moisture is excessive during six months of the year. The temperature is equable; during the rainy and cold seasons, however, it is foggy. The air is cold and invigorating, and there is no impurity from dust.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 58° in December to 74° in May.

The low night temperature varies from 47° in December to 68° in July.

The mean annual temperature is about 64° ; mean daily range 9° .

The average fall of rain is about 613 inches, of which 490 fall in the three months ending August; the wettest month is June, the fall being about 243 inches.

Dehree.

About six miles to the E. of the Kymore Hills.

This station is situated on the Grand Trunk Road, 86 miles from Benares.

Shinghotty.

This is a station on the Grand Trunk Road, for the reception of troops passing along by bullock train.

The climate seems good for Europeans. The cool season is pleasant, and during the hot season there is always cool air at night.

Benares.

Latitude $25^{\circ} 17' N.$, 74 miles E. of Allahabad.

Longitude, $83^{\circ} 4' E.$

Height above sea, 270 ft.

The Hill fort of Rhotasgurrh is on the nearest higher ground.

The station is not exposed to cold or variable winds. The prevailing winds are east and west, the latter being the more prevalent throughout the year; sudden vicissitudes are rare.

The climate of Benares, like its geographical position, is intermediate between that of Bengal and the North-western Provinces. The cold is less intense, and the heat less scorching than that of the North-west Provinces, and it is much drier than Bengal. It is not subject to sudden changes of temperature, but there are considerable diurnal alterations, especially at the commencement of the cold season. The atmosphere is generally loaded with dust during the hot westerly winds.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 68° in December to 98° in May.

The low night temperature varies from 59° in December to 88° in May.

The mean annual temperature is about 78° ; mean daily range 7° .

The annual fall of rain is about 37 inches, of which 29 fall in the six months, April to September.

Allahabad.

Latitude, $25^{\circ} 27' N.$ Longitude, $81^{\circ} 50' E.$

Height above sea, 368 ft.

Due south from this, running east and west, are the Kymore Hills, upwards of 2,000 ft. in height. From Mirzapore, on the Ganges, a branch of this range, in some places 1,000 ft. high, is within 15 miles.

In the dry season the air is frequently heavily laden with dust, and dust storms, at times violent, occur.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 71° in December to 98° in May.

The low night temperature varies from 54° in January to 83° in June.

The mean annual temperature is about 78° ; the mean daily range 15° .

The annual fall of rain is about 35 inches.

Jhansi.

Latitude, $25^{\circ} 32' N.$ Longitude, $78^{\circ} 34' E.$

Height above sea, 765 ft.

The surrounding country is void of vegetation and the soil rocky.

The prevalent winds are W. and S.W.

The climate is one of peculiar and intense heat.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 73° in December to 98° in May.

The low night temperature varies from 55° in January to 83° in June.

The mean annual temperature is about 79° ; mean daily range 15° .

The annual fall of rain is about 35 inches.

Dinapore.

Latitude, $25^{\circ} 38' N.$, 375 miles from Calcutta.

Longitude, $85^{\circ} 1' E.$

Height above sea, 212 ft.

Nearest mountain, Burhee, distant 120 miles from the station, which is tolerably open. The prevailing winds are the east before and during the rains, April to September, and the west for the rest of the year.

The climate is generally a medium one, between the damp of Bengal and the drought of the N.W. provinces. It is tolerably dry in the cold weather, yet not so much as to wither up the grass; neither is the heat in April, May, and June, nor the cold in November, December, and January, so great as in the north-west. It is tolerably free from dust, and moderately variable only. Fog occasionally in November and December.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 69° in December to 98° in May.

The low night temperature varies from 53° in January to 83° in June.

The mean annual temperature is about 78° ; mean daily range 15° .

The annual fall of rain is about 30 inches.

Ghazepore.

Latitude, $25^{\circ} 49' N.$ Longitude, $80^{\circ} 48' E.$

The station lies on the banks of the Ganges.

The nearest mountain range is the Kyanore, 70 miles from the station, which is open. The wind varies much between the E., N.W., and W. The station is quite out of the influence of the sea breeze.

The climate is not very variable; the cold season is bracing. During the hot season, when the wind is from the W., it is dry and hot, and there is much dust in the air.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 74° in December to 105° in May.

The low night temperature varies from 56° in December to 83° in July.

The mean annual temperature is about 82° ; mean daily range 20° .

The annual fall of rain is about 47 inches.

Lucknow, Roy Bareilly, Fyzabad, Gondah, Seetapore.

Latitudes, $26^{\circ} N.$ Longitudes, $81^{\circ} E.$

Heights above sea, 360 ft. about.

The distance of Lucknow from the nearest hills is 100 miles; Roy Bareilly, 150 miles; Fyzabad, 70 miles; Gondah, 50 miles; and Seetapore, 70 miles.

The climate of the provinces, as in most other parts of India, is divisible into the cold, hot, and rainy seasons. The cold season sets in at the beginning of October, and is at its height in December, when the night temperature is low enough to freeze water. Ice is also made in January, and sometimes even so late as towards the end of February. The cold season ends in March. Heavy dew often falls in the winter months, and there are not unfrequent showers of rain. The hot season sets in towards the end of April, and hot winds blow throughout May and June till the rains commence, which they commonly do at the end of June. During this season dust storms are frequent, and

often very violent, and while it lasts the air in the day is more or less charged with fine dust.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 66° in December to 100° in May.

The low night temperature varies from 53° in January to 82° in June and September.

The mean annual temperature is about 79°; mean daily range 16°.

The annual fall of rain averages from 30 to 40 inches.

Goruckpore.

Latitude, 26° N. Longitude, 82° E.

Contiguous on the west to the Oude territory.

The hot westerly winds which are generally so prevalent in the more westerly stations in April, May, and June, seldom occur at Goruckpore.

From its proximity to the lower range of the Himalaya, much rain usually falls in this district; the fall, however, is not confined to the regular rainy season of other stations, as there is rain throughout the year, though in greater abundance during the season from June to September.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 71° in December to 98° in May.

The low night temperature varies from 53° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range 15°.

The annual fall of rain is about 62 inches.

Azringhur.

Latitude, 26° 10' N. Longitude, 83° 15' E.

59 miles N.E. of Benares.

44 miles N.W. of Ghazeepore.

Morar.

Latitude, 26° 15' N., 75 miles from Agra.

Longitude, 78° E.

The hot westerly wind generally commences here in April, at first blowing only during the day, but afterwards continuing during the greater part of the night. Frequent dust storms occur during this season of the year, accompanied with rain, hail, and thunder; they come on suddenly, and though severe are but of short duration. The hot winds cease about the middle of June, and are succeeded by the rains, which continue till September, the average annual fall being 50 inches.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 73° in December to 98° in May.

The low night temperature varies from 54° in January to 83° in June.

The mean annual temperature is about 79°; mean daily range, 15°.

The annual fall of rain is about 50 inches.

Seepree.

Latitude, 26° 21' N. Longitude, 84° 30' E.

Height above sea, 1,700 ft.

70 miles south of Gwalior, on the high road from Agra to Bombay.

The station is open on all sides. The prevailing winds are,—in the cold season, N.W.; in the hot season, W.; and in the rainy season, S.E.; but variable.

The climate of Seepree is good; cool and pleasant throughout the year; while Morar is parched and dried up, excessively hot, and requiring punkahs night and day, Seepree is green and fresh to a degree seldom seen in India, and so cool that a punkah is seldom required.

The following are the approximate mean monthly values of temperature:—

The mean high day temperature varies from 70° in December to 97° in May.

The mean low night temperature varies from 53° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range, 15°.

The annual fall of rain is about 35 inches.

Kherwarrah.

Latitude, 26° 42' N. Longitude, 79° 12' E.

Height above sea, 1,200 ft.

The nearest mountain is the Kummulnath, about 30 miles distant from the station, which is open, and much

exposed to land winds, but not immediately to the sea-breeze. The land wind from the east is unhealthy.

During March, April, May, and till the 20th June, the climate is hot and dry; from the 20th June till the 20th September, the temperature is lower, more equable, and the air loaded with exhalations; from the 20th of September to the 20th of November the vicissitudes are of daily occurrence. The air is cold, the weather variable, and fogs prevail.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 74° in January and December to 103° in May.

The low night temperature varies from 52° in December to 84° in May.

The mean annual temperature is about 78°; mean daily range 18°.

The annual fall of rain is about 27 inches; of which, 20 fall in the three months, June to August; 12 inches fall in the month of July.

Shahjehampore.

Latitude, 27° N. Longitude, 80° E.

This station is situated between the provinces of Rohilcund and Oude.

The N. and E. wind often blow for weeks together in the hot season. They are very unhealthy from blowing over an extent of jungle.

The climate is fitful, and the rains are less prolonged and regular than at other stations.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 71° in December to 98° in May.

The low night temperature varies from 53° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range, 16°.

The annual fall of rain is about 32 inches.

Darjeeling.

Latitude, 27° 2' N. 36 miles from nearest part of the plains.

Longitude, 88° 18' E.

Height above sea, 7,000 ft. to 7,600 ft.

The station is situated on the western side of a mountain, surrounded by much more elevated mountains at a considerable distance.

The station is open and freely exposed to the wind; but there is very little. It chiefly blows from the S. and S.E., and its effect is beneficial.

The climate is temperate and damp; there is much fog and mist in the rainy season.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 50° in January to 65° in June, August, and September.

The low night temperature varies from 39° in December, January, and February, to 58° in July, August, and September.

The mean annual temperature is about 54°; mean daily range, 10°.

The annual fall of rain is about 124 inches.

Agra.

Latitude, 27° 11' N. Longitude, 77° 53' E.

Height above sea, 800 ft.

Nearest mountain land is at Futtarpore Seckra.

The station is not exposed to cold or variable winds.

The climate from the end of October to the beginning of April is cool, clear, and healthy; it is very hot and dry, and not unhealthy, till the end of June, when exposure to the sun must be avoided. Till the end of September it is hot and moist.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 73° in December to 98° in May.

The low night temperature varies from 53° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range, 15°.

The annual fall of rain is about 28 inches.

Delhi.

Latitude, 28° 39' N. Longitude, 77° 18' E.

Height above sea, 800 ft.

The climate is malarious and unhealthy for Europeans. Delhi is considered one of the hottest places in India. The hot winds blow with great fury for three or four months in the year. The rainy and cold seasons are tolerably agreeable, but all the year round it is infected with hordes of small

flies, which with the dust, form one of its plagues. The rains commence generally in the latter end of June, and last, with many intermissions, to the end of September, sometimes extending to November, and vary in quantity as much as in duration. In some seasons so low a quantity as 10 inches has been measured.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 70° in December, to 99° in May.

The low night temperature varies from 50° in January, to 83° in June.

The mean annual temperature is about 78°, mean daily range 17°.

The annual fall of rain, 25 inches.

Meerut.

Latitude, 28° 59' N. Longitude, 77° 46' E.

Height above sea, 900 ft.

Nearest mountains, Sewalek range, 70 miles from the station, which is open, and freely exposed to cold winds in the months of November, December, January, and February. There are land winds also, generally from east or west, the latter being the more prevalent and healthy.

The climate is good, being dry for a great portion of the year and not variable. Fogs are very rare. There is much dust during the dry seasons.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 69° in December to 103° in May.

The low night temperature varies from 50° in January and November to 85° in July.

The mean annual temperature is 77°; mean daily range 19°.

The annual fall of rain is about 18 inches; the rain fall at this station is not very remarkable, it being about the quantity which falls in a dry year on the east coast of England.

Nynee Täl.

Latitude, 29° 20' N. Longitude, 79° 30' E.

Height above sea, 6,400 ft.

The station is in a valley in the heart of the mountains, it is perfectly open, and exposed to winds which are bracing and conducive to health.

The climate is excellent. In the rains the air is damp; but at other times it is remarkably dry and pure.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 64° in January to 83° in May.

The low night temperature varies from 28° in January to 59° in July.

The mean annual temperature is 60°; mean daily range 29°.

The annual fall of rain is about 96 inches; of which 67 fall in the three months ending with August; the wettest month is August, the fall being 29 inches.

Roorkee.

Latitude, 29° 53' N. Longitude, 77° 57' E.

The Himalaya mountains, are distant about 40 miles from the station, which is generally very open. A cool wind in the hot weather blows at nights from the north, and is pleasant and healthy.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 69° in December to 99° in May.

The low night temperature varies from 50° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range 17°.

The annual fall of rain is about 10 inches.

Dera Ghazee Khan.

Latitude, 30° 4' N. Longitude, 70° 54' E.

Height above sea, 200 ft.

The nearest mountains are the Sooliman range, 40 miles west of the station, which is not exposed to cold or variable winds, or to land or sea breezes.

As a rule very little rain falls in the district, and the climate may be said to be dry, though the air is always more or less charged with moisture from the proximity of canals, irrigated fields, and the river Indus. For the same reason

also the temperature is lower, and the air freer from dust than in other parts of the district, beyond the influence of the cultivation.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 73° in December to 99° in May.

The low night temperature varies from 51° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range 18°.

The annual fall of rain is about 15 inches.

Umballa.

Latitude, 30° 23' N. Longitude, 76° 44' E.

Height above sea, 1,050 ft.

The nearest mountain land is the Himalaya, 35 miles from the station, which is not exposed to cold or variable winds, or to the sea breeze, and the hot land winds that prevail at one season of the year, are not unhealthy.

The climate is generally a healthy one. It is dry and hot for three months of the year, moist and hot for three more, temperate for two, and cold and bracing for the remaining four. It is neither variable nor foggy; the atmosphere, however, of the entire district is more or less affected by dust from April till July.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 76° in December to 113° in June.

The low night temperature varies from 37° in January and December to 76° in June and August.

The mean annual temperature is 79°; mean daily range 39°.

The annual fall of rain is about 26 inches.

Landour (Convalescent Depôt).

Latitude, 30° 27' N. Longitude, 78° 10' E.

Height above sea, 7,000 ft.

The station is exposed to winds from the plains, and more frequently from the interior hills.

The climate of Landour, like that of most hill stations, is very moist for some months of the year, but there is no peculiarity in the nature of the atmosphere excepting that due to elevation.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 69° in December to 99° in May.

The low night temperature varies from 50° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range 18°.

The annual fall of rain is about 93 inches.

Mean Meer.

Latitude, 30° 34' N., 6 miles S.E. of Lahore.

Longitude, 74° 4' E.

Height above sea, 1,128 ft.

The nearest mountain range is 100 miles distant from the station, which is remarkably open. A cold N.E. wind blows during the cold months, which augments considerably the sensation of cold.

The climate is dry. The thermometer in a northerly-covered verandah stands at 107° at 4h. p.m. in hot weather; after a dust storm the fall may be 19°. Fogs during the cold weather are rare. During the hot weather the air is loaded with dust.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 64° in January to 98° in May.

The low night temperature varies from 45° in January to 82° in June.

The mean annual temperature is 75°; mean daily range 19°.

The annual fall of rain is about 16 inches, of which 13½ fall in the six months ending September.

Kussowlie.

Latitude, 30° 54' N. Longitude, 77° 3' E.

Height above sea, 6,650 ft.

The station of Kussowlie is situated on the lower range of the Himalayas, and is free without undue exposure to the wind, from almost every quarter.

The climate is very good, except during the S.W. monsoon.

The annual fall of rain is about 70 inches.

Ferozepore.

Latitude, 30° 55' N. Longitude, 74° 35' E.

Height above the sea, 720 ft.

The nearest mountain is Kangra, 90 miles from the station, which is open to the land winds but no sea-breeze. During the summer months frequent dust storms arise with great violence from every quarter, without rain, loading the atmosphere with dust, which on subsiding leaves the air pure, and contributes greatly to the healthiness of the station.

The climate is dry; free from any great variation. From December to March inclusive are the most healthy months, and August and September the most unhealthy. Fevers, particularly those of an intermittent kind, are the prevailing diseases, and in severe hot weather Europeans may suffer, though rarely, from attacks of heat apoplexy.

Rain falls less frequently than in the generality of other stations, except those of Sind.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 72° in January to 106° in June.

The low night temperature varies from 47° in January to 84° in June.

The mean annual temperature is 78°; mean daily range, 22°.

The annual fall of rain is about 14 inches.

Loodiana.

Latitude, 30° 55' N. Longitude 75° 54' E.

Height above sea, 900 ft.

Nearest mountains, the Himalayan range, 70 miles N.E. of the station, which is exposed sometimes to hot land winds from the west, but most frequently from the east.

The climate is dry and the heat great from April to October. In the winter season the nights are cold, and it sometimes freezes to a slight extent. Fogs are rare. During the hot season the air is frequently laden with dust and small sand.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 69° in December to 99° in May.

The low night temperature varies from 48° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range 18°.

The annual fall of rain is about 17 inches.

Jullundur.

Latitude 31° 21' N. Longitude, 75° 31' E.

Height above the sea, 937 ft.

The nearest mountains are 28 miles north; a broken ridge, extending for 70 miles N., and varying from 2,000 to 5,000 ft. above the level of the sea.

The station is open to all the winds that blow, and their effect upon health is good.

The climate is good, with only three months of rainy season, July, August, September; the other months are generally dry, with occasional dust and thunderstorms; the nights become cold about October.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 70° in December to 99° in May.

The low night temperature varies from 49° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range 18°.

The annual fall of rain is about 57 ins.

Punjab.—Unritsir and Gorindgurh.

Latitude, 31° 40' N. Longitude, 74° 45' E.

Height above sea, 900 ft.

The station is open, and freely exposed to the prevailing winds. The prevailing winds blow about N.W. and S.E.; those from the N. and W. are generally designated the hot winds, during the months of April, May, and June, and prevail generally, with occasional intervals, the whole year.

The S.E. winds prevail in the rainy months, July, August, September, and part of October. The N.W. winds are healthy, even when the heat is excessive, and this can be easily accounted for, by the air being so dry and free from moisture. The S.E. winds are loaded with moisture, and when they begin to blow, towards the end of June, are indicative of the rainy season, and certainly act, from this

cause alone, on the general health, as well as being the medium through which malaria is conveyed to the lines.

The following are the approximate mean monthly values of temperature:—

The high day temperature varied from 61° in January to 92° in June.

The low night temperature varied from 44° in December to 86° in June.

The mean annual temperature is about 73°; mean daily range 13°.

The annual fall of rain is about 57 inches; of which 52½ inches fall in the six months ending September; the heaviest fall occurred in the month of July, viz., 23 inches.

Kangra.

Latitude, 32° 5' N. Longitude, 76° 18' E.

Height above plains, 2,500 feet.

The European soldiers have had uninterruptedly good health at this station. Its situation is favourable in every way, and conducive to health, sheltered and shaded by the surrounding hills, yet in an elevated position, 2,500 ft. above the level of the plains, and open to the snowy range of the Kooloo Hills, from which cool breezes blow at night-time nearly all the year round.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 68° in December to 99° in May.

The low night temperature varies from 47° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range 18°.

The annual fall of rain is about 25 inches.

Sealkote.

Latitude, 32° 29' N., 63 miles N.N.E. of Lahore.

Longitude, 74° 33' E.

Height above sea, 900 ft.

Nearest mountain land 30 miles from the station, which is open, and freely exposed to the winds.

The climate of this station is remarkably healthy, and suited to the European constitution; very variable, June, July, and August being very hot. Monsoon not very heavy; the cold is very great in December, January, February, and for five months of the year. The air is particularly free from dust and impurities.

The following are the approximate mean monthly values of temperature:—

The high day temperature varied from 63° in January to 98° in June.

The low night temperature varied from 51° in January and February to 81° in June.

The mean annual temperature is about 75°; mean daily range 17°.

The annual fall of rain is about 29 inches.

Jhelum.

Latitude, 32° 56' N. Longitude, 73° 47' E.

Height above sea, 1,000 feet.

100 miles N.N.W. from Lahore.

66 miles S.S.E. from Rawul Pindi.

The station is generally surrounded by high ground.

The climate appears to be a desirable one for six months of the year, from November to May. The temperature during the hot season is high, averaging from 80° to 90°, but not so oppressive as at Lahore. The station of Rawul Pindi appears for convalescents more favourable than this station.

Jhelum, is conveniently situated on the Grand Trunk road, between Peshawur and Lahore.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 68° in December to 100° in May.

The low night temperature varies from 45° in January to 83° in June.

The mean annual temperature is about 78°; mean daily range 18°.

Rawul Pindi.

Latitude, 53° 34' N., 50 miles from Attock.

Longitude, 75° 5' E., 20 miles from Himalaya's lower range.

Height above sea, 1,500 ft.

There is a range of mountains 15 miles distant from the station, which is open and freely exposed to the winds. The

winds that prevail are wholesome dry winds, generally from the N.W.; the S.E. winds indicate rain.

The climate of Rawul Pindi has been proved by 10 years' experience to be decidedly the finest in the plains of India.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 68° in December to 100° in May.

The low night temperature varies from 46° in January to 83° in June.

The mean annual temperature is about 79°; mean daily range 18°.

The annual fall of rain is about 18 inches.

Murree.

Latitude, 34° N. Longitude, 73° E.

Height above sea, 7,800 ft.

The upper portion of Murree is open and freely exposed to every wind; the lower part is sheltered from N.E. and E. winds. During the winter and spring months N. and N.E. winds prevail, and their effect upon health is invigorating. During the summer months W. and N.W. winds prevail, and bring with them dense fogs and rains.

This station is a sanitarium.

Peshawur.

Latitude, 34° 20' N. Longitude, 71° 29' E.

Height above sea, 1,056 ft.

The mountain of Tarturrah, about 10 miles distant from the station, which is situated where it is freely exposed to such winds as circulate in the valley. It is not exposed to cold or variable winds, but during the cold season the wind blowing off the snow is naturally sharp, but it has no injurious effect on health.

The climate of Peshawur is exceedingly trying to weak constitutions, chiefly owing to the great changes from heat to cold and from dryness to moisture; it is this variability of climate that affects the health of the troops. The air is generally free from dust.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 60° in January to 102° in June.

The low night temperature varies from 44° in January to 81° in July.

The mean annual temperature is about 74°; mean daily range 19°.

The annual fall of rain is about 14 inches.

Nowsheera.

Latitude, 34° 20' N. Longitude, 73° 54' E.

This station is nearly equidistant between Attock and Peshawur. It is situated in a valley on the right bank of the Cabul river, and is surrounded by high land.

The climate is dry and hot. It is subject to dust storms. In August 1858 the station was entirely submerged by the overflow of the Indus, causing the destruction of all the private bungalows and the native lines; from its low situation such inundations are not unlikely, either from the overflow of the Cabul or Indus rivers.

REMARKS on the CLIMATE of different STATIONS in the PRESIDENCY of BOMBAY.

Bombay Presidency.

Lies between latitude 14° and 29°, and between longitude 66° and 77°, comprising a narrow strip of the peninsula on the W. and N.W. sides. This presidency is the smallest of the three into which India is divided. A part of the great table land of the Deccan belongs to it, and to the north of them a part of the Malwah table land bounded N.W. by the Arrawulli mountain range, which separate the basins of the Ganges and Indus. Among the hill ranges and upon the higher tracts there are many fine valleys and plains. The climate for the most part is pretty good, owing to the influence of the sea, and the extended coast, and elevated land of the interior, except in Scindia, some low tracts on the west, in the neighbourhood of Bombay, the Indus delta, and part of Guzerat

Aden.

Latitude, 12° 45' N. Longitude, 45° 15' E.

Height above sea 123 ft. (the cantonment).

There are high and lofty hills in the distance.

The station is exposed to no cold winds. With S.W. monsoon from May to September the heat is excessive. At the other seasons a fresh cool sea-breeze blows constantly.

From its vicinity to the sea the climate is equable throughout the year, and in general there is much moisture in the atmosphere. The temperature is pretty high, and the sun's rays are always very powerful. At times, especially during the hot months, clouds of dust envelop the camp.

Jacobabad.

Height above sea, 220 ft.

The nearest mountain is 60 miles distant from the station, which is perfectly open. It is exposed to fresh dry cold winds in the winter months, and in the summer to fiery hot winds.

The climate during the greater part of the year is the driest in the world. The heat in summer is excessive, rendering it quite unfit as a station for European soldiers.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 77° in January to 109° in June.

Low night temperature varies from 44° in January to 90° in June.

Mean annual temperature is about 81°; mean daily range 27°.

Annual fall of rain is about 8½ inches.

BOMBAY PRESIDENCY.

Stations on or near the coast ranging between 15° N. and 19° N.

Vingorla.

Latitude, 15° 50' N., 215 miles S. of Bombay.

Longitude 73° 41' E.

Height above sea, 20 ft.

A few small hills only within sight of the station; it is well exposed to the sea breeze, a compound of the west, which are the prevailing winds. The land wind, which is that from the E.N.E., is usually of short duration.

There is no considerable variation in the climate. It is never very cold, and the heat is moderate, but from heavy dews it is occasionally damp at night.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 82° in August and September to 88° in April and May.

Low night temperature varies from 72° in January to 80° in May.

The mean annual temperature is about 85°; mean daily range 9°.

Annual fall of rain is about 118 inches; of which 41 inches fall in the month of July, and 115 inches in the six months, April to September.

Dharwar.

Latitude, 15° 50' N. Longitude, 75° 10' E.

Height above sea, 2,482 ft.

There is no mountain near the station, which is exposed to the sea breeze. The land or east wind blows from December to February.

The climate is good from November to February; it is dry and cool. There is a great deal of moisture in the air from March to June when the rains commence. From February to June the climate is generally hot by day but cool at night. The climate is never very cold; fog prevails occasionally in the mornings of the hot season.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 77° in August and September to 92° in March.

Low night temperature varies from 61° in January to 77° in May.

The mean annual temperature is about 80°; mean daily range 13°.

Annual fall of rain is about 34 inches, of which 20½ inches fall in the three months, June to August, 9·7 inches falling in August.

Belgaum.

Latitude, $15^{\circ} 52'$ N. Longitude, $74^{\circ} 42'$ E.

Height above sea, 2,260 ft.

70 miles from the coast, 30 miles from Western Ghats.

During the monsoon the wind blows from the W.; in the cold season the prevailing wind is from the E., and during the hot season from the same quarter, veering however to the W. during the latter part of the day.

The heat is greatest during April and May, but a sea breeze generally rises during the afternoon, continuing throughout the night.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 78° in August to 97° in April.

Low night temperature varies from 57° in January and December to 66° in April, May, June, and July.

The mean annual temperature is about 74° ; mean daily range 23° .

Annual fall of rain is about 50 inches; about 15 inches fall in July, and 34 inches in June, July, and August.

Kulladghee.

Latitude, $16^{\circ} 11'$ N., 71 miles E.N.E. of Belgaum.

Longitude, $75^{\circ} 33'$ E.

Height above sea, 1,750 ft.

The nearest mountain is 50 or 60 miles distant from the station, which is open and freely exposed to winds.

The climate throughout the year may be considered tolerably good. It is dry, with the exception of the monsoon months.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 85° in December to 104° in April.

Low night temperature varies from 60° in January and December to 74° in March, April, and May.

The mean annual temperature is about 81° ; mean daily range 24° .

Annual fall of rain is about 24 inches.

Kolapore.

Latitude, $16^{\circ} 42'$ N., 185 miles S.E. from Bombay.

Longitude, $74^{\circ} 18'$ E., 70 miles S. of Sattara.

Height above sea, 1,797 ft.

The nearest mountain is three miles distant from the station, which is open and freely exposed to the prevailing winds. They are generally strong; the land or N.E. wind blows from November to February. The sea breeze or S.W. wind commences in March, and blows during the greater part of the day and night.

During the cold season, from November to February, the climate is dry, the winds blowing generally from the N. and E.; dews fall in the early morning, which are moist and fresh till an hour after sunrise. The climate generally is temperate, there is no severe cold during any of the seasons. The atmosphere is not rendered impure by dust, except very temporarily, and the climate is good.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 77° in January, July, August, and December to 89° in May.

Low night temperature varies from 67° in January and December to 77° in May.

The mean annual temperature is about 76° ; mean daily range 9° .

Annual fall of rain is about 39 inches; $6\frac{1}{2}$ inches fall in July, and $12\frac{1}{2}$ inches in three months, June, July, and August.

Rutnagherry.

Latitude, $17^{\circ} 0'$ N. Longitude, $73^{\circ} 20'$ E.

Height above sea, 150 ft.

The nearest mountains are the Syndree range of Ghats, at a distance of 30 miles from the station, which is open to all winds. The heat of the summer months is moderated by fresh northerly sea breezes. The climate is damp during the monsoon, and dry in the forenoon during the prevalence of land winds from November to February. The climate may be described as generally moist, warm, and relaxing, with an annual range of about 20° , and a diurnal range not exceeding 12° . It is not affected by dust, and other admixtures affecting the atmosphere.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 84° in August to 93° in May.

Low night temperature varies from 70° in January and December to 77° in May, June, and September.

The mean annual temperature is about 81° ; mean daily range 14° .

Annual fall of rain is about 127 inches; $41\frac{1}{2}$ inches fall in June, and $93\frac{1}{2}$ inches in June, July, and August.

Sattara.

Latitude, $17^{\circ} 40'$ N., 60 miles from coast.

Longitude, $74^{\circ} 2'$ E.

Height above sea, 2,320 ft.

The fort hill is distant about $1\frac{1}{2}$ mile from the station, which is open; subject to land winds (E. and N.E.) and to the sea breeze (W.S.W.), the latter modified by distance from the ocean; both prevail with tolerable regularity, according to the season and time of day.

The climate generally considered is good for three months. The air is hot and dry, but not very exhausting. In the rains it is fresh, not damp or chilly, and the temperature very equable. The cold in the winter months is not invigorating.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 74° in August to 92° in April.

Low night temperature varies from 63° in December to 75° in April and May.

The mean annual temperature is about 76° ; mean daily range 12° .

Annual fall of rain is about 38 inches; about 13 inches fall in July, $25\frac{1}{4}$ inches fall in June, July, and August.

Dapoollee.

Latitude, $17^{\circ} 48'$ N. 55 miles N. of Rutnagherry.

Longitude, $73^{\circ} 16'$ E.

Height above sea, 600 ft.

The nearest table land is that of the Deccan.

The station is not exposed to cold or variable winds, nor freely to land winds, but fully to sea breezes.

The climate is divided into three seasons; 1st, the cold season, from December to the end of February; 2nd, the hot season, from March till June, increasing in heat; and the 3rd, or rainy season, from June till October. October and November are close hot months.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 80° in August to 93° in April.

Low night temperature varies from 61° in January and December to 76° in May.

The mean annual temperature is about 81° ; mean daily range 18° .

Annual fall of rain is about 122 inches; 97 inches fall in June, July, and August, of which $4\frac{1}{2}$ inches fall in July.

Poorundhur (Sanitarium).

Latitude, $18^{\circ} 12'$ N. Longitude, $73^{\circ} 54'$ E.

Height above sea, 4,200 ft.

The climate of this station is good and equable, the monthly mean temperature of the year ranging from 60° to 80° . The year is divided into the three seasons, hot, rainy or monsoon, and the cold. The hot season begins in March, and terminates about the middle of June; the station at this season is marked by the general absence of hot winds, and the almost total exemption from hot nights, a cool fresh breeze from the N.W. generally blowing from sunset to sunrise. The rainy season extends from June to October; the gloomy state of the weather, the absence of all sunshine for weeks together, combined with the impossibility of the men taking exercise without getting wet through, tend to produce an injurious influence and great depression of spirits. During this season one or two breaks generally occur in the weather, and continue for a week or ten days; and then it is difficult to imagine a more beautiful climate. During the cold season a strong dry wind prevails.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 63° in August to 83° in April.

Low night temperature varies from 59° in December to 71° in April.

The mean annual temperature is about 67° ; mean daily range 9° .

Annual fall of rain is about 72 inches; 23 inches fall in July, and about 50 inches in the three months ending August.

Poona.

Latitude, $18^{\circ} 30'$ N. Longitude, $74^{\circ} 0'$ E.

Height above sea, 1,800 ft.

The nearest mountain is Singhur, 13 miles distant from the station, which is open and freely exposed to the winds. From November to February cold land winds prevail, with occasional sea breezes; from March to June hot, scorching, variable winds; and for the rest of the year the prevailing winds are from the sea.

The climate is good; there is almost a total freedom from fogs, and dampness is only observable during the rains, and then mild in degree. Dust storms are rare.

The following are the approximate mean monthly values of temperature:—

High day temperature varies from 78° in August to 95° in April.

Low night temperature varies from 58° in January and December to 74° in May.

The mean annual temperature is about 77° ; mean daily range 18° .

Annual fall of rain is about 22 inches.

Kirkee.

Latitude, $18^{\circ} 30'$ N., 70 miles S.E. of Bombay.

Longitude, $74^{\circ} 15'$ E., 50 miles E. of the coast.

Height above sea, 1,900 feet.

The nearest mountain is Surghur, 15 miles distant from the station, which is open and freely exposed to winds. From November to February cold land winds prevail, with occasional sea breezes; from March to June there are hot, scorching, variable winds, and for the rest of the year the prevailing winds are from the sea. The cold and rainy seasons are beneficial to the health of the troops, but the hot season is injurious.

The climate is good. There is almost a total absence of fog; dampness is only observable in the rains, and then is mild in degree. Dust storms are very rare, and do not affect perceptibly the purity of the atmosphere.

Colaba.

Latitude, $18^{\circ} 53'$ N. Longitude, $72^{\circ} 52'$ E.

The climate is equable, neither so hot in summer nor so cold in winter as most other places in India. The greatest temperature noted during the 10 years, 1850 to 1860, was 97° ; the lowest on record was 53° , in February 1847. January is the coolest month; December and February, somewhat less so, are much alike; then November and March; April and May are the hottest months. The monsoon months, June to September, vary little in temperature.

The land winds (S.E.) prevail during the dry season. A S.W. wind or sea breeze prevails during the monsoon months, sometimes with great strength.

Wet-bulb thermometer.

The temperature of evaporation or wet-bulb thermometer increases, though irregularly, from the month of January to July, and falls from July to December. About the middle of June the sun attains its extreme southerly declination, and the rain, which falls in torrents, keeps the atmosphere saturated with humidity.

In June and July the temperature of evaporation coincides with the mean annual temperature of air. The presence of clouds in the sky has the effect of increasing the temperature of evaporation.

BOMBAY PRESIDENCY.

Stations on or near the sea-coast, ranging between 21° N. and 25° N.

Surat.

Latitude, $21^{\circ} 10'$ N., 150 miles N. of Bombay.

Longitude, $72^{\circ} 52'$ E., 130 miles S. of Ahmedabad.

Height above sea, 33 ft.

The nearest mountain is Songhur, 42 miles E. of the station.

From March to October the sea breeze prevails, and during the remainder of the year the land wind is predominant.

For about nine months in the year the climate may be said to be decidedly moist, the wind coming from the direction of the sea, which is 10 miles distant. It is never very cold, and the temperature rises considerably, as elsewhere, during the months of April and May. There is but little if any fog in the camp, though it is sometimes observed on the other side of the river, which is a lower level. There are occasional dust storms, but, generally speaking, the atmosphere is fine.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 78° in January to 108° in May.

The low night temperature varies from 59° in January to 80° in May and June.

The mean annual temperature is about 82° ; mean daily range 20° .

Baroda.

Latitude, $22^{\circ} 16'$ N., 68 miles S.E. of Ahmedabad, 81 miles N. of Surat.

Longitude, $73^{\circ} 14'$ E., 166 miles W. of Mhow.

Height above sea, 90 ft.

The hill fort of Powagurh, distant 26 miles, is the only high ground within sight of the station, which is so encumbered with trees, that it is not sufficiently exposed to the breeze, which blows from the direction of the sea for the greater part of the year; from November to March the land wind blows from the E. and N.E.

The climate is very damp in the rains; at other times comparatively moist. Fogs prevail till the end of November, and during the hot season winds and dust prevail; it is never very cold.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 84° in January to 105° in May.

The low night temperature varies from 56° in February to 83° in May.

The mean annual temperature is about 81° ; mean daily range 21° .

The annual fall of rain is about 35 inches; about 16 inches fall in July, 30 inches generally fall in June, July, and August.

Rajcote.

Latitude, $22^{\circ} 18'$ N., 125 miles S.W. of Ahmedabad.

Longitude, $70^{\circ} 50'$ E., 150 miles W. of Baroda.

Height above sea, 450 ft.

The nearest mountain is the Girnar, 56 miles to the S.W. of the station, which is thoroughly open to the sea breeze, which blows steadily during eight months of the year. From November to February the winds are northerly and north-easterly.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 78° in January to 99° in May.

The low night temperature varies from 59° in January to 83° in May and June.

The mean annual temperature is about 81° ; mean daily range 15° .

The annual fall of rain is about 27 inches; 21 inches fall in June, July, and August, of which 8.3 and 8.9 inches fall in July and August respectively.

Ahmedabad.

Latitude, 23° N. Longitude, 72° E.

Height above sea, 320 ft.

Nearest mountain, Aboo, is 150 miles distant from the station, which is exposed to hot and cold winds from the W.S.W. and N.E.

The climate is dry, except during the monsoon. Sand storms occasionally occur during the hot season.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 78° in January to 108° in May.

The low night temperature varies from 60° in December to 86° in May.

The mean annual temperature is about 83° ; mean daily range 18° .

The annual fall of rain is about 23 inches; 11 inches fall generally in July, very little rain falls during the first and last three months of the year.

Ahmednuggur.

Latitude, 23° 34' N., 91 miles N. of Baroda.

Longitude, 73° 1' E.

Height above sea, 1,900 ft.

The nearest hill is six miles distant, and is 617 feet elevation above the station, which, generally speaking, is well exposed to the prevailing winds. It is singularly exempt from variable winds; and is freely exposed to the sea breeze, which diminishes the temperature.

The climate is dry, like that of the Deccan generally, which is attributable to the great elevation. Occasionally dust storms occur during the hot months, March, April, and May.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 80° in December to 98° in April and May.

The low night temperature varies from 59° in January and December to 76° in May.

The mean annual temperature is about 77°; mean daily range about 18°.

The annual fall of rain is about 25 inches.

Kurrachee.

Latitude, 24° 51' N. Longitude, 67° 2' E.

Height above sea, 27 ft.

A low mountain range, about six miles distant from the station, which is not exposed to cold or variable winds. Land and sea breezes prevail in spring and autumn, and the climate is good. The month of November is characterised by dryness, July and August by humidity; December, January, and February being the cold months. From May to September is the hot season, during which time strong westerly monsoon winds prevail. Damp cannot be said to exist at any time.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 74° in February to 95° in August.

The low night temperature varies from 44° in December to 82° in August.

The mean annual temperature is about 78°; mean daily range 19°.

The annual fall of rain is about 5 inches; the heaviest monthly fall of rain is in July, viz., 1·8 inches.

BOMBAY PRESIDENCY.

*Inland Stations.**Sholapore.*

Latitude, 17° 40' N., 165 miles S.E. of Poona.

Longitude, 76° 0' E.

Height above sea, 1,821 ft.

There is no higher ground within 30 miles of the station, which is completely open, and exposed to the prevailing winds. The sea breeze is not felt at Sholapore; and the only wind that may be said to be unhealthy is that from the east.

The climate is warm and dry during the greater part of the year, the mean annual temperature being about 80°. May is generally the hottest, and December the coldest month. Fogs occasionally occur during the months of February and March towards evening. The atmosphere is pure.

The following are the approximate mean monthly values, of temperature :—

The high day temperature varies from 78° in December to 93° in April, and May.

The low night temperature varies from 66° in December to 79° in April.

The mean annual temperature is about 74°; mean daily range 9°.

The annual fall of rain is about 33 inches, of which nearly 15 inches fall in July, August and September.

Seroor.

Latitude, 18° 50' N., 30 miles S.W. by W. of Ahmednuggur.

Longitude, 77° 25' E.

Height above sea, 1,752 ft.

The hill fort of Poorundhur is situated on the nearest table land.

The station generally is remarkably open and exposed to the prevailing winds. The W. wind is most commonly prevalent at the station.

The climate is on the whole, and with the exception of the monsoon months, dry, but not excessively so, being

within the influence of the sea breeze which generally blows tolerably strongly towards the evening. The variations of cold and heat, dryness and moisture, are moderate and not sudden. The air is generally free from dust and other impurities, but dust storms do occasionally occur during the hot season.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 84° in September to 107° in April.

The low night temperature varies from 50° in January and December to 69° in May and June.

The mean annual temperature is about 75°; mean daily range 33°.

The annual fall of rain is about 21 inches; of which 8 inches fall in the three months ending August.

Mulligaum.

Latitude, 20° 32' N., 154 miles N.E. of Bombay, on the Trunk road from Bombay to Agra.

Longitude, 74° 30' E.

Height above sea, 1,300 ft.

Nearest mountain 35 miles distant from the station, which is open and freely exposed to all winds, except those from the sea.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 81° in January to 96° in May.

The low night temperature varies from 64° in January to 82° in June.

The mean annual temperature is about 81°; mean daily range 14°.

Dhoolia.

Latitude, 20° 54' N., 181 miles N.E. of Bombay, on the route from Bombay to Agra.

Longitude, 74° 45' E.

Height above sea, 1,000 ft.

The nearest high land is the hill fort of Galna, 24 miles distant from the station is open, and would be freely exposed to the winds, if not so encumbered with trees, &c. It is exposed to N.W., and occasionally to N. and N.E. winds in December, January, and February, veering to W. in March, and S.W. with monsoon.

The climate is hot and close; there are but few dust storms.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 80° in January to 97° in May.

The low night temperature varies from 62° in January to 83° in June.

The mean annual temperature is about 80°; mean daily range 13°.

The annual fall of rain is about 84 inches; about 20 inches fall in the months of July and September.

Mhow.

Latitude, 22° 33' N. Longitude, 75° 46' E.

Height above sea, 1,862 ft.

The station is open and freely exposed to variable winds, which in the cold season are northerly. The prevailing wind, however, is from the W.

The climate has always been considered good, dry, and cool. The atmosphere is seldom loaded with dust.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 74° in December to 95° in May.

The low night temperature varies from 65° in January to 79° in April.

The mean annual temperature is about 74°; mean daily range 10°.

Neemuch.

Latitude, 24° 27' N., 155 miles N.W. of Mhow, 371 miles S.W. of Delhi.

Longitude, 74° 54' E., 306 miles W. of Saugor.

Height above sea, 1,476 ft.

The nearest mountains are distant 70 miles.

The western side of the camp is well exposed to the prevailing winds, the eastern portion is shut out by the bazaar. For four months of the year N. and N.E. winds prevail, and for the remainder of the year W. and S.W. winds.

The dry N.E. winds appear predisposed to rheumatism, &c.

The climate varies with the season of the year. From November 15 to February 15 the air is cold, dry, and bracing; and from the middle of February to the middle of June the heat gradually increases, the maximum being obtained during the month of May, when fierce hot winds prevail. During the monsoon the climate is mild and pleasant. In October the heat again increases, decreasing at the latter end of the month. The diurnal variation of the temperature is great, the nights being generally cool and pleasant, owing to the elevation.

The atmosphere contains but little moisture, even during the monsoon, and the air is free from dust and other impurities.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 62° in January to 94° in May.

The low night temperature varies from 49° in January to 78° in June.

The mean annual temperature is about 71°; mean daily range 14°.

The annual fall of rain is about 34 inches, of which 29½ inches fall in June, July, and August.

Deesa.

Latitude, 25° 14' N., 301 miles N.W. of Mhow.

Longitude, 72° 5' E., 251 miles W. of Neemuch.

Height above sea, 400 ft., 370 miles N. of Bombay.

The nearest mountain, Aboo, is 16 miles distant from the station, which is open and freely exposed to the winds. The sea-breeze (S.W.) blows from about the middle of March to the end of June, but reaches this station exceedingly dry and scorching. The winds are more variable from July to October, but generally from the S. and W.; this is the wet season. Between October and March N. winds are most frequent, and four months of this period are dry, cool, and bracing.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 79° in January to 106° in May.

The low night temperature varies from 48° in December to 79° in June and July.

The mean annual temperature is about 80°; mean daily range 26°.

The annual fall of rain is about 25 inches; 19 inches fall generally in June, July, and August.

Hyderabad. Sind.

Latitude, 25° 30' N. Longitude, 69° 5' E.

Height above sea, 99 ft.

The nearest mountain is about 20 miles distant from the station, which is freely exposed to the winds. Cold and variable winds affect the health of the station more or less.

The climate is exceedingly dry, even when heavy showers of rain fall about July and August. The heat is extreme from the middle of March to the middle of October, and during the day a hot breeze blows from the westward, and dust storms are frequent, but the mornings are clear, cool, and refreshing, except in September and October, when the whole 24 hours are disagreeably oppressive.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 71° in January to 99° in May and June.

The low night temperature varies from 58° in January and December to 85° in June.

The mean annual temperature is about 81°; mean daily range 14°.

The annual fall of rain is about 21 inches; 15 inches fall in August.

Nusseerabad.

Latitude, 26° 20' N., 222 miles W. of Agra.

Longitude, 74° 50' E., 350 miles N.W. of Saugor.

Height above sea, 1,500 ft., 143 miles N. of Neemuch.

There is a range of hills six miles from the station, which is open, and freely exposed to the winds. During the hot season, from the middle of March to the middle of July, the prevailing winds are from the S. and S.W., these are scorching, and in order to keep the barracks cool khus-khus tatties are used. During the monsoon the winds are variable and pleasant. In the cold season, from November to March, the winds are from the N. and N.E.

With regard to the climate, the temperature ranges very high for about five or six months, in July sometimes rising to 120°, and during the hot season there is a hot wind

blowing constantly, day and night from the W. During the hot season, the station is visited with severe dust storms, causing great discomfort.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 65° in January to 99° in June.

The low night temperature varies from 59° in December to 88° in June.

The mean annual temperature is about 79°; mean daily range 9°.

The annual fall of rain is about 16 inches; 8 inches fall in August, 13 inches in the three months ending August.

REMARKS on the CLIMATE of different STATIONS in the PRESIDENCY of MADRAS.

Madras Presidency.

This presidency extends from Cape Comorin, in latitude 8° 4' to the N. extremity of Ganjam, in latitude 20° 18'; and from longitude 74° 9' to 85° 15' E, and is bounded N. and N.W. by the presidencies of Bengal and Bombay and the kingdoms of Nagpore and Berar.

It is in size intermediate between the two other presidencies.

Palamcottah.

Latitude, 8° 43' N., 3 miles E. of Tinnivelly.

Longitude, 77° 48' E., 88 miles S. of Madura.

Height above sea, 120 ft., 160 miles S.W. of Trichinopoly.

The nearest mountains are between 20 and 25 miles distant from the station, which being situated so near to the apex of the peninsula is exposed to winds which are, except during the very hottest months, moderately cool. The S.W. wind, which sets in towards the close of May continuing to the end of August, passes over an extensive tract of cultivated land, and is thus rendered cool, although disagreeable at times on account of its violence, and raising dust storms.

The following are the approximate mean monthly values of temperature:—

High day temperature varies from 86° in January and December to 94° in April and May.

Low night temperature varies from 76° in January to 84° in April, May, and June.

Mean annual temperature is about 81°; mean daily range 10°.

Annual fall of rain is about 22 inches, 10 inches of which fall in September, October, November.

Trichinopoly.

Latitude, 10° 20' N. Longitude, 77° 10' E.

Height above sea, 250 ft.

The nearest mountains are some 25 miles distant from the station, which is open and freely exposed to winds. Hot land winds blow during the months of April, May, and June, and cold N.E. winds during the monsoon.

The monthly temperature varies from 78° to 87°.

The mean annual fall of rain is about 30 inches.

There is often a dry and sultry atmosphere for months together. Whirlwinds accompanied by clouds of dust and sand, occur at short intervals in May, June, and July.

Wellington.

Latitude, 11° 5' N. Longitude, 77° 5' E.

Height above sea, 6,000 ft.

The nearest mountain is Dodabetta, 9 miles distant from the station, which is open and freely exposed to the winds; they are from the land, principally from the N.E. and S.W.

The following are the approximate mean monthly values of temperature:—

High day temperature varies from 66° in February to 75° in August and September.

Low night temperature varies from 59° in September to 65° in May and June.

The mean annual temperature is about 62°; the mean daily range is about 9°.

The annual fall of rain is about 31 inches.

Salem.

Latitude, 11° 39' N., 100 miles S.E. of Bangalore.

Longitude 78° 12' E., 170 miles S.W. of Madras.

Height above sea, 800 ft.

The Shevaroy hills are 5 miles distant from the station, which is not open to any wind or to the sea breeze.

Bangalore.

Latitude, 12° 57' N. Longitude, 77° 38' E.

Height above sea, 3,000 ft.

Nundydroog, 36 miles distant from the station, which is freely exposed to winds. There is no sea breeze, and the land wind is not hot like that up the country. The winds are very dry.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 79° in January to 91° in May.

Low night temperature varies from 59° in January to 72° in May.

The mean annual temperature is about 73°; the mean daily range 16°.

The annual fall of rain is about 25 inches; 13 inches fall in June, July, and August.

Hurryhur.

Latitude, 14° 31' N., 160 miles N.W. of Bangalore.

Longitude, 75° 51' E., 181 miles N.E. of Mangalore.

Height above sea, 1,831 ft., 85 miles S.W. of Bellary.

The nearest table lands are the Babadbooder hills and Mercara, lying south by west from this station, both at a considerable distance.

The station is sufficiently open to all the prevailing winds, which generally are neither cold nor variable, and the more prevalent are from the N.E. and S.W., at the seasons respectively constituting the corresponding monsoons. There are occasionally westerly winds towards the after part of the day, which are generally agreeable, and are usually looked upon as sea breezes. The N.E. and E. winds, which usually blow in the early part of the year, are mostly hot and dry.

The climate of Hurryhur is dry, with a considerable diurnal range of temperature, especially in the cold months of the year. In all essential respects the atmosphere seems to be pure.

Ramandroog.

Latitude, 15° 8' N. Longitude, 76° 33' E.

Height above sea, 3,400 ft.

This station is 37 miles from Bellary.

The climate is good. The station is situated under the influence of both monsoons, without suffering excessively from either; it is near enough to the western coast to have the benefit of the sea breeze, which in the hot season moderates the temperature. It is situated on an isolated range. The wet season commences in June with the S.W. monsoon, and continues with intermissions till September. After a short interval the N.E. monsoon sets in and lasts till November, the average quantity of rain being from 34 to 40 inches. From November to February the air is clear, and easterly winds prevail.

Kurnool.

Latitude, 15° 50' N., 90 miles N.E. by E. of Bellary.

Longitude, 78° 5' E.

Height above sea, 800 ft.

There is a range of small hills about 4 miles distant from the station, which is open and freely exposed to the winds.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 79° in December to 93° in April and May.

Low night temperature varies from 74° in December to 90° in April.

The mean annual temperature is about 84°; mean daily range 4°.

The annual fall of rain is about 72 inches; 40 inches of which fall in June, July, and August, 17 inches fall generally in July.

Bellary.

Latitude, 17° 0' N. Longitude, 77° 0' E.

Height above sea, 1,500 ft.

No table land; but about six miles from the station there is a range of small hills, and among these a peak, rising to 1,000 ft. above the station.

The station is open and freely exposed to cold E. and N.E. winds, in November, December, and January. It is also exposed to warm land winds from February to June. The rest of the year a pleasant strong W. wind generally is prevalent.

The climate is dry and temperature not very high; not being humid, the heat is bearable; range not great. No fogs. Dust storms occasionally occur, but the air is usually clear.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 78° in January and December to 92° in May.

The low night temperature varies from 65° in February to 77° in May.

The mean annual temperature is about 75°; mean daily range 12°.

The annual fall of rain is about 22 in.; 11 in. fall in the three months ending November, of which 6 in. fall in October.

Secunderabad.

Latitude, 17° 28' N., 6 miles N. of Hyderabad.

Longitude, 78° 32' E.

Height above sea, 1,800 ft.

The table land of Bedur is 70 miles distant from the station, which is open, and free currents of air everywhere exist. It is much exposed to cold and variable winds during and after the rainy monsoon, and when the rains have quite passed away; there is an extreme dryness combined with cold, parching yet chilling the surface.

The climate may be characterized as remarkably dry. The average number of days on which rain falls is about 50. From January to June the air is dry; the first two months being cool and variable in temperature. From March to June hot land winds blow, and the heat is great. Fogs are unfrequent, and dew seldom deposited. The air is generally clear; but liable, in the hot season, to occasional dust storms.

The following are the approximate mean monthly values of temperature :—

The mean high day temperature varies from 77° in December to 95° in May.

The mean low night temperature varies from 64° in January to 82° in May.

The mean annual temperature is about 74°; mean daily range 12°.

The annual fall of rain is about 28 inches.

MADRAS PRESIDENCY.

Malabar, or West Coast Stations.

Quilon.

Latitude, 8° 53' N., 38 miles N.W. of Trevandrum.

Longitude, 76° 39' E., 225 miles S.E. of Cannanore.

Height above sea, 40 ft., 385 miles S.W. of Madras.

The nearest mountains are the Wurrakally hills, about 12 miles distant from the station, which is open and well exposed to sea and land winds. The sea is about 250 yards distant from the station.

The effects of the climate on Europeans is renovating. During the rains, the weather is close; during the dry weather, parching but free from dust.

Cochin.

Latitude, 9° 11' N. Longitude, 76° E.

Height above sea, 40 ft.

Nearest high ground is about 30 miles distant. The hills rise to a height of 6,000 ft. above the level of the sea.

The station is exposed to cold and variable winds from the land side, during the dry season, beginning in November, about 7 p.m., and gradually becoming later, until, in February, its commencement is about 2 a.m.

The climate is variable; the breeze from the land, owing to its coming over a large expanse of water, is moist and chilly. It is occasionally very sultry.

Tellicherry.

Latitude, 11° 45' N., 95 miles S.W. of Seringapatam.

Longitude, 75° 33' E.

Height above sea, .

The Wynaad range of hills is 30 miles distant from the station, which is on the sea coast, and exposed to the sea breeze. The land wind is excluded by trees, houses, and gardens.

The climate is moist, especially during the monsoon. The hottest months are March, April, and May; but it is cooler than at most other Indian stations. The air is generally pure. The wet season, from May to September, is the most unhealthy.

Cannanore.

Latitude, 11° 52' N. Longitude, 75° 30' E.

Height above sea, 15 ft.

The nearest mountain range is the Western Ghauts, 30 to 40 miles distant from the station.

During November, December, and January a strong land

wind blows from shortly after sunset until the earth has been sufficiently heated by the sun of next day, when a current almost invariably sets in from the sea.

The climate at this station is, on the whole tolerably equable, it is occasionally variable and chilly, and during the wet season it is moist and debilitating.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 82° in August to 90° in April.

The low night temperature varies from 76° in October to 82° in April.

The mean annual temperature is about 82°; mean daily range, 7°.

The annual fall of rain is about 121 inches, of which about 85 inches fall in June, July, and August.

Mercara.

Latitude, 12° 24' N., 47 miles N.E. of Cannanore.

Longitude, 75° 48' E., 130 miles S.E. of Mangalore.

Height above sea, 4,500 ft., 315 miles W. of Madras.

The station is exposed to every wind that blows. The sea breeze is distinctly felt. The east wind is dreaded as parching and destroying young trees.

The climate of Mercara is excellent. The temperature during the hottest season ranging from 62° to 75°. For six months of the year it rains heavily, but the roads are dusty whenever rain is long withheld.

French Rocks.

Latitude, 12° 31' N., 5 miles N. of the River Cauvery, at Seringapatam.

Longitude, 76° 45' E.

Height above sea, 2,560 ft.

There are no mountains or high lands near the station, which is exposed to variable winds, not to sea breeze.

The climate is good, being dry during eight months of the year, and somewhat moist during the monsoon. It is not very variable, and pretty free from fog or damp. There are occasional dust storms, which last but a short time.

Mangalore.

Latitude, 12° 50' N. Longitude, 75° 0' E.

Height above sea, 40 ft., on the coast W.

The nearest mountain is about 50 miles distant from the station, which is exposed to land and sea breezes.

MADRAS PRESIDENCY.

Coromandel or East Coast Stations.

Arcot.

Latitude, 12° 30' N. Longitude, 79° 8' E.

Height above sea, 550 ft.

The nearest table land is at Palamanair, 50 miles off, and about 1000 feet higher than this station.

The climate is generally a dry heat. In the monsoon and cold weather, the station is subject to fogs on the lower ground, which extend on to the irrigated land. In the hot weather occasional dust storms take place.

Vellore.

Latitude, 12° 55' N., 220 miles N. of Madura.

Longitude, 79° 11' E., 104 miles E. of Bangalore.

Height above sea, 675 ft., 94 miles N.W. of Cuddalore, 79 miles W. of Madras.

The nearest hill is about $\frac{3}{4}$ of a mile from the cantonment and has an elevation of 780 feet.

The prevailing winds in February are northerly; after March S.E. winds are prevalent, they are hot during the day, but occasionally cool towards early morning. The sea breeze occasionally in the afternoon is strong, but it is generally light, or is replaced by long-shore winds direct.

This is a hot station.

Palaveram.

Latitude, 12° 58' N., 11 miles S.W. of Madras.

Longitude, 80° 15' E.

Height above sea, 40 ft.

There are no hills of any extent nearer than the Neilgherries.

The station would be open were it not for the two hills on the sea or south side, which in a great measure exclude the sea breeze or only cool wind, whereas it is quite exposed to the land or hot winds. This is one of the hottest stations

in India, the thermometer seldom being below 80°, there is no cold season.

The observations of the Madras Observatory would apply here, except that the air is always much closer.

Saint Thomas' Mount.

Latitude, 13° 0' N., 252 miles N.E. of Madura.

Longitude, 80° 15' E., 95 miles N. of Cuddalore,

Height above sea, 60 feet, 178 miles E. of Bangalore, 10 S.W. of Madras.

St. Thomas' Mount rises close behind the barracks.

The station is exposed both to the sea breeze and land wind.

The climate is dry for at least nine months, and hot all the year round, varying from 71° to 95°. There are heavy rains during the months of October and November, and occasional showers from July till September. The average annual fall is between 30 and 40 inches. The climate is very equable; fogs are rare, the air very dusty during the dry season.

Poonamallee.

Latitude, 13° 2' N., 13 miles due W. of Madras.

Longitude, 10° 10' E., 9 miles direct line from coast.

Height above sea, 2 ft.

There are hills of unknown height 40 miles distant from the station, which is open, and freely exposed to variable winds, and to land and sea breezes.

The following are the approximate mean monthly values of temperature :—

High day temperature varies from 80° in January and November to 87° in June.

Low night temperature varies from 74° in January to 82° in June, July, and August.

The mean annual temperature is about 82°; mean daily range 4°.

The annual fall of rain is about 50 inches; 30 inches of which fall in September, October, and November.

Nellore.

Latitude, 14° 20' N. Longitude, 80° 0' E.

Height above sea, 50 ft.

The nearest mountains are 40 miles distant from the station, which is open, and freely exposed to winds. The same winds prevail here as at Madras, Nellore being under the influence of the same monsoons. The long-shore southerly winds in March and April are very exhausting to a European constitution.

The climate of this station is particularly dry, with little variability.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 76° in January to 93° in May.

The low night temperature varies from

The mean annual temperature is about 82°.

The annual fall of rain is about 60 inches; 40 inches fall in September, October, and November, of which 32 inches fall in November.

MADRAS PRESIDENCY.

East Coast upper portion, ranging from 16° N. to 19½° N.

Masulipatam.

Latitude, 16° 10' N., 325 miles N.E. of Bangalore.

Longitude, 81° 13' E., 195 miles S.E. of Hyderabad.

Height above sea, 7 ft., 215 miles N. of Madras.

The nearest high land is the Condapillay hills, about 55 miles distant, at an elevation of 900 to 1000 feet above the level of the station.

The climate has the character of being salubrious. It is dry during the hot season, and damp during the monsoon, is not of a penetrating character. The heat is great at times during the hot land winds in April, May, and the early part of June. It is not subject to any great variations of temperature, but the early mornings in the month of February are distinguished by dense fogs, which are dispersed by the sun at about 8 o'clock. During the dry weather the station is subject to severe dust storms which sweep across in heavy clouds so as at times to obscure the atmosphere.

The following are the approximate mean monthly values of temperature :—

The high day temperature varies from 82° in January to 95° in May.

The low night temperature varies from 68° in December to 82° in May and June.

The mean annual temperature is about 80°; mean daily range 12°.

The annual fall of rain is about 43 inches.

Guntoor.

Latitude, 16° 20' N., 300 miles N.E. of Bangalore.

Longitude 80° 30' E., 225 miles N. of Madras.

Height above sea, 100 ft., 47 miles W. of Masulipatam.

The nearest mountain is one of a range called Kondaveed and is about 12 miles distant from the station, which is freely exposed to the winds. Sometimes during the months of November and December intensely cold winds from the N. or N.W. set in, and continue for five or six days, which cause severe colds to Europeans. The sea breeze blows pretty constantly every evening during the hotter months of the year, with a most pleasant and salutary effect. Land winds blow at times with great strength.

The climate of Guntoor may be stated to be dry, warm, and not subject to sudden variations of temperature. Fogs occasionally prevail at the end of the year. The air is quite free from dust or other impurity, and the climate would seem to have a most beneficial effect upon convalescents from malarious fever, &c.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 79° in December to 94° in May and June.

The low night temperature varies from 65° in December to 84° in May and June.

The mean annual temperature of the air is about 81°; mean daily range, 10°.

The annual fall of rain is about 42 inches; 18 inches fall in the three months June, July, and August, and 15 inches in the next three months.

Samulcottah.

Latitude, 17° 4' N., 245 miles E. of Hyderabad.

Longitude, 82° 14' E., 410 miles N.E. of Bangalore.

Height above sea, 50 feet, 300 miles N. of Madras.
550 miles S.W. of Calcutta.

The hill of Dhumaverim is to the N.; it is distant 12 miles from the station, which is not exposed to cold or variable winds, the coldest being the N. which is seldom felt.

The N.E. and E. sea breezes prevail from October to January; the S.E. and S. winds from January to May; and land winds S.W. and W. by S. from May to September.

Samulcottah is moderately dry for eight months of the year, and moderately damp for the remaining four months. Unless for a few days before the S.W. monsoon there is no excessive heat, and from November to March the temperature is agreeable.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 81° in January to 96° in May.

The low night temperature varies from 66° in December to 82° in May and June.

The mean annual temperature 79°; mean daily range 13°.

The annual fall of rain is about

Vizianagrum.

Latitude, 18° 7' N., 329 miles E. of Hyderabad.

Longitude 83° 28' E., 200 miles N.E. of Masulipatam.

438 miles S.E. of Calcutta.

The nearest mountain is Galleepareevatum, distant about 40 miles from the station, which is exposed to cold sea breezes, and land winds.

Berhampore.

Latitude, 19° 20' N., 150 miles N.E. of Vizagapatam.

Longitude, 84° 50' E., 325 miles S.E. of Calcutta.

Height above sea, 112 ft.

The nearest mountain is 8 miles distant from the station which is open and freely exposed to the winds except on the west; it is exposed to variable winds; to cold winds, November to February; to hot land winds, March to June; to S.W. winds from June to September; and to N.E. winds from the end of September to October.

The climate may be considered a dry one from March to the middle of June, the heat from April to the latter part of June being very great. In July and August the climate

is variable. September, October, and November are damp months. January and February are cold and foggy. There are occasional dust storms which do not, however, render the air impure.

Three stations belonging probably to Bombay Presidency.

Jaulnah.

Latitude, 19° 50' N., 240 miles N.W. of Secunderabad.

Longitude, 75° 56' E., 235 miles S.W. of Nagpore.

Height above sea, 1,652 ft., 210 miles N.E. of Bombay.

The nearest high table land is that of Roza, 55 miles distant from the station, which is open, and freely exposed, but not to cold or variable winds. The land or dry westerly winds blow during the months of March, April, May, and June. The station is too far from the sea for the breeze to reach it.

The climate is generally salubrious; dry and cold, yet liable to great sudden variations of temperature. Fogs and damp are rare. The air is pure, rarely containing dust, &c.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 80° in January to 96° in May.

The low night temperature varies from 64° in January and December to 82° in June.

The mean annual temperature is about 80°; mean daily range, 13°.

The annual fall of rain is about 40 inches.

Kamptee.

Latitude, 21° 10' N., 10 miles N.E. of Nagpore.

Longitude, 79° 50' E., 722 miles from Madras.

Height above sea, 900 ft., 324 miles from Secunderabad.
577 miles from Bombay.

The nearest mountains are those of Chindwarra and Seonie.

The station is open to every wind that happens to blow.

The hot land winds are very distressing in May, and until the rains set in in June. The station being 400 miles distant from the sea, no mention of the sea breeze need be made.

The climate partakes of both heat and cold. The year is divided into three seasons, cold, hot, and rainy; transitions of which are regulated, and may be calculated at certain periods.

The cold season is from the middle of October to the middle of March; the hot season, from the middle of March to the middle of June; and the rainy season from the middle of June to the middle of October. The rainy season is preceded by distressing sultriness; and there is a considerable diurnal range of temperature in the cold season which is extremely prejudicial to weak constitutions.

The following are the approximate mean monthly values of temperature:—

The high day temperature varies from 78° in January and December to 96° in May.

The low night temperature varies from 62° in January and December to 83° in June.

The mean annual temperature is about 80°; mean daily range 15°.

The annual fall of rain is about

Hoshingabad. (N.W. Provinces.)

Latitude, 22° 44' N., 114 miles S.W. of Saugor.

Longitude, 77° 44' E., 428 miles S.W. of Allahabad.

144 miles E. of Mhow.

924 miles N.W. of Calcutta.

The Putchmaree hills are about 70 miles distant from the station, which is open and is not particularly exposed to cold or variable winds.

The climate is exceedingly hot, oppressive, and relaxing for the greater part of the year, and very trying to a European constitution.

The following are the approximate mean monthly temperatures of the air:—

The high day temperature varies from 78° in January to 97° in May.

The low night temperature varies from 61° in January to 83° in June.

The mean annual temperature is about 79°; mean daily range 14°.

RELATING TO SECTION II.

MEAN MONTHLY OBSERVED MAXIMUM TEMPERATURE of the AIR.

Tables XLIII. to XLV. at Elevations below 1,000 Feet.
Tables XLVI. to LII. at Elevations above 1,000 Feet.

TABLE XLIII., showing the MEAN MONTHLY MAXIMUM TEMPERATURE of the AIR at Elevations below 1,000 Feet between the Latitudes 8° 43' N. and 17° 4' N. and Longitudes 75° 30' E. and 82° 14' E., principally in the MADRAS PRESIDENCY.

Place . . .	PALAM-COTTAH.	CANNA-NORE.	POONA-MALLEE.	FORT ST. GEORGE.	MADRAS.	NELLORE.	KURNOOL.	GUNTOOR.	SAMUL-COTTAH.	MEANS.
Latitude . . .	8° 43' N.	11° 52' N.	13° 2' N.	13° 4' N.	13° 6' N.	14° 20' N.	15° 50' N.	16° 20' N.	17° 4' N.	14° 49' N.
Longitude . . .	77° 48' E.	75° 30' E.	80° 10' E.	80° 14' E.	80° 21' E.	80° 0' E.	78° 5' E.	80° 30' E.	82° 14' E.	79° 26' E.
Height . . .	120 feet.	15 feet.	2 feet.	.....	.....	50 feet.	800 feet.	100 feet.	50 feet.	126 feet.
MONTH.	5 Years, 1855 to 1859.	10 Years, 1850 to 1859.	5 Years, 1855 to 1859.	....	30 Years, 1796 to 1825.	2 Years, 1859 and 1880.	3 Years, 1857 to 1859.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	....
January - -	86	87	80	84	84	76	80	82	78	82
February - -	90	87	81	87	88	80	85	84	83	85
March - -	93	89	82	89	91	85	91	91	88	89
April - -	94	90	85	93	93	86	93	91	92	91
May - -	94	88	86	101	100	93	93	94	95	94
June - -	93	83	87	99	98	92	88	94	90	92
July - -	92	83	86	92	95	87	85	86	85	88
August - -	93	82	84	96	94	86	83	87	85	88
September - -	93	83	83	92	93	87	84	84	85	87
October - -	91	84	82	90	92	85	85	81	83	86
November - -	87	87	80	86	87	78	80	81	80	83
December - -	86	86	81	86	84	77	79	79	78	82
Means - -	91	86	83	91	92	84	85	86	85	87
Difference between hottest and coldest months.	8	8	7	17	16	17	14	15	17	12

TABLE XLIV., showing the MEAN MONTHLY MAXIMUM TEMPERATURE at Elevations below 1,000 Feet between the Latitudes 15° 50' N. and 25° 30' N. and Longitudes 67° 2' E. and 73° 41' E., principally in the BOMBAY PRESIDENCY.

Place . . .	VIN-GORLA.	RUTNA-GHERRY.	DAPOO-LEE.	SURAT.	BARODA.	RAJCOTE.	AHMED-ABAD.	KURRA-CHEE.	DEESA.	HYDER-ABAD.	JACOB-ABAB.	MEANS.
Latitude . . .	15° 50' N.	17° 0' N.	17° 48' N.	21° 10' N.	22° 16' N.	22° 18' N.	23° 0' N.	24° 51' N.	25° 14' N.	25° 30' N.	....	21° 22' N.
Longitude . . .	73° 41' E.	73° 20' E.	73° 16' E.	72° 52' E.	73° 14' E.	70° 50' E.	72° 0' E.	67° 2' E.	72° 5' E.	69° 5' E.	....	71° 44' E.
Height . . .	20 feet.	150 feet.	600 feet.	33 feet.	90 feet.	450 feet.	320 feet.	27 feet.	400 feet.	99 feet.	220 feet.	215 feet.
MONTH.	4 Years, 1856 to 1859.	5 Years, 1855 to 1859.	2 Years, 1858 and 1859.	10 Years, 1850 to 1859.	7 Years, 1847 to 1853.	4 Years, 1857 to 1860.	2 Years, 1858 and 1859.	....	3 Years, 1857 to 1859.	2 Years, 1856 and 1857.	12 Years, 1848 to 1859.	....
January - -	84	86	88	87	84	78	78	79	79	71	77	81
February - -	85	87	89	91	90	83	96	77	85	78	82	86
March - -	87	90	91	98	96	89	94	85	94	89	93	91
April - -	88	92	93	101	94	97	104	87	102	94	100	96
May - -	88	93	91	100	105	99	108	91	106	99	108	99
June - -	85	89	86	94	98	95	94	95	100	99	109	95
July - -	83	85	83	90	91	88	104	91	93	95	108	92
August - -	82	84	80	87	88	84	92	92	87	93	102	88
September - -	82	85	83	90	90	85	90	89	89	90	101	88
October - -	84	87	88	93	87	89	90	92	93	89	94	90
November - -	83	87	92	91	90	86	87	89	89	80	88	87
December - -	85	87	87	88	89	79	79	81	82	73	79	83
Means - -	85	88	88	92	92	88	93	87	92	87	95	90
Difference between hottest and coldest months.	6	9	13	14	21	21	30	18	27	28	32	18

TABLE XLV., showing the MEAN MONTHLY MAXIMUM TEMPERATURE at Elevations below 1,000 Feet between the Latitudes 20° 18' N. and 23° 29' N. and Longitudes 74° 33' E. and 92° 41' E. in the PRESIDENCY of BENGAL.

Place . . .	THYET MYO.	SEETA- BULDEE.	FORT WILLIAM, CALCUTTA.	BERHAM- PORE.	CHUNAR.	BE- NARES.	LUCK- NOW.	MEERUT.	FEROZE- PORE.	PUNJAB.	SEAL- KOTE.	MEANS.
Latitude . .	20° 18' N.	21° 10' N.	22° 34' N.	24° 5' N.	25° 5' N.	25° 17' N.	26° 0' N.	28° 59' N.	30° 55' N.	31° 40' N.	32° 29' N.	26° 49' N.
Longitude . .	92° 46' E.	79° 9' E.	88° 25' E.	88° 17' E.	83° 0' E.	83° 4' E.	82° 0' E.	77° 46' E.	74° 35' E.	74° 45' E.	74° 33' E.	80° 33' E.
Height . . .	240 feet.	939 feet.	58 feet.	76 feet.	250 feet.	270 feet.	360 feet.	900 feet.	720 feet.	800 feet.	900 feet.	527 feet.
MONTH.	1 Year, 1859.	3 Years, 1858 to 1860.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	10 Years, 1850 to 1859.	2 Years, 1858 and 1859.	3 Years, 1858 to 1860.	1 Year, 1859.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	1 Year, 1859.	....
January - -	89	80	78	76	76	73	78	72	72	61	63	73
February - -	95	84	83	82	82	74	78	74	77	66	66	76
March - - -	98	88	90	91	93	78	89	76	89	76	80	85
April - - -	101	97	93	98	98	88	98	92	95	83	89	93
May - - - -	93	99	94	99	102	98	100	103	105	89	94	98
June - - - -	84	96	91	100	103	90	98	97	106	92	98	97
July - - - -	87	84	88	92	96	87	96	99	101	89	93	93
August - - -	87	83	87	99	94	83	88	92	96	88	92	89
September - -	88	84	88	91	93	86	88	85	96	86	91	89
October - - -	87	85	87	88	91	81	86	90	89	84	86	87
November - - -	85	79	82	81	85	74	78	81	81	72	76	79
December - - -	84	74	77	75	77	68	66	69	73	65	64	71
Means - - -	90	86	86	89	91	82	87	86	90	79	83	86
Difference between hottest and coldest months. }	17	25	17	25	27	30	34	34	34	31	35	27

TABLE XLVI., showing the MEAN MONTHLY MAXIMUM TEMPERATURE at Elevations between 1,000 and 2,000 Feet between the Latitudes 17° 0' N. and 17° 28' N. and Longitudes 77° 0' E. and 78° 32' E. in the MADRAS PRESIDENCY.

Place	BELLARY.	SECUNDER- ABAD.	MEANS.
Latitude	17° 0' N.	17° 28' N.	17° 14' N.
Longitude	77° 0' E.	78° 32' E.	77° 46' E.
Height	1,500 feet.	1,800 feet.	1,650 feet.
MONTH.	9 Years, 1851 to 1859.	10 Years, 1850 to 1859.	....
January - - -	78	78	78
February - - -	81	82	82
March - - - -	85	87	86
April - - - -	90	92	91
May - - - - -	92	95	94
June - - - - -	86	86	86
July - - - - -	82	83	83
August - - - -	82	83	83
September - - -	84	82	83
October - - - -	80	82	81
November - - - -	80	79	79
December - - - -	78	77	78
Means - - - - -	83	84	83
Difference between hottest and coldest months. }	14	18	16

TABLE XLVII., showing the MEAN MONTHLY MAXIMUM TEMPERATURE at Elevations above 3,000 Feet between the Latitudes 11° 25' N. and 12° 57' N. and Longitudes 77° 5' E. and 77° 38' E. in the MADRAS PRESIDENCY.

Place	BANGALORE.	WELLINGTON.
Latitude	12° 57' N.	11° 25' N.
Longitude	77° 38' E.	77° 5' E.
Height	3,000 feet.	6,000 feet.
MONTH.	1 Year, 1859.	1 Year, 1859.
January - - - -	79	68
February - - - -	83	66
March - - - - -	88	71
April - - - - -	86	67
May - - - - -	91	73
June - - - - -	84	73
July - - - - -	84	74
August - - - - -	81	75
September - - - -	82	75
October - - - - -	82	74
November - - - -	79	68
December - - - -	80	75
Means - - - - -	83	72
Difference between hottest and coldest months. }	12	9

TABLE XLVIII., showing the MEAN MONTHLY MAXIMUM TEMPERATURE at Elevations between 1,000 and 2,000 Feet between the Latitudes 16° 11' N. and 26° 20' N., and Longitudes 73° 1' E. and 77° 25' E., principally in the BOMBAY PRESIDENCY.

Place .	KULLAD-GHEE.	KOLA-PORE.	SHOLA-PORE.	POONA.	SEROOR.	DHOOLIA.	MHOW.	AHMED-NUGGUR.	NEEMUCH.	NUSSEER-ABAD.	MEANS.
Latitude	16° 11' N.	16° 42' N.	17° 40' N.	18° 30' N.	18° 50' N.	20° 54' N.	22° 33' N.	23° 34' N.	24° 27' N.	26° 20' N.	20° 35' N.
Longitude	75° 33' E.	74° 18' E.	76° 0' E.	74° 0' E.	77° 25' E.	74° 45' E.	75° 46' E.	73° 1' E.	74° 54' E.	74° 50' E.	75° 3' E.
Height	1,750 feet.	1,797 feet.	1,821 feet.	1,800 feet.	1,752 feet.	1,000 feet.	1,862 feet.	1,900 feet.	1,476 feet.	1,500 feet.	1,665 feet.
MONTH.	5 Years, 1855 to 1859.	10 Years, 1850 to 1859.	11 Years, 1850 to 1860.	5 Years, 1856 to 1860.	5 Years, 1854 to 1858.	6 Years, 1853 to 1858.	2 Years, 1859 and 1860.	6 Years, 1854 to 1859.	1 Year, 1860.	2 Years, 1859 and 1860.	....
January - -	89	77	80	81	94	80	75	83	62	65	79
February - -	92	82	84	87	94	86	77	87	71	76	84
March - - -	101	87	91	91	101	92	85	94	80	80	90
April - - -	104	88	93	95	107	98	92	98	92	91	96
May - - -	101	89	93	93	98	101	95	98	94	95	96
June - - -	96	81	88	85	96	94	85	88	82	99	89
July - - -	91	77	84	80	91	85	86	83	76	91	84
August - - -	93	77	84	78	88	84	77	82	75	89	83
September - -	91	78	84	79	84	84	78	81	79	86	82
October - - -	91	80	83	84	96	86	81	84	77	84	85
November - - -	88	78	81	83	95	83	78	82	78	84	83
December - - -	85	77	78	80	99	81	74	80	76	69	80
Means - - -	93	81	85	85	95	88	82	87	79	84	86
Difference between hottest and coldest months.	19	12	15	17	23	21	21	18	32	34	17

TABLE XLIX., showing the MONTHLY MEAN MAXIMUM TEMPERATURE at Elevations between 2,000 and 3,000 Feet, between the Latitudes 15° 50' N. and 17° 40' N., and Longitudes 74° 2' E. and 75° 10' E., principally in the BOMBAY PRESIDENCY.

Place . . .	DHARWAR.	BELGAUM.	SATTARA.	MEANS.
Latitude . .	15° 50' N.	15° 52' N.	17° 40' N.	16° 27' N.
Longitude . .	75° 10' E.	74° 42' E.	74° 2' E.	74° 38' E.
Height . . .	2,482 feet.	2,260 feet.	2,320 feet.	2,354 feet.
MONTH.	2 Years, 1859 and 1860.	4 Years, 1856 to 1859.	....	....
January - -	83	85	82	83
February - -	89	91	82	87
March - - -	92	94	89	92
April - - -	91	97	92	93
May - - -	91	89	90	90
June - - -	83	81	80	81
July - - -	80	79	76	78
August - - -	77	78	75	77
September - -	77	80	78	78
October - - -	82	85	79	82
November - - -	85	84	79	83
December - - -	80	83	80	81
Means - - -	84	85	82	84
Difference between hottest and coldest months.	15	19	17	16

TABLE L., showing the MONTHLY MEAN MAXIMUM TEMPERATURE at Elevations between 4,000 and 5,000 Feet between the Latitudes 17° 59' N. and 44° 45' N., and Longitudes 72° 49' E. and 73° 54' E., principally in the BOMBAY PRESIDENCY.

Place . . .	MAHAB-LESHWUR.	POORUN-DHUR.	MOUNT ABOO.	MEANS.
Latitude . .	17° 59' N.	18° 12' N.	24° 45' N.	20° 19' N.
Longitude . .	73° 30' E.	73° 54' E.	72° 49' E.	73° 24' E.
Height . . .	4,500 feet.	4,200 feet.	4,000 feet.	4,233 feet.
MONTH.	1 Year, 1834.	2 Years, 1852 and 1853.	5 Years, 1855 to 1859.	....
January - -	71	71	71	71
February - -	74	77	78	76
March - - -	82	81	82	82
April - - -	82	83	87	84
May - - -	81	78	92	84
June - - -	69	80	92	80
July - - -	67	71	81	73
August - - -	67	68	76	71
September - -	66	73	78	72
October - - -	69	74	79	74
November - - -	70	73	79	74
December - - -	68	70	73	70
Means - - -	72	75	81	76
Difference between hottest and coldest months.	16	15	21	14

TABLE LI., showing the MEAN MONTHLY MAXIMUM TEMPERATURE, at Elevations between 1,000 and 2,000 Feet, between the Latitudes 26° 42' N. and 34° 20' N., and Longitudes 71° 29' E. and 77° 12' E., principally in the BENGAL PRESIDENCY.

Place . . .	KHER-WARRAH.	UMBALLA.	MEAN MEER.	PESHA-WUR.	MEANS.	MEANS.
Latitude . .	26° 42' N.	30° 23' N.	30° 34' N.	34° 20' N.	30° 30' N.	30° 32' N.
Longitude . .	79° 12' E.	76° 44' E.	74° 4' E.	71° 29' E.	75° 22' E.	74° 55' E.
Height . . .	1,200 feet.	1,050 feet.	1,128 feet.	1,056 feet.	1,109 feet.	1,128 feet.
MONTH.	5 Years, 1854 to 1858.	2 Years, 1851 and 1852.	5 Years, 1855 to 1859.	6 Years, 1855 to 1860.	Including Umbala.	Without Umbala.
January - -	74	81	64	60	70	66
February - -	82	86	72	62	75	72
March - - -	91	84	80	73	82	81
April - - -	99	101	92	87	95	93
May - - - -	103	109	98	96	102	99
June - - - -	93	113	95	102	101	97
July - - - -	87	108	96	100	98	94
August - - -	85	100	95	99	95	93
September - -	88	100	91	94	93	91
October - - -	87	98	84	86	89	86
November - -	81	84	78	74	79	78
December - -	74	76	69	63	71	69
Means - - -	87	95	84	83	87	85
Difference between hottest and coldest months.	29	37	34	42	32	33

TABLE LII., showing the MEAN MONTHLY MAXIMUM TEMPERATURE at Elevations above 4,000 Feet, between the Latitudes 25° 14' N. and 27° 2' N. and Longitudes 88° 18' E. and 91° 45' E. in the PRESIDENCY of BENGAL.

Place . . .	CHIRRA-POONGEE.	DAR-JEELING.	NYNEE TÂL.
Latitude . .	25° 14' N.	27° 2' N.	29° 20' N.
Longitude . .	91° 45' E.	88° 18' E.	79° 30' E.
Height . . .	4,118 feet.	7,000 feet.	6,400 feet.
MONTH.	2 Years, 1859 and 1860.	3 Years, 1857 to 1859.	9 Years, 1846 to 1854.
January - - -	61	50	64
February - - -	65	51	65
March - - - -	67	57	72
April - - - -	72	60	78
May - - - - -	74	63	83
June - - - - -	71	65	81
July - - - - -	73	64	77
August - - - -	71	65	76
September - - -	72	65	76
October - - - -	73	61	76
November - - -	64	57	71
December - - -	58	52	67
Means - - - -	68	59	74
Difference between hottest and coldest months.	16	15	19

RELATING TO SECTION III.

MEAN MONTHLY OBSERVED MINIMUM TEMPERATURE of the AIR.

Tables LIII. to LV. at Elevations below 1,000 Feet

Tables LVI. to LXII. at Elevations above 1,000 Feet.

TABLE LIII., showing the MEAN MONTHLY MINIMUM TEMPERATURE at Elevations below 1,000 Feet, between the Latitudes 8° 43' N. and 17° 4' N., and Longitudes 75° 30' E. and 82° 14' E., principally in the MADRAS PRESIDENCY.

Place . . .	PALAM-COTTAH.	CAN-NANORE.	POONA-MALLEE.	FORT ST. GEORGE.	MADRAS.	NELLORE.	KURNOOL.	GUNTOOR.	SAMUL-COTTAH.	MEANS.
Latitude . .	8° 43' N.	11° 52' N.	13° 2' N.	13° 4' N.	13° 6' N.	14° 20' N.	15° 50' N.	16° 20' N.	17° 4' N.	14° 49' N.
Longitude . .	77° 48' E.	75° 30' E.	80° 10' E.	80° 14' E.	80° 21' E.	80° 0' E.	78° 5' E.	80° 30' E.	82° 14' E.	79° 26' E.
Height . . .	120 feet.	15 feet.	2 feet.	....	....	50 feet.	800 feet.	100 feet.	50 feet.	....
MONTH.	5 Years, 1855 to 1859.	10 Years, 1850 to 1859.	5 Years, 1855 to 1859.	....	30 Years, 1796 to 1825.	2 Years, 1859 and 1860.	3 Years, 1857 to 1859.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	....
January - - -	76	78	74	65	69	72	75	68	55	70
February - - -	77	79	76	65	70	75	79	73	60	73
March - - - -	82	81	78	69	72	77	86	72	65	76
April - - - -	84	82	80	74	77	-	90	81	75	80
May - - - - -	84	80	81	78	81	-	88	84	80	82
June - - - - -	84	77	82	79	81	-	84	84	78	81
July - - - - -	83	77	82	77	79	-	82	80	78	80
August - - - -	82	78	82	74	79	-	81	81	77	79
September - - -	83	77	79	74	78	79	81	79	76	78
October - - - -	82	76	78	73	76	81	81	70	74	77
November - - -	79	77	75	67	73	76	76	72	63	73
December - - -	77	76	76	66	71	74	74	65	53	70
Means - - - -	81	78	78	72	76	-	81	76	69	77
Difference between hottest and coldest months.	8	6	8	14	12	-	16	19	27	12

TABLE LIV., showing the MEAN MONTHLY MINIMUM TEMPERATURE at Elevations below 1,000 Feet, between the Latitudes 15° 50' N. and 25° 30' N., and Longitudes 67° 2' E. and 73° 41' E., principally in the BOMBAY PRESIDENCY.

Place . . .	VIN-GORLA.	RCTNA-GHERRY.	DAPOO-LEE.	SURAT.	BARODA.	RAJCOTE.	AHMED-ABAD.	KURRA-CHEE.	DEESA.	HYDER-ABAD.	JACOB-ABAD.	MEANS.
Latitude . .	15° 50' N.	17° 0' N.	17° 45' N.	21° 10' N.	22° 16' N.	22° 18' N.	23° 0' N.	24° 51' N.	25° 14' N.	25° 30' N.	..	21° 22' N.
Longitude . .	73° 41' E.	73° 20' E.	73° 16' E.	72° 52' E.	73° 14' E.	70° 50' E.	72° 0' E.	67° 2' E.	72° 5' E.	69° 5' E.	..	71° 44' E.
Height . . .	20 feet.	150 feet.	600 feet.	33 feet.	90 feet.	450 feet.	320 feet.	27 feet.	400 feet.	99 feet.	220 feet.	215 feet.
MONTH.	4 Years, 1856 to 1859.	5 Years, 1855 to 1859.	2 Years, 1858 and 1859.	10 Years, 1850 to 1859.	7 Years, 1847 to 1853.	4 Years, 1857 to 1860.	2 Years, 1858 and 1859.	..	3 Years, 1857 to 1859.	2 Years, 1856 and 1857.	12 Years, 1848 to 1859.	..
January - - -	72	70	61	59	58	59	65	51	50	58	44	59
February - - -	73	71	62	69	56	62	65	57	54	62	48	62
March - - -	76	74	69	70	71	71	73	66	62	72	56	69
April - - -	79	76	74	76	69	77	82	73	71	78	70	75
May - - -	80	77	76	80	83	83	86	77	78	83	83	81
June - - -	77	77	75	80	80	83	84	80	79	85	90	81
July - - -	76	74	75	78	80	81	77	79	79	84	87	79
August - - -	76	76	73	79	76	79	77	80	76	82	83	78
September - - -	76	77	72	77	77	79	77	78	73	80	81	77
October - - -	77	74	70	73	73	77	77	72	62	76	69	73
November - - -	75	71	66	67	64	66	70	56	53	65	53	64
December - - -	73	70	61	63	58	64	60	51	48	58	46	59
Means - - -	76	74	69	72	69	73	74	67	65	73	67	72
Diff. between hottest and coldest months.	8	7	15	21	27	24	26	29	31	27	46	22

TABLE LV., showing the MEAN MONTHLY MINIMUM TEMPERATURE at Elevations below 1,000 Feet, between the Latitudes 20° 15' N. and 32° 29' N., and Longitudes 74° 33' E. and 92° 46' E., in the PRESIDENCY of BENGAL.

Place . . .	THYET-MYO.	SEETA-BULDEL.	FORT WILLIAM (CALCUTTA).	BERHAM-PORE.	CHUNAR.	BENARES.	LUCK-NOW.	MEERUT.	FEROZEPORE.	PUNJAB.	SEALKOTE.	MEANS.
Latitude . .	20° 15' N.	21° 10' N.	22° 34' N.	24° 5' N.	25° 5' N.	25° 17' N.	26° 0' N.	28° 59' N.	30° 55' N.	31° 40' N.	32° 29' N.	26° 49' N.
Longitude . .	92° 46' E.	79° 9' E.	88° 25' E.	88° 17' E.	83° 0' E.	83° 4' E.	82° 0' E.	77° 46' E.	74° 35' E.	74° 45' E.	74° 33' E.	80° 33' E.
Height . . .	240 feet.	939 feet.	8 feet.	76 feet.	250 feet.	270 feet.	360 feet.	900 feet.	720 feet.	800 feet.	900 feet.	527 feet.
MONTH.	1 Year, 1859.	2 Years, 1858 and 1860.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	10 Years, 1850 to 1859.	2 Years, 1858 and 1859.	3 Years, 1858 to 1860.	1 Year, 1859.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	1 Year, 1859.	..
January - - -	53	61	60	51	54	60	53	50	47	47	51	53
February - - -	62	75	65	54	57	65	59	55	58	54	51	59
March - - -	67	78	73	61	63	71	69	58	63	60	58	65
April - - -	77	87	77	69	74	80	78	71	67	71	67	74
May - - -	78	92	79	71	80	88	81	77	83	82	74	81
June - - -	75	86	81	77	81	85	82	83	84	86	81	83
July - - -	77	81	80	76	79	85	80	85	80	85	80	82
August - - -	78	80	79	77	78	80	81	80	76	84	78	79
September - - -	78	80	80	78	77	81	82	76	78	80	72	79
October - - -	76	77	77	70	72	78	73	63	69	67	64	71
November - - -	66	69	67	60	62	67	62	50	56	51	60	60
December - - -	62	65	59	55	53	59	55	53	52	44	54	55
Means - - -	71	78	73	67	69	75	71	67	68	68	66	70
Diff. between hottest and coldest months.	25	31	22	27	28	29	29	35	37	42	30	30

TABLE LVI., showing the MEAN MONTHLY MINIMUM TEMPERATURE at Elevations between 1,000 and 2,000 Feet, between the Latitudes 17° 0' N. and 17° 28' N., and Longitudes 77° 0' E. and 78° 32' E., in the MADRAS PRESIDENCY.

Place	BELLARY.	SECUNDER- ABAD.	MEANS.
Latitude	17° 0' N.	17° 28' N.	17° 14' N.
Longitude	77° 0' E.	78° 32' E.	77° 46' E.
Height	1,500 feet.	1,800 feet.	1,650 feet.
MONTH.	9 Years, 1851 to 1859.	10 Years, 1850 to 1859.	..
January - - -	68	64	66
February - - -	65	66	66
March - - - -	68	73	70
April - - - -	75	76	75
May - - - -	77	82	80
June - - - -	76	77	77
July - - - -	72	75	74
August - - - -	73	74	73
September - - -	73	73	73
October - - - -	70	71	71
November - - -	72	67	70
December - - -	68	64	66
Means - - -	71	72	72
Difference between hot- test and coldest months.	} 12	18	14

TABLE LVII., showing the MEAN MONTHLY MINIMUM TEMPERATURE at Elevations above 3,000 Feet, between the Latitudes 11° 25' N. and 12° 57' N., and Longitudes 77° 5' E. and 77° 38' E., in the MADRAS PRESIDENCY.

Place	BANGALORE.	WELLINGTON.
Latitude	12° 57' N.	11° 25' N.
Longitude	77° 38' E.	77° 5' E.
Height	3,000 feet.	6,000 feet.
MONTH.	1 Year, 1859.	1 Year, 1859.
January - - - - -	59	60
February - - - - -	63	60
March - - - - -	70	63
April - - - - -	71	62
May - - - - -	72	65
June - - - - -	69	65
July - - - - -	70	62
August - - - - -	69	65
September - - - -	70	59
October - - - - -	69	65
November - - - -	67	64
December - - - -	62	65
Means - - - -	67	63
Difference between hottest and coldest months.	} 13	6

TABLE LVIII., showing the MEAN MONTHLY MINIMUM TEMPERATURE at Elevations between 1,000 and 2,000 Feet, between the Latitudes 16° 11' N. and 26° 20' N., and Longitudes 73° 1' E. and 77° 25' E., principally in the BOMBAY PRESIDENCY.

Place . .	KULLAD- GHEE.	KOLAPORE	SHOLA- PORE.	POONA.	SEROOR.	DHOOLIA.	MHOW.	AHMED- NUGGUR.	NEEMUCH.	NUSSEER- ABAD.	MEANS.
Latitude .	16° 11' N.	16° 42' N.	17° 40' N.	18° 30' N.	18° 50' N.	20° 54' N.	22° 33' N.	23° 24' N.	24° 27' N.	26° 20' N.	20° 35' N.
Longitude .	75° 33' E.	74° 18' E.	76° 0' E.	74° 0' E.	77° 25' E.	74° 45' E.	75° 46' E.	73° 1' E.	74° 54' E.	74° 50' E.	75° 3' E.
Height . .	1,750 feet.	1,797 feet.	1,821 feet.	1,800 feet.	1,752 feet.	1,000 feet.	1,862 feet.	1,900 feet.	1,476 feet.	1,500 feet.	1,665 feet
MONTH.	5 Years, 1855 to 1859.	10 Years, 1850 to 1859.	11 Years, 1850 to 1860.	5 Years, 1856 to 1860.	5 Years, 1854 to 1858.	6 Years, 1853 to 1858.	2 Years, 1859 and 1860.	6 Years, 1854 to 1859.	1 Year, 1860.	2 Years, 1859 and 1860.	..
January - - -	60	67	69	58	50	62	65	59	49	61	60
February - - -	66	69	72	63	51	65	68	62	50	69	63
March - - - -	74	75	78	68	59	72	75	69	60	73	70
April - - - -	74	76	85	71	64	79	79	75	70	83	76
May - - - -	74	77	83	74	69	83	78	76	75	84	77
June - - - -	72	76	79	72	69	81	64	74	78	88	75
July - - - -	73	74	78	70	68	79	78	73	73	84	75
August - - - -	73	73	77	69	68	77	74	71	73	77	73
September - - -	73	74	77	68	66	76	73	70	71	76	72
October - - - -	68	75	76	66	68	73	74	69	66	78	71
November - - -	63	72	73	61	59	65	73	63	56	66	65
December - - -	60	67	66	58	50	61	67	59	55	59	60
Means - - -	69	73	75	66	62	73	72	68	64	75	70
Difference between hot- test and cold- est months.	} 14	10	19	16	19	22	14	17	29	29	17

TABLE LIX., showing the MONTHLY MEAN MINIMUM TEMPERATURE at Elevations between 2,000 and 3,000 Feet between the Latitudes 15° 50' N. and 17° 40' N., and Longitudes 74° 2' E. and 75° 10' E., principally in the BOMBAY PRESIDENCY.

Place	DHARWAR.	BELGAUM.	SATTARA.	MEANS.
Latitude	15° 50' N.	15° 52' N.	17° 40' N.	16° 27' N.
Longitude	75° 10' E.	74° 42' E.	74° 2' E.	74° 38' E.
Height	2,482 feet.	2,260 feet.	2,320 feet.	2,354 feet.
MONTH.	2 Years, 1859 and 1860.	4 Years, 1856 to 1859.	....	....
January - - -	61	57	64	61
February - - -	71	59	66	65
March - - -	74	62	71	69
April - - -	73	66	75	71
May - - -	77	66	75	73
June - - -	75	66	72	71
July - - -	73	66	71	70
August - - -	70	65	71	69
September - - -	70	64	70	68
October - - -	71	62	69	67
November - - -	69	62	64	65
December - - -	64	57	62	61
Means - - -	70	63	69	67
Difference between hottest and coldest months. }	16	9	13	12

TABLE LX., showing the MONTHLY MEAN MINIMUM TEMPERATURE at Elevations between 4,000 and 5,000 Feet, between the Latitudes 17° 59' N. and 24° 45' N., and Longitudes 72° 49' E. and 73° 54' E., principally in the BOMBAY PRESIDENCY.

Place	MAHAB- LESHWUR.	POORUN- DHUR.	MOUNT ABOO.	MEANS.
Latitude	17° 59' N.	18° 12' N.	24° 45' N.	20° 19' N.
Longitude	73° 30' E.	73° 54' E.	72° 49' E.	73° 34' E.
Height	4,500 feet.	4,200 feet.	4,000 feet.	4,250 feet.
MONTH.	1 Year, 1834.	2 Years, 1852 and 1853.	5 Years, 1855 to 1859.	....
January - - -	60	62	43	55
February - - -	61	67	47	58
March - - -	66	70	60	65
April - - -	67	71	61	66
May - - -	67	68	66	67
June - - -	63	65	66	65
July - - -	63	65	65	64
August - - -	64	64	64	64
September - - -	64	65	62	64
October - - -	62	67	61	63
November - - -	57	65	55	59
December - - -	56	59	43	53
Means - - -	62	65	57	62
Difference between hottest and coldest months. }	11	12	23	14

TABLE LXI., showing the MEAN MINIMUM TEMPERATURE at Elevations between 1,000 and 2,000 Feet, between the Latitudes 26° 42' N. and 34° 20' N., and Longitudes 71° 29' E. and 79° 12' E., principally in the PRESIDENCY of BENGAL.

Place . . .	KHER- WARRAH.	UMBALLA.	MEAN MEER.	PESHAWUR.	MEANS.	MEANS.
Latitude . .	26° 42' N.	30° 23' N.	30° 34' N.	34° 20' N.	30° 30' N.	30° 32' N.
Longitude .	79° 12' E.	76° 44' E.	74° 4' E.	71° 29' E.	75° 22' E.	74° 55' E.
Height . .	1,200 feet.	1,050 feet.	1,128 feet.	1,056 feet.	1,109 feet.	1,128 feet.
MONTH.	5 Years, 1854 to 1858.	2 Years, 1851 and 1852.	5 Years, 1855 to 1859.	6 Years, 1855 to 1860.	Including Umballa.	Not including Umballa.
January -	53	37	45	44	45	40
February -	58	46	48	49	50	52
March -	67	50	62	57	59	62
April -	76	54	66	64	65	69
May -	84	62	74	78	75	79
June -	81	76	82	79	80	81
July -	78	74	78	81	78	79
August -	76	76	77	77	77	77
September -	76	65	74	73	72	74
October -	68	54	66	67	64	67
November -	54	41	59	54	52	56
December -	52	37	51	48	47	50
Means -	69	56	65	64	64	66
Difference be- tween hottest and coldest month. }	32	39	37	37	35	34

TABLE LXII., showing the MEAN MINIMUM TEMPERATURE at Elevations above 4,000 Feet between the Latitudes 25° 14' N. and 29° 20' N., and Longitudes 79° 30' E. and 91° 45' E. in the PRESIDENCY of BENGAL.

Place . . .	CHIRRA- POONGEE.	DARJEE- LING.	NYNEE TAL.
Latitude . .	25° 14' N.	27° 2' N.	29° 20' N.
Longitude .	91° 45' E.	88° 18' E.	79° 30' E.
Height . .	4,118 feet.	7,000 feet.	6,400 feet.
MONTH.	2 Years, 1859 and 1860.	3 Years, 1857 to 1859.	9 Years, 1846 to 1854.
January -	52	39	28
February -	50	39	31
March -	56	46	38
April -	64	50	45
May -	66	53	52
June -	66	58	57
July -	68	58	59
August -	67	58	58
September -	67	56	54
October -	65	50	46
November -	48	44	38
December -	47	39	35
Means -	60	49	45
Difference be- tween hottest and coldest months. }	21	19	31

RELATING TO SECTION IV.

MEAN MONTHLY OBSERVED DAILY RANGE OF TEMPERATURE IN EACH PRESIDENCY.

Tables LXIII. to LXV. at Elevations below 1,000 Feet.

Tables LXVI. to LXXI. at Elevations above 1,000 Feet.

TABLE LXIII., showing the MEAN DAILY RANGE of TEMPERATURE at Elevations below 1,000 Feet, between the Latitudes 8° 43' N. and 17° 4' N., and Longitudes 75° 30' E. and 82° 14' E., principally in the PRESIDENCY of MADRAS.

Place	PALAM-COTTAH.	CANNANORE.	POONA-MALLEE.	FORT ST. GEORGE.	MADRAS.	NELLORE.	KURNOOL.	GUNTOOR.	SAMUL-COTTAH.	MEANS.
Latitude	8° 43' N.	11° 52' N.	13° 2' N.	13° 4' N.	13° 6' N.	14° 20' N.	15° 50' N.	16° 20' N.	17° 4' N.	14° 49' N.
Longitude	77° 48' E.	75° 30' E.	80° 10' E.	80° 14' E.	80° 21' E.	80° 0' E.	78° 5' E.	80° 30' E.	82° 14' E.	79° 26' E.
Height	120 feet.	15 feet.	2 feet.	....	....	50 feet.	800 feet.	100 feet.	50 feet.	144 feet.
MONTH.	5 Years, 1855 to 1859.	10 Years, 1850 to 1859.	5 Years, 1855 to 1859.	....	30 Years, 1796 to 1825.	2 Years, 1859 and 1860.	3 Years, 1857 to 1859.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	...
January - - -	10	9	6	19	15	4	5	14	23	12
February - - -	13	8	5	21	18	5	6	11	23	12
March - - -	11	8	4	20	19	8	5	19	23	13
April - - -	10	8	5	19	16	-	3	10	17	11
May - - -	10	8	5	23	19	-	5	10	15	12
June - - -	9	6	5	20	17	-	4	10	12	10
July - - -	9	6	4	15	16	-	3	6	7	8
August - - -	11	4	2	21	15	-	2	6	8	9
September - - -	10	6	4	18	15	8	3	5	9	9
October - - -	9	8	4	16	16	4	4	11	9	9
November - - -	8	10	5	19	14	2	4	9	17	10
December - - -	9	10	5	20	13	3	5	14	25	12
Means - - -	10	7	4	19	16	-	4	10	16	15
Difference between greatest and least range - - }	5	6	4	8	6	-	4	14	18	5

TABLE LXIV., showing the MEAN DAILY RANGE of TEMPERATURE at Elevations below 1,000 Feet, between the Latitudes 15° 50' N. and 25° 30' N., and Longitudes 67° 2' E. and 73° 41' E., principally in the BOMBAY PRESIDENCY.

Place	VIN-GORLA.	RUTNA-GHERRY.	DAPOOLLEE.	SURAT.	BARODA.	RAJCOTE.	AHMED-ABAD.	KURRA-CHEE.	DEESA.	HYDER-ABAD.	JACOB-ABAD.	MEANS.
Latitude	15° 50' N.	17° 0' N.	17° 45' N.	21° 10' N.	22° 16' N.	22° 18' N.	23° 0' N.	24° 51' N.	25° 14' N.	25° 30' N.	....	21° 22' N.
Longitude	73° 41' E.	73° 20' E.	73° 16' E.	72° 52' E.	73° 14' E.	70° 50' E.	73° 0' E.	67° 2' E.	72° 5' E.	69° 5' E.	....	71° 44' E.
Height	20 feet.	150 feet.	600 feet.	33 feet.	90 feet.	450 feet.	320 feet.	27 feet.	400 feet.	99 feet.	220 feet.	215 feet.
MONTH.	4 Years, 1856 to 1859.	5 Years, 1855 to 1859.	2 Years, 1858 and 1859.	10 Years, 1850 to 1859.	7 Years, 1847 to 1853.	4 Years, 1857 to 1860.	2 Years, 1858 and 1859.	....	3 Years, 1857 to 1859.	2 Years, 1856 and 1857.	12 Years, 1848 to 1859.	....
January - - -	12	16	27	28	26	19	13	27	29	13	33	22
February - - -	12	16	27	22	34	21	31	20	31	16	34	24
March - - -	11	16	22	28	25	18	21	19	32	17	37	22
April - - -	9	16	19	25	25	20	22	14	31	16	30	21
May - - -	8	16	15	20	22	16	22	14	28	16	25	18
June - - -	8	12	11	14	18	12	10	14	21	14	19	14
July - - -	7	11	8	12	11	7	27	12	14	11	21	13
August - - -	6	8	7	8	12	5	15	12	11	11	19	10
September - - -	6	8	11	13	13	6	13	10	16	10	20	11
October - - -	7	13	18	20	14	12	13	21	31	13	25	17
November - - -	8	16	26	24	26	20	17	33	36	15	35	23
December - - -	12	17	26	25	31	15	19	30	34	15	33	23
Means - - -	9	14	19	20	23	15	19	20	27	14	28	18
Difference between greatest and least range - - }	6	9	20	20	15	14	21	23	25	6	18	14

TABLE LXV., showing the MEAN DAILY RANGE of TEMPERATURE at Elevations below 1,000 Feet, between the Latitudes 20° 15' N. and 32° 29' N., and Longitudes 74° 33' E. and 92° 46' E., in the PRESIDENCY of BENGAL.

Place . . .	THYET MYO.	SEETA- BULDEE.	FORT WILLIAM, CALCUTTA.	BERHAM- PORE.	CHUNAR.	BENARES.	LUCK- NOW.	MEERUT.	FEROZE- PORE.	PUNJAB.	SEAL- KOTE.	MEANS.
Latitude . .	20° 15' N.	21° 10' N.	22° 34' N.	24° 5' N.	25° 5' N.	25° 17' N.	26° 0' N.	28° 59' N.	30° 55' N.	31° 40' N.	32° 29' N.	26° 49' N.
Longitude . .	92° 46' E.	79° 9' E.	88° 25' E.	88° 17' E.	83° 0' E.	83° 4' E.	82° 0' E.	77° 46' E.	74° 35' E.	74° 45' E.	74° 33' E.	80° 33' E.
Height . . .	240 feet.	939 feet.	8 feet.	76 feet.	250 feet.	270 feet.	360 feet.	900 feet.	720 feet.	800 to 900 feet.	900 feet.	527 feet.
MONTH.	1 Year, 1859.	2 Years, 1858 to 1860.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	10 Years, 1850 to 1859.	2 Years, 1858 and 1859.	3 Years, 1858 to 1860.	1 Year, 1859.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	1 Year, 1859.	..
January - -	36	19	18	25	22	13	25	22	25	14	12	20
February - -	33	9	18	28	25	9	19	19	19	12	15	17
March - - -	31	10	17	30	30	7	20	18	26	16	22	20
April - - -	24	10	16	29	24	8	20	21	28	12	22	19
May - - - -	15	7	15	28	22	10	19	26	22	7	20	17
June - - - -	9	4	10	23	22	5	16	14	22	6	17	14
July - - - -	10	3	8	16	17	2	16	14	21	4	13	11
August - - -	9	3	8	13	16	3	7	12	20	4	14	10
September - -	10	4	8	13	16	5	6	9	18	6	19	10
October - - -	11	8	10	18	19	3	13	27	20	17	22	16
November - - -	19	10	15	21	23	7	16	31	25	21	16	19
December - - -	22	9	18	20	24	9	11	16	21	21	10	16
Means - - -	19	8	13	22	22	7	16	19	22	11	17	16
Difference between greatest and least range - - - -	27	16	10	17	14	11	19	22	10	17	9	10

TABLE LXVI., showing the MEAN DAILY RANGE of TEMPERATURE at Elevations up to 6,000 Feet in the MADRAS PRESIDENCY.

Place	BELLARY.	SECUNDERABAD.	MEANS of two pre- ceding columns.	BANGALORE.	WELLINGTON.
Latitude	17° 0' N.	17° 28' N.	17° 14' N.	12° 27' N.	11° 25' N.
Longitude	77° 0' E.	78° 32' E.	77° 46' E.	77° 38' E.	77° 5' E.
Height	1,500 feet.	1,800 feet.	1,650 feet.	3,000 feet.	6,000 feet.
MONTH.	9 Years, 1851 to 1859.	10 Years, 1850 to 1859.	9½ Years, 1850 to 1859.	1 Year, 1859.	1 Year, 1859.
January - - - -	10	14	12	20	8
February - - - -	16	16	16	20	6
March - - - - -	17	14	16	18	8
April - - - - -	15	16	16	15	5
May - - - - - -	15	13	14	19	8
June - - - - - -	10	9	9	15	8
July - - - - - -	10	8	9	14	12
August - - - - -	9	9	9	12	10
September - - -	11	9	10	12	16
October - - - -	10	11	10	13	9
November - - - -	8	12	10	12	4
December - - - -	10	13	12	18	10
Means - - - - -	12	12	11	5	20
Difference between greatest and least range - - - - -	8	8	7	8	11

TABLE LXVII., showing the MEAN DAILY RANGE of TEMPERATURE at Elevations between 1,000 and 2,000 Feet, between the Latitudes 16° 11' N. and 26° 20' N., and Longitudes 73° 1' E. and 77° 25' E., principally in the BOMBAY PRESIDENCY.

Place . .	KUL-LADGHEE.	KOLA-PORE.	SHOLA-PORE.	POONA.	SEROOR.	DHOOLIA.	MHOW.	AHMED-NUGGUR.	NEEMUCH.	NUSSEER-ABAD.	MEANS.
Latitude . .	16° 11' N.	16° 42' N.	17° 40' N.	18° 30' N.	18° 50' N.	20° 54' N.	22° 33' N.	23° 34' N.	24° 27' N.	26° 20' N.	20° 35' N.
Longitude . .	75° 33' E.	74° 18' E.	76° 0' E.	74° 0' E.	77° 25' E.	74° 45' E.	75° 46' E.	73° 1' E.	74° 54' E.	74° 50' E.	75° 3' E.
Height . .	1,750 feet.	1,797 feet.	1,821 feet.	1,800 feet.	1,752 feet.	1,000 feet.	1,862 feet.	1,900 feet.	1,476 feet.	1,500 feet.	1,665 feet.
MONTH.	5 Years, 1855 to 1859.	10 Years, 1850 to 1859.	11 Years, 1850 to 1860.	5 Years, 1856 to 1860.	5 Years, 1854 to 1859.	6 Years, 1853 to 1858.	2 Years, 1859 and 1860.	6 Years, 1854 to 1859.	1 Year, 1860.	2 Years, 1859 and 1860.	...
January - -	29	10	11	23	44	18	10	24	13	4	19
February - -	26	13	12	24	43	21	9	25	21	7	20
March - -	27	12	13	23	42	20	10	25	20	7	20
April - -	30	12	8	24	43	19	13	23	22	8	20
May - -	27	12	10	19	29	18	17	22	19	11	18
June - -	24	15	9	13	27	13	21	14	4	11	15
July - -	18	3	6	10	23	6	8	10	3	7	9
August - -	20	3	7	9	20	7	3	11	2	12	9
September - -	18	4	7	11	18	8	5	11	8	10	10
October - -	23	5	7	18	28	13	7	15	11	6	13
November - -	25	6	8	22	36	18	5	19	22	18	18
December - -	25	10	12	22	49	20	7	21	21	10	20
Means - -	24	8	10	19	33	15	10	19	15	9	16
Difference between greatest and least range	12	10	7	15	31	14	18	15	19	14	11

The results at Seroor are evidently erroneous, and possibly belong to radiation and not to temperature.

TABLE LXVIII., showing the MEAN DAILY RANGE of TEMPERATURE at Elevations between 2,000 and 3,000 Feet, between the Latitudes 15° 50' N. and 17° 40' N., and Longitudes 74° 2' E. and 75° 10' E., principally in the BOMBAY PRESIDENCY.

Place . . .	DHARWAR.	BELGAUM.	SATTARA.	MEANS.
Latitude . .	15° 50' N.	15° 52' N.	17° 40' N.	16° 27' N.
Longitude . .	75° 10' E.	74° 42' E.	74° 2' E.	74° 38' E.
Height . . .	2,482 feet.	2,260 feet.	2,320 feet.	2,354 feet.
MONTH.	2 Years, 1859 and 1860.	4 Years, 1856 to 1859.	..	..
January - -	22	28	17	22
February - -	18	32	17	22
March - -	18	32	17	22
April - -	18	31	17	22
May - -	14	23	15	17
June - -	8	15	7	10
July - -	7	13	5	8
August - -	7	13	3	8
September - -	7	16	7	10
October - -	11	23	10	15
November - -	16	22	14	17
December - -	16	26	17	20
Means - -	14	22	13	17
Difference between greatest and least range	15	19	14	14

TABLE LXIX., showing the MEAN DAILY RANGE of TEMPERATURE at Elevations between 4,000 and 5,000 Feet, between the Latitudes 17° 59' N. and 24° 45' N., and Longitudes 72° 49' E. and 73° 54' E., principally in the BOMBAY PRESIDENCY.

Place . . .	MAHAB-LESHWUR.	POORUN-DHUR.	MOUNT ABOO.	MEANS.
Latitude . .	17° 59' N.	18° 12' N.	24° 45' N.	20° 19' N.
Longitude . .	73° 30' E.	73° 54' E.	72° 49' E.	73° 24' E.
Height . . .	4,500 feet.	4,200 feet.	4,000 feet.	4,233 feet.
MONTH.	1 Year, 1834.	2 Years, 1852 add 1853.	5 Years, 1855 to 1859.	..
January - -	11	9	28	16
February - -	13	10	31	18
March - -	16	11	22	16
April - -	15	12	26	18
May - -	14	10	26	17
June - -	6	15	26	16
July - -	4	6	16	8
August - -	4	4	12	7
September - -	2	8	16	8
October - -	7	7	18	11
November - -	13	8	24	15
December - -	12	11	30	17
Means - -	10	10	24	14
Difference between greatest and least range	14	8	19	11

TABLE LXX., showing the MEAN DAILY RANGE of TEMPERATURE at Elevations between 1,000 and 2,000 Feet, between the Latitudes 26° 42' N. and 34° 20' N., and Longitudes 71° 29' E. and 79° 12' E., principally in the BENGAL PRESIDENCY.

Place . . .	KHER- WARRAH.	UMBALLA.	MEAN MEER.	PESHAWUR.	MEANS.
Latitude . .	26° 42' N.	30° 23' N.	30° 34' N.	34° 20' N.	30° 32' N.
Longitude . .	79° 12' E.	76° 44' E.	74° 4' E.	71° 29' E.	74° 55' E.
Height . . .	1,200 feet.	1,050 feet.	1,128 feet.	1,056 feet.	1,128 feet.
MONTH.	5 Years, 1854 to 1859.	2 Years, 1851 and 1852.	5 Years, 1855 to 1859.	5 Years, 1855 to 1859.	Without Umbala.
January - - -	21	24	19	16	19
February - - -	24	40	24	13	20
March - - -	24	34	18	16	19
April - - -	23	47	26	23	24
May - - -	19	47	24	18	20
June - - -	12	37	13	23	16
July - - -	9	34	18	19	15
August - - -	9	24	18	22	16
September - -	12	35	17	21	17
October - - -	19	44	18	19	19
November - - -	27	43	19	20	22
December - - -	22	39	18	15	19
Means - - -	18	45	19	19	19
Difference between greatest and least range - - -	18	20	13	10	9

TABLE LXXI., showing the MEAN DAILY RANGE of TEMPERATURE at Elevations above 4,000 Feet, between the Latitudes 25° 14' N. and 29° 20' N., and Longitudes 79° 30' E. and 91° 45' E., principally in the BENGAL PRESIDENCY.

Place . . .	CHIRRA- POONGEE.	DARJEE- LING.	NYNEE TÂL.
Latitude . .	25° 14' N.	27° 2' N.	29° 20' N.
Longitude . .	91° 45' E.	88° 18' E.	79° 30' E.
Height . . .	4,118 feet.	7,000 feet.	6,400 feet.
MONTH.	2 Years, 1859 and 1860.	3 Years, 1857 to 1859.	9 Years, 1846 to 1854.
January - - -	9	11	36
February - - -	15	12	34
March - - -	11	11	34
April - - -	8	10	33
May - - -	8	10	31
June - - -	5	7	24
July - - -	5	6	18
August - - -	4	7	18
September - -	5	9	22
October - - -	8	11	30
November - - -	16	13	33
December - - -	11	13	32
Means - - -	8	10	29
Difference between greatest and least range - - -	11	7	18

The results at Nynee Tâl are probably connected with radiation observations, or else the instruments have been placed too near the ground.

RELATING TO SECTION V.

The MEAN MONTHLY OBSERVED TEMPERATURE of the AIR.

Tables LXXII. to LXXIV. at Elevations below 1,000 Feet.

Tables LXXV. to LXXXII. at Elevations above 1,000 Feet.

TABLE LXXII., showing the MEAN MONTHLY TEMPERATURE of the AIR at Elevations above the Sea less than 1,000 Feet, between the Latitudes 8° 43' N. and 17° 4' N., and Longitudes 75° 30' E. and 82° 14' E., in the PRESIDENCY of MADRAS, arranged in the Order of Latitude.

Place	PALAM- COTTAH.	ANGARA KANDY.	CANNA- NORE.	POONA- MALLÉE.	FORT ST. GEORGE.	MADRAS.	NEL- LORE.	KIR- NOOL.	GUN- TOOR.	SAMUL- COTTAH.	MEANS.
Latitude	8° 43' N.	11° 40' N.	11° 52' N.	13° 2' N.	13° 4' N.	13° 6' N.	14° 20' N.	15° 50' N.	16° 20' N.	17° 4' N.	13° 30' N.
Longitude	77° 48' E.	75° 40' E.	75° 30' E.	80° 10' E.	80° 14' E.	80° 21' E.	80° 0' E.	78° 5' E.	80° 30' E.	82° 14' E.	79° 3' E.
Height	120 feet.	..	15 feet.	2 feet.	..	..	50 feet.	800 feet.	100 feet.	50 feet.	126 feet.
MONTH.	5 Years, 1855 to 1859.	10 Years, 1810 to 1813 and 1818 to 1823.	10 Years, 1850 to 1859.	5 Years, 1855 to 1859.	..	55 Years, 1796 to 1850.	2 Years, 1859 and 1860.	3 Years, 1857 to 1859.	5 Years, 1855 to 1859.	2 Years, 1858 and 1859.	..
January - - -	81	80	82	77	74	76	74	78	75	67	76
February - - -	84	82	82	79	77	78	77	82	79	71	79
March - - -	87	84	84	80	79	80	80	88	82	77	82
April - - -	89	86	86	82	83	83	85	91	86	84	85
May - - -	89	84	85	83	89	87	92	90	89	87	87
June - - -	89	80	80	85	88	87	91	86	89	84	86
July - - -	87	78	79	84	86	85	85	82	83	82	83
August - - -	88	79	79	83	86	84	85	84	84	81	83
September - -	88	79	79	81	83	84	83	83	82	80	82
October - - -	86	81	81	80	82	82	82	83	76	79	81
November - - -	83	81	82	78	76	79	77	78	76	72	78
December - - -	82	80	81	78	76	77	76	77	72	66	77
Means - - -	86	81	82	81	82	82	82	84	81	78	82
Mean difference between hottest and coldest months - - -	8	8	7	8	15	11	18	14	17	21	11

TABLE LXXIII., showing the MEAN TEMPERATURE of the AIR at Elevations above the Sea less than 1,000 Feet, between the Latitudes 15° 50' N. and 25° 30' N., and Longitudes 67° 2' E. and 73° 41' E., principally in the BOMBAY PRESIDENCY, arranged in the order of Latitude.

Place . . .	VINGORLA.	RUTNAGHERRY.	DAPOOLEE.	BOMBAY.	SURAT.	BARODA.	RAJCOTE.	AHMED-ABAD.	KURRACHEE.	DEESA.	HYDER-ABAD.	JACOB-ABAD.	MEANS.
Latitude . . .	15° 50' N.	17° 0' N.	17° 48' N.	18° 53' N.	21° 10' N.	22° 16' N.	22° 18' N.	23° 0' N.	24° 51' N.	25° 14' N.	25° 30' N.	...	21° 32' N.
Longitude . . .	73° 41' E.	73° 20' E.	73° 16' E.	72° 52' E.	72° 52' E.	73° 14' E.	70° 50' E.	72° 0' E.	67° 2' E.	72° 5' E.	69° 5' E.	...	71° 42' E.
Height . . .	20 feet.	150 feet.	600 feet.	....	33 feet.	90 feet.	450 feet.	320 feet.	27 feet.	400 feet.	99 feet.	220 feet.	290 feet.
MONTH.	4 Years, 1856 to 1859.	5 Years, 1855 to 1859.	2 Years, 1858 and 1859.	12 Years, 1847 to 1858.	10 Years, 1850 to 1859.	7 Years, 1847 to 1853.	4 Years, 1857 to 1860.	2 Years, 1858 and 1859.	..	3 Years, 1857 to 1859.	2 Years, 1856 and 1857.	12 Years, 1848 to 1859.	..
January - -	78	78	75	74	73	71	69	71	64	64	64	60	70
February - -	79	79	-	76	77	70	75	80	67	70	71	65	73
March - - -	82	82	81	80	84	83	82	83	76	80	81	74	80
April - - -	83	84	86	83	88	81	86	93	81	87	87	85	85
May - - -	85	85	86	86	89	94	90	97	83	91	91	95	89
June - - -	81	83	83	83	87	89	89	89	88	89	92	99	87
July - - -	79	80	82	81	84	85	85	90	86	88	91	98	87
August - -	79	80	80	81	83	84	82	84	85	82	88	92	83
September - -	79	82	79	80	83	83	81	83	83	83	85	91	82
October - -	81	83	80	82	83	80	83	83	79	81	82	81	81
November - -	79	79	80	79	78	77	77	78	73	84?	73	70	77
December - -	78	79	..	76	74	73	73	69	64	69	66	63	72
Means - -	80	81	81	80	82	81	81	83	78	80	81	81	80
Difference between hottest and coldest months - -	7	7	11	12	16	24	21	28	24	27	28	39	19

TABLE LXXIV., showing the MEAN MONTHLY TEMPERATURE at Elevations above the Sea less than 1,000 Feet, between the Latitudes 21° 10' N. and 31° 40' N., and Longitudes 74° 35' E. and 88° 25' E., principally in the PRESIDENCY of BENGAL, arranged in the order of Latitude.

Place	SEETABULDEE.	CALCUTTA.	BERHAMPORE.	CHUNAR.	BENARES.	LUCKNOW.	CAWNPORE.	FUTTYGHUR.	MEERUT.	FEROZEPORE.	PUNJAB.	MEANS.
Latitude	21° 10' N.	22° 34' N.	24° 5' N.	25° 5' N.	25° 17' N.	26° 0' N.	26° 29' N.	27° 2' N.	28° 59' N.	30° 55' N.	31° 40' N.	26° 18' N.
Longitude	79° 9' E.	88° 25' E.	88° 17' E.	83° 0' E.	83° 4' E.	82° 0' E.	80° 22' E.	79° 30' E.	77° 46' E.	74° 35' E.	74° 45' E.	80° 59' E.
Height	939 feet.	80 feet.	76 feet.	250 feet.	270 feet.	360 feet.	500 feet.	600 feet.	900 feet.	720 feet.	900 feet.	509 feet.
MONTH.	2 Years, 1858 to 1860.	..	3 Years, 1857 to 1859.	10 Years, 1850 to 1859.	..	3 Years, 1858 to 1860.	2 Years, 1834 and 1835.	2 Years, 1832 and 1833.	1 Year, 1859.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	..
January - - - -	71	70	64	65	64	66	64	57	61	59	54	63
February - - - -	79	75	68	70	69	68	70	63	65	68	60	69
March - - - -	83	83	76	78	77	79	72	74	70	76	68	76
April - - - -	92	88	83	86	87	88	89	85	83	81	77	85
May - - - -	95	89	85	91	94	91	97	90	90	94	86	91
June - - - -	88	87	89	92	89	90	91	95	92	95	89	91
July - - - -	83	85	84	87	86	88	87	87	88	90	87	87
August - - - -	81	85	83	86	84	84	87	85	84	86	86	85
September - - -	82	85	84	85	84	85	85	84	82	86	83	84
October - - - -	81	84	79	82	81	79	79	75	76	79	76	79
November - - - -	74	78	70	74	71	70	75	69	68	68	61	71
December - - - -	69	72	65	65	64	60	68	58	62	58	55	63
Means - - - -	82	82	77	80	80	79	80	77	77	78	73	78
Difference between hottest and coldest months - -	26	19	25	27	30	31	33	38	31	37	35	28

TABLE LXXV., showing the MEAN MONTHLY TEMPERATURE of the AIR at Elevations between 1,000 and 2,000 Feet between the Latitudes 14° 31' N. and 17° 28' N., and Longitudes 75° 51' E. and 78° 32' E., in the MADRAS PRESIDENCY.

Place	HURRYHUR.	BELLARY.	SECUNDERABAD.	MEANS.
Latitude	14° 31' N.	17° 0' N.	17° 28' N.	16° 20' N.
Longitude	75° 51' E.	77° 0' E.	78° 32' E.	77° 8' E.
Height	1,831 feet.	1,500 feet.	1,800 feet.	1,710 feet.
MONTH.	4 Years, 1857 to 1860.	9 Years, 1851 to 1859.	10 Years, 1850 to 1859.	....
January - - - -	74	74	73	74
February - - - -	79	79	76	78
March - - - -	81	85	81	82
April - - - -	81	88	86	85
May - - - -	84	86	89	86
June - - - -	81	83	83	82
July - - - -	79	80	80	80
August - - - -	78	79	79	79
September - - - -	79	79	78	79
October - - - -	80	78	78	79
November - - - -	78	74	76	76
December - - - -	76	73	73	74
Means - - - -	79	80	80	79
Difference between hottest and coldest months - - }	10	15	16	12

TABLE LXXVI., showing the MEAN TEMPERATURE of the AIR at Elevations between 1,000 and 2,000 Feet, at Stations between the Latitudes 16° 11' N. and 26° 20' N., and Longitudes 73° 1' E. and 77° 25' E., principally in the BOMBAY PRESIDENCY.

Place	KULLAD- GHEE.	SHOLA- PORE.	POONA.	SEROOR.	DHOOLIA.	MHOW.	AHMED- NUGGUR.	NEEMUCH.	NUSSEER- ABAD.	MEANS.
Latitude	16° 11' N.	17° 40' N.	18° 30' N.	18° 50' N.	20° 54' N.	22° 33' N.	23° 34' N.	24° 27' N.	26° 20' N.	20° 59' N.
Longitude	75° 33' E.	76° 0' E.	73° 30' E.	77° 25' E.	74° 45' E.	75° 46' E.	73° 1' E.	74° 54' E.	74° 50' E.	75° 5' E.
Height	1,750 feet.	1,821 feet.	1,800 feet.	1,752 feet.	1,000 feet.	1,862 feet.	1,900 feet.	1,476 feet.	1,500 feet.	1,663 feet.
MONTH.	5 Years, 1855 to 1859.	11 Years, 1850 to 1860.	....	5 Years, 1854 to 1858.	6 Years, 1853 to 1858.	2 Years, 1859 and 1860.	6 Years, 1854 to 1859.	1 Year, 1860.	2 Years, 1859 and 1860.	....
January - - - -	75	75	70	72	70	70	71	55	63	69
February - - - -	79	78	74	71	76	72	75	60	68	73
March - - - -	88	84	79	80	82	80	82	70	77	80
April - - - -	89	89	83	87	88	86	87	81	87	86
May - - - -	87	88	84	83	91	87	87	84	89	87
June - - - -	84	83	80	81	87	74	81	80	94	83
July - - - -	82	81	77	76	82	82	77	74	88	80
August - - - -	83	80	76	76	80	75	76	74	77	87
September - - - -	82	81	76	76	80	75	76	75	81	78
October - - - -	79	80	78	77		77	77	71	79	78
November - - - -	76	77	76	75	76	75	73	67	75	74
December - - - -	72	72	71	72	72	71	70	65	64	70
Means - - - -	81	81	77	77	81	77	77	71	79	79
Difference be- tween hottest and coldest months - }	17	17	14	16	21	17	17	29	31	18

TABLE LXXVII., showing the MEAN MONTHLY TEMPERATURE of the AIR at Elevations between 1,000 and 2,000 Feet in the PRESIDENCY of BENGAL.

Place .	KHER-WARRAH.	KULSEA.	UM-BALLA.	MEAN MEER.	PESHA-WUR.	MEANS.	MEANS.
Latitude .	26° 42' N.	30° 0' N.	30° 23' N.	36° 34' N.	34° 20' N.	30° 24' N.	30° 24' N.
Longitude .	79° 12' E.	77° 30' E.	76° 44' E.	74° 4' E.	71° 29' E.	75° 48' E.	75° 34' E.
Height .	1,200feet.	1,100feet.	1,050feet.	1,128feet.	1,056feet.	1,107feet.	1,121feet.
MONTH.	5 Years, 1854 to 1858.	2 Years, 1837 and 1838.	2 Years, 1851 and 1852.	5 Years, 1855 to 1859.	6 Years, 1855 to 1860.	Umballa included.	Umballa left out.
January -	64	58	60	55	52	58	57
February -	71	61	70	60	55	63	62
March -	79	63	67	71	65	69	69
April -	89	78	83	79	75	81	80
May -	94	81	89	86	88	88	87
June -	88	86	97	86	91	89	88
July -	82	84	87	87	91	86	86
August -	80	75	91	86	88	84	82
September -	81	77	92	82	84	83	81
October -	77	71	84	75	73	76	74
November -	68	63	67	69	64	66	66
December -	64	60	62	60	56	60	60
Means -	78	71	79	75	74	75	74
Difference between hottest and coldest months. }	30	28	37	32	39	31	31

TABLE LXXVIII., showing the MEAN MONTHLY TEMPERATURE of the AIR at Elevations between 2,000 and 3,000 Feet in the MADRAS PRESIDENCY.

Place	SERINGAPATAM.
Latitude	12° 45' N.
Longitude	76° 51' E.
Height	2,412 feet.
MONTH.	2 Years, 1814 to 1816.
January - - - - -	71
February - - - - -	77
March - - - - -	81
April - - - - -	84
May - - - - -	85
June - - - - -	79
July - - - - -	75
August - - - - -	74
September - - - - -	77
October - - - - -	77
November - - - - -	74
December - - - - -	72
Means - - - - -	77
Difference between hottest and coldest months. }	14

TABLE LXXIX., showing the MEAN TEMPERATURE of the AIR, at Elevations between 2,000 and 3,000 Feet, between the Latitudes 15° 50' N. and 17° 40' N., and Longitudes 74° 2' E. and 75° 10' E., principally in the BOMBAY PRESIDENCY.

Place	DHAR-WAR.	BEL-GAUM.	SATTARA.	MEANS.
Latitude	15° 50' N.	15° 52' N.	17° 40' N.	16° 27' N.
Longitude	75° 10' E.	74° 42' E.	74° 2' E.	74° 38' E.
Height	2,482feet.	2,260feet.	2,320feet.	2,354feet.
MONTH.	1 Year, 1859.	4 Years, 1856 to 1859.	....	....
January - - - - -	72	72	71	72
February - - - - -	80	75	74	76
March - - - - -	83	78	79	80
April - - - - -	82	81	83	82
May - - - - -	84	78	84	82
June - - - - -	79	75	76	77
July - - - - -	76	73	75	75
August - - - - -	73	72	73	73
September - - - - -	73	74	74	74
October - - - - -	76	74	76	75
November - - - - -	77	72	73	74
December - - - - -	72	70	71	71
Means - - - - -	77	74	76	76
Difference between hottest and coldest months. }	12	11	13	11

TABLE LXXX., showing the MEAN TEMPERATURE of the AIR at Elevations between 4,000 and 5,000 Feet between the Latitudes 17° 59' N. and 24° 45' N., and Longitudes 72° 49' E. and 73° 30' E., principally in the BOMBAY PRESIDENCY.

Place	MAHAB-LESHWUR.	MOUNT ABOO.	MEANS.
Latitude	17° 59' N.	24° 45' N.	21° 22' N.
Longitude	73° 30' E.	72° 49' E.	73° 9' E.
Height	4,500feet.	4,000feet.	4,250feet.
MONTH.	15 Years, 1829 to 1843.	5 Years, 1855 to 1859.	....
January - - - - -	64	57	60
February - - - - -	66	63	64
March - - - - -	72	71	71
April - - - - -	75	72	74
May - - - - -	72	79	75
June - - - - -	66	79	72
July - - - - -	63	74	68
August - - - - -	63	70	66
September - - - - -	64	70	67
October - - - - -	67	71	69
November - - - - -	64	67	65
December - - - - -	63	58	60
Means - - - - -	66	69	68
Difference between hottest and coldest months. }	12	22	15

TABLE LXXXI., showing the MEAN MONTHLY TEMPERATURE of the AIR at STATIONS whose Elevations are respectively 3,000, 4,500, 6,000, 7,361, and 8,640 Feet.

Place	DODABETTA.	OOTACAMUND.	MERCARA.	BANGALORE.	WELLINGTON.
Latitude	11° 25' N.	11° 35' N.	12° 24' N.	12° 57' N.	....
Longitude	77° 5' E.	76° 45' E.	75° 48' E.	77° 38' E.	....
Height	8,640 feet.	7,361 feet.	4,500 feet.	3,000 feet.	6,000 feet.
MONTH.	2 Years, 1817 and 1818.	3 Years, 1831 to 1833.	3 Years, 1838 to 1840.	....	1 Year. 1859.
January - - - - -	52	53	67	70	64
February - - - - -	52	55	71	73	63
March - - - - -	55	60	74	79	67
April - - - - -	56	63	73	79	64
May - - - - -	57	62	72	80	69
June - - - - -	53	60	69	76	69
July - - - - -	53	58	67	75	68
August - - - - -	53	58	66	74	70
September - - - - -	53	58	66	75	67
October - - - - -	53	58	67	73	69
November - - - - -	52	56	67	72	66
December - - - - -	51	53	64	70	70
Means - - - - -	54	58	68	76	67
Difference between Hottest and Coldest Months. }	6	10	8	13	7

TABLE LXXXII., showing the MEAN MONTHLY TEMPERATURE of the AIR, at Elevations above 4,000 Feet, between the Latitudes 25° 14' N. and 31° 0' N., and Longitudes 77° 0' E. and 91° 45' E., principally in the BENGAL PRESIDENCY.

Place	CHIRRAPOON- GEE, KHASIA HILLS.	DARJEELING.	NYNEE TÂL.	KHATMANDU.	UTTRA MULLAY.	KOTGURH.
Latitude	25° 14' N.	27° 2' N.	29° 20' N.	27° 42' N.	24° 55' N.	31° 0' N.
Longitude	91° 45' E.	88° 18' E.	79° 30' E.	87° 40' E.	85° 20' E.	77° 0' E.
Height	4,118 feet.	7,000 feet.	6,400 feet.	4,650 feet.	4,600 feet.	6,634 feet.
MONTH.	2 Years. 1859 and 1860.	3 Years, 1857 to 1859.	9 Years, 1846 to 1854.	....	2 Years, 1845 and 1846.	3 Years, 1819 to 1821.
January - - - - -	57	45	46	48	63	40
February - - - - -	60	43	48	52	65	45
March - - - - -	62	52	55	58	68	..
April - - - - -	68	56	62	67	68	..
May - - - - -	70	58	68	72	66	68
June - - - - -	70	61	69	74	64	72
July - - - - -	70	61	68	76	65	71
August - - - - -	69	61	67	74	65	67
September - - - - -	70	61	65	72	66	65
October - - - - -	68	56	61	65	64	56
November - - - - -	57	51	55	55	65	51
December - - - - -	52	45	51	46	63	..
Means - - - - -	64	54	60	63	65	..
Difference between Hot- test and Coldest Months }	18	18	23	30	5	..

RELATING TO SECTION VII.

Mean Monthly and Annual observed Temperatures of the Dew Point.
" " " Amount of Vapour in a Cubic Foot of Air.
" " " Amount of Vapour required to saturate a Cubic Foot of Air.
" " " Degree of Humidity.

At Stations between the Latitudes 11° 25' N. and 34° 20' N., and Longitudes 69° 5' E. and 92° 46' E.

TABLE LXXXIII., showing the MEAN MONTHLY and ANNUAL TEMPERATURE of the DEW POINT at Stations situated between the Latitudes 11° 25' N. and 34° 20' N., and Longitudes 69° 5' E. and 92° 46' E.

Place . .	DODA-BETTA.	MADRAS.	BELGAUM.	BELLARY.	SECUN- DERABAD.	SATTARA.	DAPOO- LEE.	MAHA- BLESII- WUR.	POONA.	BOMBAY.	SEROOR.	DHOOLIA.	RAJ- COTE.
Latitude .	11° 25' N.	13° 6' N.	15° 52' N.	17° 0' N.	17° 28' N.	17° 40' N.	17° 48' N.	17° 59' N.	18° 30' N.	18° 53' N.	18° 50' N.	20° 54' N.	22° 18' N.
Longitude	77° 5' E.	80° 21' E.	74° 42' E.	77° 0' E.	78° 32' E.	74° 2' E.	73° 16' E.	73° 30' E.	74° 0' E.	72° 52' E.	77° 25' E.	74° 45' E.	70° 50' E.
Height .	8,640feet.	....	2,260 feet.	1,500 feet.	1,800 feet.	2,320 feet.	600 feet.	4,500feet.	1,800 feet.	64 feet.	1,752 feet.	1,000feet.	450 feet.
MONTH.	1 Year, 1847.	18 Years, 1833 to 1850.	2 Years, 1858 and 1859.	9 Years, 1851 to 1859.	10 Years, 1850 to 1859.	5 Years, 1855 to 1859.	2 Years, 1858 and 1859.	9 Years, 1835 to 1843.	5 Years, 1856 to 1860.	12 Years, 1847 to 1858.	5 Years, 1854 to 1858.	6 Years, 1853 to 1858.	4 Years, 1857 to 1860.
January -	40	67	54	54	54	59	68	51	51	64	57	58	44
February -	50	68	51	60	51	61	70	47	50	64	48	57	45
March -	45	71	58	58	60	61	74	49	54	68	32	59	49
April -	50	76	60	69	59	60	78	53	59	73	48	65	56
May -	53	76	66	62	62	66	80	61	65	75	59	68	64
June -	51	73	68	69	66	69	70	66	67	76	64	74	71
July -	51	73	68	69	68	67	76	65	69	76	67	74	72
August -	51	74	67	66	71	70	76	65	69	74	66	75	72
September -	51	75	66	59	73	69	75	63	67	75	66	75	67
October -	51	74	61	67	66	66	72	64	62	74	58	70	60
November -	50	71	61	66	58	62	72	54	55	67	48	61	44
December -	47	69	55	60	54	60	64	53	51	64	37	56	43
Means -	49	72	61	64	62	64	72	57	59	71	54	66	57

(continued.)

Place . .	AHMED- NUGGER.	KURRA- CHEE.	DEESA.	HYDER- ABAD.	THYET MYO.	CAL- CUTTA.	FORT WIL- LIAM.	HAZA- REE- BAUGH.	DARJEE- LING.	BE- NARES.	KUER- WARRAH.	MEERUT.	LAN- DOUR.	PESHA- WUR.
Latitude .	23° 34' N.	24° 51' N.	25° 14' N.	25° 30' N.	20° 18' N.	22° 34' N.	22° 34' N.	24° 0' N.	27° 2' N.	25° 17' N.	26° 42' N.	28° 59' N.	30° 27' N.	34° 20' N.
Longitude	73° 1' E.	77° 2' E.	72° 5' E.	69° 5' E.	92° 46' E.	88° 25' E.	88° 25' E.	85° 24' E.	88° 10' E.	83° 4' E.	79° 12' E.	77° 56' E.	78° 10' E.	71° 29' E.
Height .	1,900feet.	27 feet.	400 feet.	99 feet.	240 feet.	....	....	1,900feet.	7,000feet.	270 feet.	1,200feet.	900 feet.	7,000feet.	1,056feet.
MONTH.	6 Years, 1854 to 1859.	5 Years, 1856 to 1860.	3 Years, 1857 to 1859.	2 Years, 1856 and 1857.	1 Year, 1859.	2 Years, 1843 and 1844.	6 Years, 1854 to 1859.	3 Years, 1858 to 1860.	3 Years, 1857 to 1859.	2 Years, 1858 and 1859.	5 Years, 1854 to 1858.	1 Year, 1859.	4 Years.	3 Years, 1858 to 1860.
January -	52	48	50	49	46	65	57	48	38	48	53	54	27	39
February -	51	55	53	52	47	67	61	53	41	53	55	56	32	43
March -	54	60	55	58	45	76	68	54	45	57	59	59	36	56
April -	56	66	60	62	-	80	72	60	48	60	60	56	41	66
May -	62	74	69	67	69	82	76	73	54	72	62	71	53	62
June -	67	76	72	71	67	83	78	66	59	78	67	76	57	72
July -	69	76	75	75	75	81	78	69	60	84	69	80	63	74
August -	66	75	74	75	74	82	78	73	60	80	77	71	64	74
September -	69	71	72	73	75	83	78	72	58	80	71	75	59	65
October -	63	66	64	67	74	78	74	61	49	76	65	71	46	56
November -	57	52	53	52	65	74	64	49	43	61	57	61	34	45
December -	52	47	48	50	61	66	57	56	40	54	51	48	29	39
Means -	59	64	62	62	62	76	70	61	49	67	62	65	44	57

TABLE LXXXIV., showing the MEAN MONTHLY and ANNUAL AMOUNT of VAPOUR in a CUBIC FOOT of AIR, at Stations situated between the Latitudes 11° 25' N. and 34° 20' N., and Longitudes 69° 5' E. and 92° 46' E.

Place	DODA-BETTA.	MADRAS.	BEL-GAUM.	BEL-LARY.	SECUN-DERABAD.	SAT-TARA.	DA-POOLEE.	MAHAB-LISHWUR	POONA.	BOMBAY.	SEROOR.	DHOO-LIA.	RAJCOTE.
Latitude. . . .	11° 25' N.	13° 6' N.	15° 52' N.	17° 0' N.	17° 28' N.	17° 40' N.	17° 48' N.	17° 59' N.	18° 30' N.	18° 53' N.	18° 50' N.	20° 54' N.	22° 18' N.
Longitude	77° 5' E.	80° 21' E.	74° 42' E.	77° 0' E.	78° 32' E.	74° 2' E.	73° 16' E.	73° 30' E.	74° 0' E.	72° 52' E.	77° 25' E.	74° 45' E.	70° 50' E.
Height	8,640feet.	....	2,260feet.	1,500feet.	1,800feet.	2,320feet.	600 feet.	4,500feet.	1,800feet.	....	1,752feet.	1,000feet.	450 feet.
MONTH.	1 Year, 1847.	18 Years, 1833 to 1850.	2 Years, 1858 and 1859.	9 Years, 1851 to 1859.	10 Years, 1850 to 1859.	5 Years, 1855 to 1859.	2 Years, 1858 and 1859.	9 Years, 1835 to 1843.	5 Years, 1856 to 1860.	12 Years, 1847 to 1858.	5 Years, 1854 to 1858.	6 Years, 1853 to 1858.	4 Years, 1857 to 1860.
January - -	grs. 2·8	grs. 7·2	grs. 4·5	grs. 4·5	grs. 4·6	grs. 5·4	grs. 7·4	grs. 4·1	grs. 4·1	grs. 6·4	grs. 5·1	grs. 5·2	grs. 3·2
February - -	4·1	7·3	4·0	5·5	4·1	5·8	8·0	3·5	3·9	6·4	3·6	5·1	3·2
March - -	3·4	8·1	5·1	5·0	5·4	5·8	9·1	3·8	4·5	7·4	1·6	5·2	3·7
April - -	4·1	9·4	5·6	7·5	5·2	5·6	10·3	4·3	5·3	8·6	3·5	6·5	4·7
May - -	4·5	9·3	6·8	5·9	5·8	6·8	10·9	5·7	6·7	9·0	5·3	7·2	6·1
June - -	4·2	8·5	7·4	7·4	6·6	7·7	7·6	6·9	7·2	9·7	6·4	8·8	8·0
July - -	4·2	8·7	7·4	7·6	7·3	7·2	9·5	6·9	7·7	9·5	7·2	8·9	8·3
August - -	4·2	8·9	7·1	6·8	8·1	7·8	9·5	6·8	7·6	9·1	6·8	9·3	8·4
September - -	4·2	9·1	7·0	5·2	8·8	7·6	9·2	6·2	7·2	9·3	6·8	9·3	7·1
October - -	4·2	8·9	5·8	7·2	6·8	7·0	8·5	6·6	6·1	8·9	5·3	7·8	5·4
November - -	4·1	8·2	5·8	7·0	5·2	6·0	8·4	4·7	4·7	7·2	3·6	5·7	3·1
December - -	4·6	7·5	4·7	5·6	4·5	5·7	6·4	4·4	4·1	6·4	2·4	5·0	3·0
Means - -	4·9	8·4	5·9	6·3	6·0	6·5	8·7	5·3	5·7	8·1	4·8	7·0	5·3

(continued.)

Place	AHMED-NUGGUR.	KURRA-CHEE.	DEESA.	HYDER-ABAD.	THYET-MYO.	CAL-CUTTA.	FORT WILLIAM (CAL-CUTTA.)	HAZA-RUE-BAUGH.	BE-NARES.	DARJEE-LING.	KHER-WARRAH.	MEERUT.	LAN-DOUR.	PESHA-WUR.
Latitude	23° 34' N.	24° 51' N.	25° 14' N.	25° 30' N.	20° 18' N.	22° 34' N.	22° 34' N.	24° 0' N.	25° 17' N.	27° 2' N.	26° 42' N.	28° 59' N.	30° 27' N.	34° 20' N.
Longitude. . . .	73° 1' E.	77° 2' E.	72° 5' E.	69° 5' E.	92° 46' E.	88° 25' E.	88° 25' E.	85° 24' E.	83° 4' E.	88° 10' E.	79° 12' E.	77° 46' E.	78° 10' E.	71° 29' E.
Height	1,900feet	27 feet.	400 feet.	99 feet.	240 feet.	....	....	1,900feet.	270 feet.	7,000feet.	1,200feet.	900 feet.	7,000feet.	1,056feet.
MONTH.	6 Years, 1854 to 1859.	5 Years, 1856 to 1860.	3 Years, 1857 to 1859.	2 Years, 1858 and 1857.	1 Year, 1859.	2 Years, 1843 and 1844.	6 Years, 1854 to 1859.	3 Years, 1858 to 1860.	2 Years, 1858 and 1859.	3 Years, 1857 to 1859.	5 Years, 1854 to 1858.	1 Year, 1859.	4 Years.	3 Years, 1858 to 1860.
January - -	grs. 4·2	grs. 3·7	grs. 1·0	grs. 5·9	grs. 3·4	grs. 6·6	grs. 5·2	grs. 3·7	grs. 3·7	grs. 2·6	grs. 4·5	grs. 4·6	grs. 1·7	grs. 2·7
February - -	4·0	4·7	4·3	4·2	3·5	7·0	5·8	4·4	4·4	2·9	4·7	4·9	2·1	3·1
March - -	4·4	5·6	4·6	5·1	3·2	9·3	7·4	4·5	5·0	3·4	5·3	5·5	2·4	4·9
April - -	4·7	6·7	5·3	5·9	-	10·6	8·5	5·5	5·5	3·8	5·4	4·8	2·9	7·0
May - -	5·9	8·8	7·4	6·8	7·4	11·4	9·5	8·6	8·3	4·7	5·7	7·8	4·4	6·0
June - -	7·0	9·4	8·3	7·9	7·0	11·7	10·3	6·8	10·1	5·6	6·9	9·3	5·1	8·1
July - -	7·5	9·5	9·2	9·0	9·4	11·2	10·2	7·4	12·5	5·8	7·5	10·8	6·3	8·8
August - -	6·8	9·1	9·1	9·1	8·9	11·5	10·2	8·8	10·9	5·8	9·8	8·0	6·6	8·9
September - -	7·7	8·2	8·4	8·7	9·1	11·8	10·2	8·3	10·9	5·4	8·1	9·4	5·5	6·4
October - -	6·3	6·9	6·3	7·1	9·1	10·3	9·1	5·8	9·5	3·9	6·7	8·2	3·4	5·0
November - -	5·1	4·2	4·2	4·2	6·6	9·1	6·1	3·9	5·8	3·1	5·2	5·8	2·3	3·3
December - -	4·3	3·9	3·7	3·9	5·8	7·0	5·0	4·9	4·6	2·8	4·2	3·7	1·8	2·7
Means - -	5·7	6·7	6·2	6·3	6·5	9·8	8·1	6·0	7·6	4·1	5·9	6·9	3·7	5·6

TABLE LXXXV., showing the MEAN MONTHLY and ANNUAL AMOUNT of VAPOUR required to saturate a Cubic Foot of Air at Stations situated between the Latitudes 11° 25' N. and 34° 20' N., and Longitudes 69° 5' E. and 92° 46' E.

Place	DODA-BETTA.	MADRAS.	BEL-GAUM.	BEL-LARY.	SECUN-DERABAD.	SAT-TARA.	DAPOO-LEE.	MAHAB-LESHWUR	POONA.	SEROOR.	BOMBAY.	DHOOLIA.	RAJ-COTE.
Latitude . . .	11° 25' N.	13° 6' N.	15° 52' N.	17° 0' N.	17° 28' N.	17° 40' N.	17° 48' N.	17° 59' N.	18° 30' N.	18° 50' N.	18° 53' N.	20° 54' N.	22° 18' N.
Longitude . .	77° 5' E.	80° 21' E.	74° 42' E.	77° 0' E.	78° 32' E.	74° 2' E.	73° 16' E.	73° 30' E.	74° 0' E.	77° 25' E.	72° 52' E.	74° 45' E.	70° 50' E.
Height	8,640feet.	....	2,260feet.	1,500feet.	1,800feet.	2,320feet.	600 feet.	4,500feet.	1,800feet.	1,752feet.	64 feet.	1,000feet.	450 feet.
MONTH.	1 Year, 1847.	18 Years, 1833 to 1850.	2 Years, 1858 and 1859.	9 Years, 1851 to 1859.	10 Years, 1850 to 1859.	5 Years, 1855 to 1859.	2 Years, 1858 and 1859.	9 Years, 1835 to 1843.	5 Years, 1856 to 1860.	5 Years, 1854 to 1858.	12 Years, 1847 to 1858.	6 Years, 1853 to 1858.	4 Years, 1857 to 1860.
January - - -	grs. 1·6	grs. 2·5	grs. 4·3	grs. 5·8	grs. 4·8	grs. 2·9	grs. 2·0	grs. 3·7	grs. 3·7	grs. 3·7	grs. 2·7	grs. 2·8	grs. 4·6
February - - -	0·3	3·0	6·3	5·5	6·9	3·6	2·0	4·5	5·8	4·9	3·3	4·6	5·9
March - - -	1·5	3·2	6·2	9·8	6·6	4·5	2·2	5·6	5·8	9·7	3·6	6·5	7·6
April - - -	0·9	3·0	6·1	4·9	8·8	6·1	2·5	6·0	7·1	10·1	3·4	7·5	8·9
May - - -	0·7	4·3	3·8	5·8	9·5	4·5	1·9	4·0	5·0	7·1	4·2	8·1	9·2
June - - -	0·3	4·7	2·0	5·4	7·0	2·0	5·6	1·4	3·4	4·9	2·3	4·8	6·4
July - - -	0·3	4·1	1·4	3·0	4·7	2·5	1·8	0·9	2·0	2·5	1·8	2·8	4·5
August - - -	0·3	3·5	1·4	4·5	3·2	1·0	1·1	0·5	1·5	2·9	2·2	1·7	3·3
September - -	0·3	2·9	1·8	6·5	2·2	1·5	1·1	1·3	1·9	2·9	1·7	1·7	4·6
October - - -	0·3	2·8	3·6	3·4	3·8	2·4	2·1	0·9	3·6	4·7	2·8	3·2	6·6
November - -	0·3	2·1	3·6	1·8	4·2	3·1	1·0	2·6	4·4	5·8	3·4	4·0	6·3
December - -	0·6	2·5	3·8	2·9	4·3	2·6	2·7	2·9	3·7	6·1	3·3	3·5	5·3
Means - - -	0·6	3·2	4·9	3·7	5·5	3·0	2·2	2·8	4·0	5·2	2·9	4·3	6·1

(continued.)

Place . .	AHMED-NUGGUR.	KURRA-CHEE.	DEESA.	HYDER-ABAD.	THYET-MYO.	CAL-CUTTA.	FORT WILLIAM (CAL-CUTTA.)	HAZA-REH-BAUGH.	DARJEE-LING.	BE-NARES.	KHER-WARRAH.	MEERUT.	LAN-DOUR.	PESHA-WUR.
Latitude .	23° 34' N.	24° 51' N.	25° 14' N.	25° 30' N.	20° 18' N.	22° 34' N.	22° 34' N.	24° 0' N.	27° 2' N.	25° 17' N.	26° 42' N.	28° 59' N.	30° 27' N.	34° 20' N.
Longitude .	73° 1' E.	77° 2' E.	72° 5' E.	69° 5' E.	92° 46' E.	88° 25' E.	88° 25' E.	85° 24' E.	88° 10' E.	83° 4' E.	79° 12' E.	77° 46' E.	78° 10' E.	71° 29' E.
Height . .	1,900feet.	27 feet.	400 feet.	99 feet.	240 feet.	...	...	1,900feet.	7,000feet.	270 feet.	1,200feet.	900 feet.	7,000feet.	1,056feet.
MONTH.	6 Years, 1854 to 1859.	5 Years, 1856 to 1860.	3 Years, 1857 to 1859.	2 Years, 1856 and 1857.	1 Year, 1859.	2 Years, 1843 and 1844.	6 Years, 1854 to 1859.	3 Years, 1858 to 1860.	3 Years, 1857 to 1859.	2 Years, 1858 and 1859.	5 Years, 1854 to 1858.	1 Year, 1859.	4 Years.	3 Years, 1858 to 1860.
January -	grs. 4·1	grs. 3·8	grs. 3·5	grs. 2·7	grs. 4·9	grs. 2·8	grs. 2·3	grs. 3·8	grs. 0·7	grs. 3·3	grs. 2·1	grs. 1·4	grs. 1·6	grs. 1·3
February -	5·4	3·6	5·1	4·1	7·1	4·0	3·0	3·9	0·5	3·4	3·6	1·9	1·1	1·4
March -	7·3	5·0	8·2	6·2	8·5	4·3	3·6	4·3	0·8	7·4	5·3	2·5	2·8	1·5
April - -	8·9	5·7	10·4	7·7	-	4·7	3·9	5·5	0·9	9·8	9·0	7·2	3·9	2·4
May - -	7·7	4·8	8·8	8·5	5·4	3·4	3·7	2·7	0·7	6·5	11·0	7·0	3·9	6·4
June - -	4·0	5·0	6·5	7·8	4·0	2·7	2·5	6·4	0·4	5·2	7·1	6·4	3·7	7·2
July - -	2·5	3·7	3·6	6·3	2·3	2·0	1·8	6·2	0·4	0·7	4·2	3·2	1·7	6·9
August -	2·9	2·9	2·2	4·9	2·8	1·3	1·8	2·2	0·4	1·9	1·2	4·4	0·9	5·5
September -	2·0	3·8	3·3	4·1	2·9	1·4	1·8	2·7	0·4	1·9	3·2	2·3	1·5	6·8
October -	3·7	5·1	6·1	4·6	2·2	2·5	2·2	3·6	1·3	1·1	3·3	1·5	1·8	3·5
November -	3·7	6·4	7·1	4·6	2·8	2·2	2·7	3·9	1·1	3·0	2·3	1·7	1·7	2·5
December -	3·7	4·4	4·6	3·1	3·0	2·4	2·8	1·9	0·5	1·8	2·4	2·3	1·5	1·3
Means -	4·7	4·5	5·8	5·4	4·7	2·8	2·6	3·9	0·7	3·8	4·5	3·5	2·2	3·9

TABLE LXXXVI., showing the MEAN MONTHLY and ANNUAL DEGREE of HUMIDITY at Stations situated between the Latitudes 11° 25' N. and 34° 20' N., and Longitudes 69° 5' E. and 92° 46' E.

Place	DODA-BETTA.	MADRAS.	BEL-GAUM.	BEL-LARY.	SECUN-DERABAD.	SAT-TARA.	DAPOO-LEE.	MAHAB-LESHWUR	POONA.	BOMBAY.	SEROOR.	DIHOOLIA.	RAJ-COTE.
Latitude . . .	11° 25' N.	13° 6' N.	15° 52' N.	17° 0' N.	17° 28' N.	17° 40' N.	17° 48' N.	17° 59' N.	18° 30' N.	18° 53' N.	18° 50' N.	20° 54' N.	22° 18' N.
Longitude . . .	77° 5' E.	80° 21' E.	74° 42' E.	77° 0' E.	78° 32' E.	74° 2' E.	73° 16' E.	73° 30' E.	74° 0' E.	72° 52' E.	77° 25' E.	74° 45' E.	70° 50' E.
Height	8,640feet.	.....	2,260feet.	1,500feet.	1,800feet.	2,320feet.	600 feet.	4,500feet.	1,800feet.	64 feet.	1,752feet.	1,000feet.	450 feet.
MONTH.	1 Year, 1847.	18 Years, 1833 to 1850.	2 Years, 1858 and 1859.	9 Years, 1851 to 1859.	10 Years, 1850 to 1859.	5 Years, 1855 to 1859.	2 Years, 1858 and 1859.	9 Years, 1835 to 1843.	5 Years, 1856 to 1860.	12 Years, 1847 to 1858.	5 Years, 1854 to 1858.	6 Years, 1853 to 1858.	4 Years, 1857 to 1860.
January - -	64	75	51	44	49	65	79	53	53	70	58	65	41
February - -	93	71	39	50	37	62	79	44	40	67	42	52	35
March - -	70	72	44	34	45	56	80	40	44	67	15?	45	33
April - -	81	76	48	60	37	48	80	41	43	72	25	46	35
May - -	87	69	63	51	38	60	85	59	57	68	43	47	40
June - -	93	64	79	58	49	79	58	83	67	80	56	65	55
July - -	93	68	84	71	60	75	85	88	79	85	75	76	64
August - -	93	72	84	60	72	89	90	94	84	80	71	85	72
September - -	93	76	79	45	80	84	89	83	79	85	71	85	60
October - -	93	76	62	67	63	74	80	88	63	76	53	71	45
November - -	93	79	62	79	55	66	89	64	52	67	38	59	33
December - -	86	75	54	65	51	69	70	60	53	67	28	57	36
Means - -	87	73	63	57	53	69	80	66	59	74	48	63	46

(continued.)

Place . .	AHMED-NUGGUR.	KURRA-CUL.	DEESA.	HYDER-ABAD.	THYET MYO.	CAL-CUTTA.	FORT WILLIAM (CAL-CUTTA.)	HAZAREE-BAUGH.	DARJEE-LING.	BE-NARES.	KHER-WARRAIL.	MEERUT.	LAN-DOUR.	PESHA-WUR.
Latitude .	23° 34' N.	24° 51' N.	25° 14' N.	25° 30' N.	26° 18' N.	22° 34' N.	22° 34' N.	24° 0' N.	27° 2' N.	25° 17' N.	26° 42' N.	28° 59' N.	30° 27' N.	34° 20' N.
Longitude	73° 1' E.	77° 2' E.	72° 5' E.	69° 5' E.	92° 46' E.	88° 25' E.	88° 25' E.	85° 24' E.	88° 10' E.	83° 4' E.	79° 12' E.	77° 46' E.	78° 10' E.	71° 29' E.
Height . .	1,900feet.	27 feet.	400 feet.	99 feet.	240 feet.	.....	.....	1,900feet.	7,000feet.	270 feet.	1,200feet.	900 feet.	7,000feet.	1,056feet.
MONTH.	6 Years, 1854 to 1859.	5 Years, 1856 to 1860.	3 Years, 1857 to 1859.	2 Years, 1856 and 1857.	1 Year, 1859.	2 Years, 1843 and 1844.	6 Years, 1854 to 1859.	3 Years, 1858 to 1860.	3 Years, 1857 to 1859.	2 Years, 1858 and 1859.	5 Years, 1854 to 1858.	1 Year, 1859.	4 Years.	3 Years, 1858 to 1860.
January -	50	49	52	59	41	70	68	49	77	52	67	77	49	67
February -	43	57	46	50	32	63	66	53	85	56	57	73	65	69
March - -	38	53	36	44	27	69	67	51	80	41	50	69	45	77
April - -	35	54	34	43	-	70	68	50	80	36	37	40	42	74
May - -	43	65	45	44	58	77	72	76	87	56	35	53	53	48
June - -	63	65	56	50	63	81	80	52	94	66	49	59	58	53
July - -	75	72	72	59	80	85	85	55	94	95	64	77	78	56
August -	71	76	80	65	76	90	85	80	94	85	90	64	88	61
September -	79	68	72	68	76	90	85	75	94	85	72	80	78	49
October -	63	57	51	60	80	80	80	62	75	90	67	84	65	57
November -	58	39	37	48	70	80	70	50	74	66	68	78	57	58
December -	53	47	44	56	66	74	64	73	84	72	63	62	54	67
Means -	56	58	51	54	58	77	74	60	84	67	60	68	61	61

RELATING TO SECTION VIII.

Monthly and Annual observed Falls of Rain at different Stations in India, arranged in the following order :—

1. Stations on the West Coast, from Latitude 8° N. up the Malabar Coast to Latitude 25½° N.
2. „ „ East or Coromandel Coast, and continued to Latitude 21½° N.
3. „ in the Interior of the Country.

TABLE LXXXVII., showing the FALL of RAIN on the WEST COAST of INDIA from CAPE COMORIN in Latitude 8° 4' N. to KURRACHEE in Latitude 24° 51' N.

Place . .	CAPE COMORIN.	VAU-RIOR.	ALLEPY.	TREVAN-DRUM.	QUILON.	COCHIN.	ANJARA-KANDY.	CANNA-NORE.	MERCARA.	VIN-GORLA.	DA-POOLEE.
Latitude .	8° 4' N	..	..	8° 28' N.	8° 53' N.	9° 11' N.	11° 40' N.	11° 52' N.	12° 24' N.	15° 50' N.	17° 48' N.
Longitude .	77° 34' E.	..	..	77° 2' E.	76° 39' E.	76° 0' E.	75° 40' E.	75° 30' E.	75° 48' E.	73° 41' E.	73° 16' E.
Height . .	50 feet.	60 feet.	30 feet.	130 feet.	40 feet.	4 feet.	..	15 feet.	4,500 feet.	20 feet.	600 feet.
MONTH.	5 Years, 1843 to 1847.	6 Years, 1841 to 1846.	6 Years, 1841 to 1846.	5 Years, 1842 to 1846.	6 Years, 1841 to 1846.	6 Years, 1841 to 1846.	14 Years, 1810 to 1823.	..	3 Years, 1838 to 1840.	4 Years, 1856 to 1859.	..
January - -	in. 0·2	in. 0·9	in. 2·4	in. 1·8	in. 0·9	in. 0·7	in. -	in. 0·3	in. -	in. -	in. -
February - -	- -	0·4	1·2	0·2	0·3	- -	0·1	0·2	0·4	- -	- -
March - -	0·9	1·1	4·3	1·8	1·9	2·0	0·3	0·4	1·5	- -	- -
April - -	0·8	0·4	3·4	3·5	3·5	3·2	1·2	3·9	2·6	0·4	1·5
May - -	4·6	4·0	26·1	10·2	16·5	17·8	6·9	13·5	7·4	16·7	2·5
June - -	4·6	2·0	26·1	13·1	17·9	30·7	31·1	36·3	30·4	29·0	30·3
July - -	0·7	1·1	18·2	6·4	19·9	17·3	38·9	32·0	55·9	40·9	43·9
August - -	0·4	0·1	9·2	3·3	6·1	13·0	22·5	16·2	27·0	22·2	17·5
September - -	0·4	0·9	7·0	3·5	3·3	4·8	12·3	5·9	11·9	6·2	15·6
October - -	8·8	7·3	12·8	12·3	9·9	9·7	6·2	8·9	4·6	2·9	2·7
November - -	3·9	3·6	6·0	4·1	3·9	2·3	2·5	2·2	1·4	0·1	0·6
December - -	2·8	2·9	2·9	4·5	1·7	3·5	1·2	1·7	0·2	- -	- -
Sums - -	28·1	24·7	119·5	64·7	85·8	105·0	123·2	121·5	143·3	118·4	114·6

(continued).

Place . .	SAWUNT WAREE.	RUTNA-GHERRY.	MALCOLM PAIT.	MAHAB-LESHWUR.	ALI-BAUGH.	BOMBAY.	TANNA.	BARODA.	RAJCOTE.	AHMED-ABAD.	KOTRI.	KURRA-CHEE.
Latitude .	15° 56' N.	17° 0' N.	17° 56' N.	17° 59' N.	18° 46' N.	18° 53' N.	19° 11' N.	22° 16' N.	22° 18' N.	23° 0' N.	23° 54' N.	24° 51' N.
Longitude .	74° 1' E.	73° 20' E.	73° 41' E.	73° 30' E.	72° 58' E.	72° 72' E.	73° 6' E.	73° 14' E.	70° 50' E.	72° 0' E.	68° 46' E.	67° 2' E.
Height . .	..	150 feet.	..	4,500 feet.	..	..	..	90 feet.	450 feet.	320 feet.	..	27 feet.
MONTH.	2 Years, 1848 and 1849.	..	1 Year, 1820.	15 Years, 1829 to 1843.	1 Year, 1845.	..	4 Years, 1844 to 1847.	17 Years, 1837 to 1853.	4 Years, 1857 to 1860.	..	..	5 Years, 1856 to 1860.
January - -	in. -	in. -	in. 0·2	in. -	in. -	in. -	in. -	in. -	in. -	in. -	in. -	in. 0·4
February - -	- -	- -	- -	0·2	- -	- -	- -	- -	- -	- -	- -	0·3
March - -	- -	- -	0·8	0·1	- -	- -	- -	- -	- -	- -	0·1	..
April - -	- -	- -	1·2	1·3	..	..	..	..	..	..	..	..
May - -	2·2	4·2	1·1	3·3	- -	0·5	- -	0·8	- -	1·0	0·4	..
June - -	32·2	34·9	50·6	46·5	29·7	22·7	34·3	6·2	4·2	3·0	1·3	..
July - -	48·3	34·3	71·9	92·1	19·1	24·5	38·4	14·5	8·3	11·7	- -	1·8
August - -	29·2	16·8	64·6	72·3	10·0	12·4	17·4	7·5	8·9	4·9	- -	1·5
September - -	16·5	10·1	35·7	31·3	8·4	10·6	15·3	5·0	5·2	3·0	- -	0·4
October - -	2·6	24·6	1·2	4·6	- -	1·7	- -	0·7	..	..	..	..
November - -	0·3	1·5	0·8	2·1	- -	0·3	..	..	..	..	..	..
December - -	- -	- -	- -	- -	- -	- -	- -	0·1	- -	- -	..	0·2
Sums - -	131·3	125·9	228·1	253·8	67·2	72·7	105·4	34·8	26·6	23·6	1·8	4·6

TABLE LXXXVIII., showing the FALL of RAIN on the EAST COAST of INDIA from PALAMCOTTAH, in Latitude 8° 43' N., to BALASORE, in Latitude 21° 31' N.

Place .	PALAM-COTTAH.	ST. THOMAS' MOUNT.	POONA-MALLEE.	FORT ST. GEORGE.	MADRAS.	NEL-LORE.	MASULI-PATAM.	GUN-TOOR.	SAMUL-COTTAH.	VIZAGA-PATAM.	POOREE.	CUT-TACK.	BALA-SORE.
Latitude.	8° 43' N.	13° 0' N.	13° 2' N.	13° 4' N.	13° 6' N.	14° 20' N.	16° 0' N.	16° 20' N.	17° 4' N.	17° 41' N.	19° 48' N.	20° 29' N.	21° 31' N.
Longitude	77° 48' E.	80° 15' E.	80° 10' E.	80° 14' E.	80° 21' E.	80° 0' E.	81° 13' E.	80° 30' E.	82° 14' E.	83° 21' E.	85° 49' E.	85° 54' E.	86° 58' E.
Height .	120 feet.	60 feet.	....	....	....	50 feet.	....	100 feet.	50 feet.	....	....	....	....
MONTH.	....	7 Years, 1842 to 1848.	....	31 Years, 1811 to 1841.	29 Years, 1822 to 1850.	2 Years, 1859 and 1860.	7 Years, 1842 to 1848.	5 Years, 1855 to 1859.	3 Years, 1857 to 1859.	....	1 Year, 1851.	1 Year, 1851.	1 Year, 1851.
January -	in. 2·7	in. 1·9	- -	in. 1·2	in. 1·2	in. 0·6	in. 0·2	- -	in. 0·3	- -	in. 0·1	in. 0·1	in. 0·5
February -	1·2	0·3	0·1	0·1	1·0	- -	1·6	- -	0·5	0·4	- -	0·3	0·3
March -	3·5	0·4	- -	0·7	0·2	- -	0·3	0·9	1·0	0·4	- -	0·3	1·2
April -	10·7	0·3	1·2	0·4	1·0	1·5	0·2	2·5	2·5	1·9	1·0	1·6	3·4
May -	5·8	2·5	1·5	1·1	1·0	0·9	1·9	4·6	1·0	2·0	0·5	0·8	0·1
June -	0·7	0·9	2·0	1·5	2·5	1·5	4·5	4·1	6·1	3·6	4·5	7·3	3·2
July -	- -	2·3	3·8	3·7	3·6	8·7	4·6	5·9	10·0	3·7	14·3	10·2	5·9
August -	- -	2·4	4·3	4·8	5·1	5·1	4·9	7·7	6·5	4·2	7·4	12·1	3·6
September	1·6	3·7	4·5	4·3	3·9	3·4	5·9	5·7	5·6	6·3	4·4	6·1	3·4
October -	9·6	8·4	11·0	11·1	11·5	4·3	6·7	7·0	9·7	13·4	{ blown } down }	11·7	9·1
November	14·7	10·2	19·7	14·1	12·4	32·1	1·1	2·1	- -	7·2	- -	- -	0·2
December	5·8	8·4	7·1	4·6	6·7	2·0	1·9	1·0	0·5	0·4	...	...	...
Sums -	56·3	41·7	55·2	47·6	50·1	60·1	33·8	41·5	42·9	43·9	...	50·2	30·9

TABLE LXXXIX., showing the FALL of RAIN at INLAND STATIONS in the SOUTHERN PART of the PRESIDENCY of MADRAS.

Place	SHEENKOTTAH.	TRICHINOPOLY.	COIMBATORE.	DODABETTA.	BANGALORE.
Latitude	9° 17' N.	10° 20' N.	11° 0' N.	11° 25' N.	12° 57' N.
Longitude	78° 10' E.	77° 10' E.	77° 1' E.	77° 25' E.	77° 38' E.
Height . . . . .	....	250 feet.	....	8,640 feet.	3,000 feet.
MONTH.	5 Years, 1842 to 1846.	7 Years, 1842 to 1848.	3 Years, 1844 to 1846.	2 Years, 1847 and 1848.	1 Year, 1859.
January - - -	in. 1·3	in. 2·0	in. 0·7	in. 0·1	...
February - - -	0·3	0·2	0·2	7·4	...
March - - -	1·6	0·5	0·8	3·6	...
April - - -	2·2	1·4	0·5	19·8	1·3
May - - -	3·6	2·7	1·8	4·9	3·8
June - - -	4·3	1·3	1·5	4·6	1·6
July - - -	3·9	2·6	1·6	7·4	5·6
August - - -	1·1	1·9	0·2	9·3	5·4
September - - -	1·8	5·3	5·3	7·5	3·2
October - - -	8·2	5·6	4·5	12·5	1·1
November - - -	5·9	2·6	0·5	11·9	2·9
December - - -	3·0	4·5	3·0	12·3	0·1
Sums - - -	37·2	30·6	20·6	101·3	25·0

TABLE XC., showing the FALL of RAIN at STATIONS in the BOMBAY PRESIDENCY between the Latitudes 15° 50' N. and 17° 40' N., and Longitudes 74° 2' E. and 76° 52' E.

<i>Place</i>	BELGAUM.	DHARWAR.	KULLAD- GHEE.	SOORA- PORE.	KOLAPORE.	JHUTT.	SHOLA- PORE.	PUNDA- PORE.	SATTARA.
<i>Latitude</i>	15° 52' N.	15° 50' N.	16° 11' N.	16° 32' N.	16° 42' N.	17° 1' N.	17° 40' N.	17° 40' N.	17° 40' N.
<i>Longitude</i>	74° 42' E.	75° 10' E.	75° 33' E.	76° 52' E.	74° 18' E.	75° 16' E.	76° 0' E.	75° 24' E.	74° 2' E.
<i>Height</i>	2,260 feet.	2,482 feet.	1,750 feet.	....	1,797 feet.	....	1,821 feet.	....	2,320 feet.
MONTH.	....	....	5 Years, 1855 to 1859.	1 Year, 1847.	....	1 Year, 1848.	11 Years, 1850 to 1860.	1 Year, 1848.	....
	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - - -	-	-	0·1	-	0·2	-	0·1	-	0·3
February - - -	-	-	-	-	-	-	0·5	...	...
March - - -	0·7	0·6	0·1	-	0·3	-	0·3	-	0·1
April - - -	1·9	1·5	1·5	-	0·7	-	1·9	-	2·0
May - - -	4·8	4·1	3·8	-	1·8	1·6	2·3	0·8	2·3
June - - -	8·3	3·8	1·6	8·1	4·1	3·1	3·7	2·0	6·3
July - - -	15·2	8·2	2·9	9·0	9·1	4·8	4·3	4·4	11·7
August - - -	8·8	7·7	2·5	8·3	4·5	2·6	6·2	6·2	5·2
September - - -	3·9	2·9	4·1	8·8	2·7	3·9	6·8	4·3	3·8
October - - -	5·6	2·5	6·7	-	4·6	2·2	4·7	8·4	4·0
November - - -	2·3	2·5	0·6	-	2·0	2·2	1·4	2·5	1·6
December - - -	-	0·1	0·4	-	-	-	0·5	-	1·1
Sums 7 - - -	51·5	33·9	24·3	34·2	30·1	20·4	32·7	28·6	38·4

TABLE XCI., showing the FALL of RAIN at INLAND STATIONS in the Northern Part of the PRESIDENCY of MADRAS.

<i>Place</i>	KURNOOL.	BELLARY.	SECUNDERABAD.	SEROOR.
<i>Latitude</i>	15° 50' N.	17° 0' N.	17° 28' N.	18° 50' N.
<i>Longitude</i>	78° 5' E.	77° 0' E.	78° 32' E.	77° 25' E.
<i>Height</i>	800 feet.	1,500 feet.	1,800 feet.	1,752 feet.
MONTH.	3 Years, 1857 to 1859.	19 Years, 1841 to 1859.	....	5 Years, 1854 to 1858.
	in.	in.	in.	in.
January - - -	-	0·2	1·3	0·1
February - - -	-	-	0·3	0·3
March - - -	-	1·0	2·1	0·4
April - - -	2·7	1·0	0·4	0·9
May - - -	8·1	2·1	3·7	2·9
June - - -	14·4	1·8	1·8	3·7
July - - -	17·2	1·7	9·2	3·
August - - -	8·4	3·0	5·4	1·0
September - - -	8·0	3·8	4·8	3·
October - - -	8·7	5·6	4·4	3·
November - - -	4·4	1·1	0·7	0·
December - - -	-	0·4	0·5	...
Sums - - -	71·9	21·7	34·6	21·1

TABLE XCII. to XCIV., showing the FALL of RAIN at STATIONS in the BOMBAY PRESIDENCY between the Latitudes 17° 59' N. and 20° 54' N., and Longitudes 73° 47' E. and 75° 30' E.

TABLE XCII.					TABLE XCIII.		
Place	PHULTUN.	POORUNDHER.	POONA.	AURUNGABAD.	Place	NASSIK.	DHOOLIA.
Latitude	17° 59' N.	18° 12' N.	18° 30' N.	19° 30' N.	Latitude	20° 0' N.	20° 54' N.
Longitude	74° 31' E.	73° 54' E.	74° 0' E.	75° 30' E.	Longitude	73° 47' E.	74° 45' E.
Height . . . .	...	4,200 feet.	1,800 feet.	...	Height . . . .	...	1,000 feet.
MONTH.	3 Years, 1846 to 1848.	6 Years.	....	1 Year, 1848.	MONTH.	4 Years, 1844 to 1847.	6 Years, 1853 to 1858.
	in.	in.	in.	in.		in.	in.
January - - -	-	0·1	0·3	..	January - - -	..	..
February - - -	-	0·3	..	..	February - - -	-	0·2
March - - -	0·2	0·2	0·4	..	March - - -	-	0·6
April - - -	1·8	0·5	0·5	0·1	April - - -	-	0·5
May - - -	3·4	5·7	2·4	5·7	May - - -	-	2·3
June - - -	3·2	10·2	4·5	7·9	June - - -	6·8	15·3
July - - -	1·8	23·0	7·1	6·8	July - - -	6·7	21·4
August - - -	0·5	16·3	4·1	2·4	August - - -	3·4	9·5
September - - -	2·2	7·4	3·0	18·3	September - - -	2·9	20·9
October - - -	2·7	6·5	2·8	1·0	October - - -	3·3	13·3
November - - -	4·4	0·7	2·4	1·9	November - - -	1·5	..
December - - -	0·8	1·4	0·1	..	December - - -	-	0·3
Sums - - -	21·0	72·3	27·6	44·1	Sums - - -	28·6	84·3

TABLE XCIV., showing the FALL of RAIN at STATIONS in the BOMBAY PRESIDENCY between the Latitudes 20° 56' N. and 23° 9' N., and Longitudes 77° 58' E. and 79° 59' E.

Place	BHORE.	SALTABULDER.	NAGPORE.	KAMPTEL.	BAITOL.	JUBBLEPORE.
Latitude	20° 56' N.	21° 10' N.	21° 10' N.	21° 16' N.	21° 51' N.	23° 9' N.
Longitude	79° 3' E.	79° 9' E.	79° 10' E.	79° 14' E.	77° 58' E.	79° 59' E.
Height	2,350 feet.	939 feet.	....	....	....	....
MONTH.	1 Year, 1848.	3 Years, 1858 to 1860.	7 Years, 1826 to 1832.	1 Year, 1843.	1 Year, 1859.	1 Year, 1851.
	in.	in.	in.	in.	in.	in.
January - - -	-	-	0·4	4·3	-	0·5
February - - -	-	0·9	0·8	..	-	0·9
March - - -	-	0·2	1·2	2·2	..	..
April - - -	-	2·2	0·1	..	..	..
May - - -	2·1	0·8	0·6	0·3	1·2	0·5
June - - -	2·4	3·8	10·7	0·8	3·5	6·0
July - - -	13·2	13·1	11·5	18·8	14·5	17·2
August - - -	5·2	12·4	9·7	4·6	8·9	3·9
September - - -	*0·9	11·1	8·1	7·4	3·7	8·2
October - - -	1·5	0·9	3·4	3·4	-	1·3
November - - -	4·2	-	0·9	-	0·2	0·4
December - - -	-	1·1	1·2	..	..	..
Sums - - -	29·5	46·5	48·6	41·8	32·0	38·9

* Bhore, it is supposed that the result in September is 10 inches too small.

TABLE XCV., showing the FALL of RAIN at STATIONS in the BOMBAY PRESIDENCY between the Latitudes 23° 34' N. and 26° 20' N. and Longitudes 69° 5' E. and 74° 54' E.

Place	AHMEDNUGGUR.	NEEMUCH.	MOUNT ABOO.	HYDERABAD.	DEESA.	NUSSEERABAD.
Latitude	23° 34' N.	24° 27' N.	24° 45' N.	25° 30' N.	25° 14' N.	26° 20' N.
Longitude	73° 1' E.	74° 54' E.	72° 49' E.	69° 5' E.	72° 5' E.	74° 50' E.
Height	1,900 feet.	1,476 feet.	4,000 feet.	99 feet.	400 feet.	1,500 feet.
MONTH.	....	1 Year, 1860.	5 Years, 1855 to 1859.	2 Years, 1856 and 1857.	3 Years, 1857 to 1859.	2 Years, 1859 and 1860.
	in.	in.	in.	in.	in.	in.
January - - -	- - -	- - -	0·8	0·6	0·6	..
February - - -	0·1	0·3	0·2	0·5	0·2	0·9
March - - -	0·4	..	..	..	..	..
April - - -	0·5	- - -	0·3	0·6	..	..
May - - -	3·2	0·3	0·3	- - -	- - -	0·4
June - - -	4·7	1·7	10·3	- - -	3·8	0·3
July - - -	2·6	11·8	25·9	1·9	8·6	6·1
August - - -	3·1	15·7	17·0	14·8	6·2	7·8
September - - -	6·6	3·8	9·9	2·1	5·2	0·3
October - - -	2·6	0·2	..	..	..	..
November - - -	1·3	..	..	..	..	..
December - - -	0·4	0·3	..	..	..	..
Sums - - -	25·5	34·1	64·7	20·5	24·6	15·8

TABLE XCVI., showing the FALL of RAIN at STATIONS in the BENGAL PRESIDENCY between the Latitudes 20° 8' N. and 27° 31' N. and Longitudes 91° 44' E. and 95° 1' E.

Place . .	ARYAB.	THYET MYO.	CHITTA- GONG.	CACHAR.	SYLHET.	CHIRRA- POONGEE.	GOWA- HUTTEE.	TEZPORE.	BATTI- COTTE.	DEBRO- GHUR.
Latitude .	20° 8' N.	20° 18' N.	22° 20' N.	24° 48' N.	24° 53' N.	25° 16' N.	26° 11' N.	26° 36' N.	26° 40' N.	27° 31' N.
Longitude .	92° 56' E.	92° 46' E.	91° 47' E.	92° 47' E.	91° 50' E.	91° 44' E.	91° 47' E.	92° 50' E.	91° 59' E.	95° 1' E.
Height . .	....	240 feet.	....	....	....	4,500 feet.	....	....	....	....
MONTH.	1 Year, 1851.	1 Year, 1859.	1 Year, 1851.	1 Year, 1851.	1 Year, 1851.	....	1 Year, 1851.	1 Year, 1851.	2 Years, 1847 and 1848.	1 Year, 1851.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	- - -	- - -	- - -	- - -	0·3	0·4	0·5	1·9	1·5	0·6
February - -	- - -	- - -	1·9	- - -	4·5	2·4	0·5	1·9	1·2	5·5
March - - -	- - -	0·3	- - -	- - -	2·2	2·1	1·4	2·1	1·1	2·3
April - - -	- - -	0·5	2·5	12·1	19·3	21·7	5·6	4·3	6·5	9·4
May - - -	11·3	2·3	7·5	27·8	43·4	62·3	6·6	9·6	1·5	14·5
June - - -	59·5	16·5	25·9	15·4	39·7	195·2	16·6	16·8	0·9	12·8
July - - -	22·4	6·9	13·1	15·6	33·5	121·3	9·4	4·5	1·3	13·7
August - - -	27·6	9·8	8·0	8·9	28·3	103·5	4·5	16·6	1·7	18·4
September - -	17·6	4·8	16·3	9·3	17·9	74·8	3·1	4·5	2·6	12·0
October - - -	14·1	6·8	10·8	11·3	20·4	28·9	3·7	3·0	15·2	17·7
November - -	- - -	- - -	- - -	2·0	- - -	- - -	0·4	- - -	15·1	..
December - -	2·5	0·4	0·4	0·5	0·4	- - -	0·5	0·3	8·3	..
Sums - - -	155·0	48·3	86·4	102·9	209·9	612·6	52·8	63·6	56·9	106·9

TABLE XCVII., showing the FALL of RAIN at STATIONS in the BENGAL PRESIDENCY between the Latitudes 22° 35' N. and 26° 11' N., and Longitudes 89° 15' E. and 91° 5' E.

TABLE XCVIII., showing the FALL of RAIN at STATIONS in the BENGAL PRESIDENCY between the Latitudes 22° 25' N. and 23° 9' N., and Longitudes 87° 19' E. and 89° 10' E.

Place . . .	TIPPER-AGH.	DACCA.	MYMEN-SING.	BURI-SAUL.	RUNG-PORE.	GWAL-POORAH.	Place . . .	MID-NAPORE.	CAL-CUTTA.	FORT WIL-LIAM.	HOOGH-LY.	JESSORE.
Latitude .	23° 27' N.	23° 43' N.	24° 49' N.	22° 35' N.	25° 43' N.	26° 11' N.	Latitude .	22° 25' N.	22° 34' N.	22° 34' N.	22° 58' N.	23° 9' N.
Longitude .	91° 5' E.	90° 23' E.	90° 24' E.	90° 17' E.	89° 15' E.	90° 40' E.	Longitude .	87° 19' E.	88° 25' E.	88° 25' E.	88° 26' E.	89° 10' E.
Height . .	...	22 feet.	...	...	...	...	Height . .	...	80 feet.	18 feet.	...	...
MONTH	1 Year, 1851.	1 Year, 1851.	1 Year, 1851.	1 Year, 1851.	1 Year, 1851.	1 Year, 1851.	MONTH.	1 Year, 1851.	15 Years, 1836 to 1850.	5 Years, 1855 to 1859.	1 Year, 1851.	1 Year, 1851.
January -	in. 0·8	in. 0·7	in. 0·8	- -	in. 1·1	in. 0·7	January -	in. 0·3	in. 0·4	in. 0·3	in. 1·0	in. 0·4
February -	1·2	1·0	3·2	2·5	0·1	0·7	February -	0·2	0·6	0·4	0·6	..
March -	-	-	0·5	-	0·5	1·0	March -	1·5	0·8	1·6	..	..
April -	5·5	4·3	5·3	3·2	3·7	10·2	April -	1·7	1·9	1·6	2·1	3·9
May -	3·1	2·7	7·3	1·1	9·7	15·1	May -	-	4·1	6·0	-	0·5
June -	19·5	18·8	35·3	20·7	23·9	42·6	June -	3·1	10·6	10·9	5·8	8·6
July -	16·1	13·8	20·0	17·9	11·7	17·9	July -	4·4	10·6	14·1	9·6	9·9
August -	25·3	10·3	20·4	21·0	14·4	11·7	August -	4·1	13·5	15·2	4·2	4·4
September -	11·0	4·7	6·5	6·9	6·3	7·4	September -	-	9·0	9·6	2·7	5·4
October -	13·5	12·7	10·7	21·2	3·2	8·8	October -	7·4	4·0	5·4	10·0	7·1
November -	..	..	..	..	..	..	November -	-	1·0	..	..	..
December -	..	..	..	..	..	..	December -	-	0·3	..	..	..
Sums -	96·0	69·0	110·0	94·5	74·6	116·1	Sums -	22·7	56·8	65·1	36·0	40·2

TABLE XCIX., showing the FALL of RAIN at STATIONS in the BENGAL PRESIDENCY between the Latitudes 24° 48' N. and 26° 7' N., and Longitudes 85° 3' E. and 85° 26' E.

TABLE C., showing the FALL of RAIN at STATIONS in the BENGAL PRESIDENCY between the Latitudes 25° 14' N. and 25° 48' N., and Longitudes 86° 43' E. and 88° 41' E.

Place . . .	GYAH.	UTTARA MULLAY.	DINAPORE.	TIRHOOT.	Place . . .	BHAUGUL-PORE.	MONGHYR.	DINAJE-PORE.	PURNEAH.
Latitude . . .	24° 48' N.	24° 55' N.	25° 37' N.	26° 7' N.	Latitude . . .	25° 14' N.	25° 27' N.	25° 37' N.	25° 48' N.
Longitude . . .	85° 3' E.	85° 20' E.	85° 5' E.	85° 26' E.	Longitude . . .	87° 0' E.	86° 43' E.	88° 41' E.	87° 33' E.
Height . . .	..	4,600 feet.	..	..	Height . . .	..	..	..	..
MONTH.	1 Year, 1851.	3 Years, 1844 to 1846.	1 Year, 1851.	1 Year, 1851.	MONTH.	1 Year, 1851.	1 Year, 1851.	1 Year, 1851.	1 Year, 1851.
January -	in. 0·3	in. 4·3	in. 1·8	in. 3·8	January -	in. 0·8	in. 0·9	in. 0·8	in. 2·1
February -	1·3	0·2	1·0	1·4	February -	1·5	1·2	0·8	3·3
March -	-	4·9	2·0	0·9	March -	-	0·2	0·3	1·5
April -	-	3·6	..	..	April -	0·8	-	0·7	2·0
May -	-	19·7	..	..	May -	0·8	1·4	2·5	0·7
June -	3·3	37·0	4·5	3·5	June -	10·5	8·2	12·5	9·8
July -	9·3	36·7	3·7	8·5	July -	14·4	6·7	12·7	15·1
August -	3·3	23·5	6·8	7·3	August -	3·5	3·4	6·7	11·8
September -	4·2	7·1	7·5	3·5	September -	2·4	8·1	3·2	3·3
October -	2·5	50·2	3·8	4·5	October -	7·9	6·6	6·5	3·8
November -	0·5	24·7	..	..	November -	..	..	..	..
December -	-	18·0	..	..	December -	..	..	..	..
Sums -	24·7	229·9	31·1	33·4	Sums -	42·6	36·7	46·7	53·4

TABLE CI., showing the FALL of RAIN at STATIONS in the BENGAL PRESIDENCY between the Latitudes 23° 13' N. and 23° 44' N., and Longitudes 87° 6' E. and 87° 52' E.

Place . .	BURDWAN.	BAN-COORAH.	BEER-BHOOM.
Latitude .	23° 13' N.	23° 13' N.	23° 44' N.
Longitude .	87° 52' E.	87° 6' E.	87° 34' E.
Height . .	....	....	....
MONTH.	1 Year, 1851.	1 Year, 1851.	1 Year, 1851.
January -	in. 0·3	in. 0·9	in. ...
February -	1·1	0·9	0·6
March -	0·3	1·1	1·2
April -	0·4	4·2	2·5
May -	- - -	1·0	...
June -	3·3	4·4	3·5
July -	8·8	8·8	11·3
August -	5·2	2·7	5·4
September -	2·6	4·1	2·7
October -	5·6	2·9	4·9
November -	0·6	...	...
December -	...	...	...
Sums -	28·2	31·0	32·1

TABLE CII., showing the FALL of RAIN at STATIONS in the BENGAL PRESIDENCY between the Latitudes 23° 24' N. and 27° 3' N., and Longitudes 85° 24' E. and 88° 33' E.

Place . .	KISH-NUGHUR.	HAZAREE-BAUGH.	BERHAM-PORE.	MOORSHED-ABAD.	BAULIAH.	DAR-JEELING.
Latitude .	23° 24' N.	24° 0' N.	24° 5' N.	24° 11' N.	24° 23' N.	27° 3' N.
Longitude .	88° 22' E.	85° 24' E.	88° 17' E.	88° 19' E.	88° 33' E.	88° 18' E.
Height . .	....	1,900 feet.	76 feet.	76 feet.	....	7,000 feet.
MONTH.	1 Year, 1851.	....	3 Years, 1857 to 1859.	1 Year, 1851.	1 Year, 1851.	....
January -	in. 2·5	in. - - -	in. 0·1	in. 0·2	in. - - -	in. 1·8
February -	1·2	1·2	0·5	1·7	0·6	2·4
March -	- - -	1·2	0·5	- - -	0·2	2·9
April -	2·6	0·6	1·4	2·3	0·2	4·3
May -	- - -	2·3	6·1	2·6	0·3	7·6
June -	4·1	10·5	6·9	4·6	6·9	26·0
July -	23·0	11·7	13·6	10·7	11·6	28·6
August -	10·8	11·2	9·7	7·7	4·9	24·3
September -	11·0	9·1	5·9	3·6	3·4	16·9
October -	2·5	3·7	4·9	7·1	3·3	8·6
November -	- - -	0·4	- - -	- - -	0·2	0·3
December -	- - -	0·8	0·2	- - -	- - -	0·3
Sums -	57·7	52·7	49·8	40·5	31·6	124·0

TABLE CIII., showing the FALL of Rain at STATIONS in the BENGAL PRESIDENCY between the Latitudes 25° 5' N. and 26° 46' N., and Longitudes 80° 48' E. and 83° 22' E.

Place . . .	CHUNAR.	BENARES.	GHAAZEEPORE.	AZIMGHUR.	GORUCKPORE.
Latitude . . .	25° 5' N.	25° 18' N.	25° 49' N.	26° 3' N.	26° 46' N.
Longitude . . .	83° 0' E.	83° 3' E.	80° 48' E.	83° 13' E.	83° 22' E.
Height . . .	250 feet.	270 feet.	....	....	....
MONTH.	10 Years, 1850 to 1859.	....	....	1 Year, 1851.	1 Year, 1851.
January - -	in. 0·5	in. 1·8	in. 1·2	in. 3·8	in. 3·6
February - -	1·5	0·8	1·5	1·1	0·2
March - -	0·8	0·4	0·5	0·6	0·2
April - -	0·5	0·2	0·2	0·8	0·1
May - -	0·5	- - -	0·3	- - -	1·4
June - -	10·0	7·6	7·9	4·5	15·6
July - -	14·0	6·9	7·4	8·7	14·1
August - -	12·0	5·7	10·0	3·8	5·0
September - -	6·0	10·5	6·9	9·5	9·9
October - -	2·5	2·9	5·1	7·2	11·6
November - -	0·5	0·5	0·2	...	...
December - -	1·3	0·1	0·2	...	...
Sums - -	50·1	37·4	41·4	40·0	61·7

TABLE CIV., showing the FALL of RAIN at STATIONS in the BENGAL PRESIDENCY between the Latitudes 26° 7' N. and 30° 23' N., and Longitudes 77° 13' E. and 79° 47' E.

Place . . .	HUMEER- PORE.	KHER- WARRAH.	ITAWAH.	ENTESH- WUR.	AGRA.	FUTTY- GHUR.	DELHI.	MEERUT.	NYNEE TAL.	ROOR- KEE.	DUDOO- PORE.	UM- BALLA.
Latitude . .	26° 7' N.	26° 42' N.	26° 45' N.	26° 46' N.	27° 10' N.	27° 23' N.	28° 31' N.	28° 59' N.	29° 20' N.	29° 53' N.	30° 12' N.	30° 23' N.
Longitude . .	79° 47' E.	79° 12' E.	79° 3' E.	79° 5' E.	78° 5' E.	79° 30' E.	77° 13' E.	77° 46' E.	79° 30' E.	77° 57' E.	..	76° 44' E.
Height . .	..	1,200 feet.	..	..	800 feet.	600 eet.	..	900 feet.	6,400feet.	..	..	1,050feet.
MONTH.	1 Year, 1851.	5 Years, 1854 to 1858.	1 Year, 1851.	1 Year, 1848.	1 Year, 1851.	..	1 Year, 1851.	1 Year, 1859.	9 Years, 1846 to 1854.	1 Year, 1860.	15 Years, 1834 to 1848.	2 Years, 1851 and 1852.
January - -	in. 1·5	in. -	in. 2·8	in. -	in. 1·2	in. 2·9	in. 2·6	in. 0·2	in. 4·6	in. -	in. 0·9	in. 0·7
February - -	0·8	-	0·6	-	1·1	0·3	0·3	0·2	2·4	-	1·8	..
March - -	-	-	-	-	-	0·3	2·6	1·8	1·7	-	1·0	7·1
April - -	0·3	-	0·1	-	0·2	-	1·0	2·6	0·9	-	0·4	0·9
May - -	-	-	0·3	2·6	0·7	0·2	0·1	-	2·8	0·5	0·8	2·8
June - -	6·7	4·0	0·9	6·0	0·3	3·0	0·4	3·6	14·7	1·5	6·2	1·3
July - -	12·6	12·3	11·4	19·8	9·8	8·9	11·6	1·5	23·4	4·0	13·6	7·8
August - -	10·5	3·9	9·2	5·0	10·0	5·4	6·5	5·9	28·8	3·0	9·0	3·1
September - -	4·8	6·5	6·2	1·8	4·0	8·5	-	1·4	12·6	1·0	4·9	..
October - -	0·7	0·8	0·3	2·3	0·6	1·6	-	-	2·7	0·3	1·0	..
November - -	-	-	-	0·2	-	-	-	-	0·8	-	0·2	2·3
December - -	-	-	0·1	-	-	0·2	-	0·8	0·2	-	0·3	0·1
Sums - -	37·9	27·5	31·9	37·7	27·9	31·5	25·1	18·0	95·6	10·3	40·1	26·1

TABLE CV., showing the FALL of RAIN at STATIONS in the BENGAL PRESIDENCY between the Latitudes 30° 27' N. and 34° 20' N., and Longitudes 70° 30' E. and 78° 10' E.

Place	LANDOUR.	MEAN MEER.	LCODIANA.	FEROZEPORE.	PUNJAB.	RAWUL PINDI.	MEERA.	PESHAWUR.
Latitude . . .	30° 27' N.	30° 34' N.	30° 55' N.	30° 57' N.	31° 40' N.	33° 34' N.	32° 37' N.	34° 20' N.
Longitude . .	78° 10' E.	74° 4' E.	75° 54' E.	74° 41' E.	74° 45' E.	73° 5' E.	70° 30' E.	71° 29' E.
Height	7,000 feet.	1,128 feet.	900 feet.	720 feet.	800 feet.	1,500 feet.	..	1,056 feet.
MONTH.	10 Years, 1850 to 1859.	3 Years, 1857 to 1859.	3 Years, 1857 to 1859.	..	3 Years, 1857 to 1859.	1 Year, 1859.	1 Year, 1848.	6 Years, 1855 to 1860.
January - - -	in. 0·6	in. 1·2	in. 2·5	in. 1·1	in. 1·1	in. -	in. -	in. 1·2
February - - -	0·6	1·4	1·1	0·9	2·0	-	-	1·8
March - - -	0·3	0·4	0·1	0·5	0·7	-	-	1·1
April - - -	1·9	0·5	0·8	0·5	5·2	-	-	0·8
May - - -	1·5	0·4	0·5	0·1	1·2	-	2·8	0·4
June - - -	11·9	1·4	1·6	0·9	8·4	4·1	10·9	0·3
July - - -	31·5	5·5	2·9	12·7	22·7	4·8	22·9	2·1
August - - -	32·3	3·6	4·3	0·7	10·5	5·1	6·2	3·3
September - -	10·3	1·9	2·3	0·9	4·2	3·6	2·3	1·7
October - - -	0·9	-	-	-	-	-	2·8	0·1
November - - -	0·6	-	0·2	-	-	-	1·9	0·3
December - - -	0·3	-	0·2	-	0·6	-	-	0·6
Sums - - -	92·7	16·3	16·5	18·3	56·6	17·6	49·8	13·7

TABLES showing the MONTHLY and YEARLY MEAN READING of the BAROMETER at STATIONS situated in the PRESIDENCY of MADRAS, arranged in the order of Latitude.

TABLE CVI., showing the Monthly and Yearly Mean Reading of the Barometer at Stations situated between the Latitudes 5° 21' N. and 17° 41' N. and Longitudes 75° 30' E. and 100° 25' E. in the Madras Presidency.

Place	PENANG.	COLOMBO.	TRIN-COMALEE.	PALAM-COTTAH.*	WELLINGTON.†	DODABETTA.	CANNANORE.‡	MERGUIS.§	BANGALORE.	POONAMALLEE.||	FORT ST. GEORGE.
Latitude . . .	5° 21' N.	6° 57' N.	8° 34' N.	8° 43' N.	11° 25' N.	11° 25' N.	11° 52' N.	12° 27' N.	12° 57' N.	13° 2' N.	13° 4' N.
Longitude . . .	100° 25' E.	80° 0' E.	81° 19' E.	77° 48' E.	77° 5' E.	77° 5' E.	75° 30' E.	98° 42' E.	77° 38' E.	80° 10' E.	80° 14' E.
Height . . . .	....	....	....	120 feet.	6,000 feet.	8,640 feet.	15 feet.	200 feet.	3,000 feet.	....	....
MONTH.	1 Year, 1859.	2 Years, 1853 and 1854.	1 Year, 1854.	5 Years, 1855 to 1859.	1 Year, 1859.	2 Years, 1847 and 1848.	10 Years, 1850 to 1859.	7 Years, 1853 to 1859.	1 Year, 1859.	5 Years, 1855 to 1859.	2 Years, 1777 and 1778.
January - -	in. 29·62	in. 29·91	in. 29·87	in. 29·57	in. 24·32	in. 22·08	in. 29·87	in. 29·90	in. 27·33	in. 29·67	in. 30·02
February - -	29·65	29·88	29·85	29·56	24·33	22·10	29·73	29·90	27·28	29·66	30·02
March - - -	29·60	29·89	29·84	(29·69)	24·34	22·13	29·63	29·90	27·26	29·62	30·01
April - - -	29·55	29·84	29·73	29·42	24·40	22·10	29·68	29·85	27·22	29·54	30·19
May - - - -	29·60	29·85	29·70	29·35	24·34	22·06	29·87	29·80	27·12	29·47	30·17
June - - - -	29·60	29·84	29·69	29·34	24·34	21·97	29·94	29·75	27·06	29·45	29·16
July - - - -	29·55	29·89	29·68	29·33	24·32	21·97	29·85	29·75	27·03	29·40	29·17
August - - -	29·55	29·84	29·71	29·35	24·37	22·00	29·85	29·75	27·07	29·45	29·19
September - -	29·60	29·88	29·70	29·37	24·33	22·00	29·75	29·75	27·08	29·47	29·18
October - - -	29·50	29·89	29·74	29·38	24·31	22·05	29·80	29·90	27·13	29·47	29·19
November - -	29·55	29·86	29·82	29·42	24·31	22·08	29·80	29·90	27·12	29·49	30·01
December - -	29·60	29·92	29·80	29·47	24·33	22·04	29·99	29·90	27·17	29·61	30·02
Means - - -	29·58	29·87	29·76	29·42	24·34	22·05	29·81	29·84	27·15	29·53	...

* Palamcottah.—The reading in March has been altered conjecturally from 29·69 to 29·49.

† Wellington and Dodabetta.—The changes of atmospheric pressure from month to month seem to be very small.

‡ Cannanore.—The results are irregular, and several of the readings are erroneous.

§ Mergui.—Most likely the instrument was not good.

|| Poonamallee.—The reading in February has been altered conjecturally from 29·71 to 29·66.

(continued.)

Place	FORT ST. GEORGE.	MADRAS.	TAVOY.	NELLORE.*	HURRYHUR.†	KURNOOL.‡	GUNTOOR.§	BELLARY.||	SECUNDERABAD.¶	VIZAGAPATAM.**
Latitude . . .	13° 4' N.	13° 6' N.	14° 7' N.	14° 20' N.	14° 31' N.	15° 50' N.	16° 20' N.	17° 0' N.	17° 28' N.	17° 41' N.
Longitude . . .	80° 14' E.	80° 21' E.	98° 18' E.	80° 0' E.	75° 51' E.	78° 5' E.	80° 30' E.	77° 0' E.	78° 32' E.	83° 21' E.
Height . . . .	....	....	12 feet.	50 feet.	1,831 feet.	800 feet.	100 feet.	1,500 feet.	....	....
MONTH.	31 Years, 1811 to 1841.	55 Years, 1796 to 1850.	11 Years, 1849 to 1859.	2 Years, 1859 and 1860.	3 Years, 1857 to 1859.	3 Years, 1857 to 1859.	5 Years, 1855 to 1859.	9 Years, 1851 to 1859.	10 Years, 1850 to 1859.	1 Year, 1859.
January - -	in. 30·11	in. 30·05	in. 30·15	in. 28·51	in. 27·84	in. 29·09	in. 29·95	in. 28·65	in. 28·88	in. 29·91
February - -	30·08	30·03	30·05	28·49	27·79	29·11	29·73	28·64	28·61	29·93
March - - -	30·02	29·98	30·14	28·45	27·74	28·98	29·76	28·59	28·33	29·87
April - - - -	29·95	29·90	30·00	28·41	27·72	28·93	29·85	28·58	28·31	29·80
May - - - -	29·87	29·80	29·95	28·31	27·70	28·93	29·76	28·59	28·82	29·74
June - - - -	29·86	29·78	29·92	28·25	27·69	28·90	29·71	28·51	28·65	29·68
July - - - -	29·86	29·79	29·91	28·22	27·65	28·80	29·70	28·40	28·62	29·71
August - - -	29·88	29·82	29·86	28·27	27·69	28·81	29·73	28·46	28·56	29·72
September - -	29·91	29·85	29·01	28·33	27·74	28·89	29·74	28·47	28·64	29·79
October - - -	29·97	29·91	30·01	28·36	27·79	28·91	29·72	28·58	28·78	29·91
November - -	30·03	29·98	30·04	28·42	27·76	(29·05)	29·89	28·68	28·56	30·04
December - -	30·08	30·03	30·10	28·48	27·82	29·14	30·02	28·70	28·70	30·06
Means - - -	29·97	29·91	30·01	28·38	27·74	28·96	29·80	28·57	28·62	29·84

* Nellore.—The reading in February has been altered conjecturally from 28·54 to 28·49.

† Hurryhur.—The reading in March has been altered conjecturally from 27·82 to 27·72. The reading in April has been altered conjecturally from 27·82 to 27·72.

‡ Kurnool.—The reading in November has been altered from 29·25 to 29·05.

§ Guntoor.—The readings seem to be erroneous.

|| Bellary.—The reading in October has been altered from 28·48 to 28·58.

¶ Secunderabad.—The readings seem to be erroneous.

** Vizagapatam.—The reading in May has been altered from 29·64 to 29·74. The reading in June has been altered from 29·58 to 29·68.

TABLES showing the MONTHLY and YEARLY MEAN READING of the BAROMETER at STATIONS situated for the most part in the BOMBAY PRESIDENCY, arranged in the Order of Latitude.

TABLE CVII., showing the Monthly and Yearly Mean Reading of the Barometer at Stations situated between the Latitudes 15° 52' N. and 23° 34' N., and Longitudes 70° 50' E. and 77° 25' E., and for the most part in the Presidency of Bombay.

Place . .	BELGAUM.	SATTARA.	DA- POOLEE.	POORUN- DHUR.	POONA.	POONA.	SEROOR.*	BOMBAY.	BOMBAY.	RAJCOTE.†	MHOW.	AHMED- NUGGUR.
Latitude . .	15° 52' N.	17° 40' N.	17° 48' N.	18° 12' N.	18° 30' N.	18° 30' N.	18° 50' N.	18° 53' N.	18° 53' N.	22° 18' N.	22° 33' N.	23° 34' N.
Longitude . .	74° 42' E.	74° 2' E.	73° 16' E.	73° 54' E.	74° 0' E.	74° 0' E.	77° 25' E.	72° 52' E.	72° 52' E.	70° 50' E.	75° 46' E.	73° 1' E.
Height . .	2,260 feet.	2,320 feet.	600 feet.	4,200 feet.	1,800 feet.	1,800 feet.	1,752 feet.	. . .	. . .	450 feet.	1,862 feet.	1,900 feet.
MONTH.	4 Years, 1856 to 1859.	5 Years, 1855 to 1859.	2 Years, 1858 and 1859.	2 Years, 1852 and 1853.	1 Year, 1830.	5 Years, 1856 to 1860.	5 Years, 1854 to 1858.	2 Years, 1843 and 1844.	12 Years, 1847 to 1858.	4 Years, 1857 to 1860.	2 Years, 1859 and 1860.	6 Years, 1854 to 1859.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	27·52	27·87	29·41	26·02	28·09	28·06	27·44	29·92	29·93	29·75	28·2	27·89
February - -	27·50	27·85	29·42	26·02	28·00	28·03	27·44	29·91	29·91	29·71	28·1	27·86
March - - -	27·44	27·83	29·38	25·94	27·95	27·98	27·40	29·85	29·86	29·71	28·1	27·81
April - - -	27·40	27·76	29·33	25·96	27·91	27·92	27·34	29·80	29·79	29·68	28·1	27·77
May - - - -	27·34	27·72	29·28	25·88	27·85	27·83	27·31	29·70	29·74	29·58	27·9	27·71
June - - - -	27·28	27·64	29·22	25·80	27·77	27·80	27·26	29·64	29·65	29·59	27·8	27·67
July - - - -	27·26	27·63	29·19	25·81	27·77	27·78	27·25	29·65	29·65	29·45	27·7	27·60
August - - -	27·32	27·69	29·24	25·84	27·84	27·83	27·30	29·71	29·72	29·56	27·8	27·66
September - -	27·36	27·73	29·30	25·84	27·93	27·89	27·35	29·79	29·77	29·50	27·9	27·71
October - - -	27·40	27·80	29·32	25·94	27·92	27·97	27·40	29·84	29·83	29·73	28·0	27·80
November - -	27·45	27·86	29·39	26·04	28·02	28·04	27·46	29·90	29·90	29·70	28·1	27·86
December - -	27·52	27·87	29·41	26·01	28·07	28·08	27·53	29·92	29·94	29·85	28·1	27·89
Means - - -	27·40	27·77	29·32	25·93	27·93	27·93	27·37	29·80	29·81	29·65	28·0	27·77

* Seroor.—The reading in November has been altered from 29·26 to 29·46.
† Rajcote.—The readings seem to be erroneous.

TABLES showing the MONTHLY and YEARLY MEAN READINGS of the BAROMETER at STATIONS situated for the most part in the PRESIDENCY of BENGAL, arranged in the Order of Latitude.

TABLE CVIII., showing the Monthly and Yearly Mean Reading of the Barometer at Stations situated between the Latitudes 20° 18' N. and 34° 20' N., and Longitudes 67° 2' E. and 92° 46' E., for the most part in the Presidency of Bengal.

Place .	THYET MYO.	CAL- CUTTA.*	CAL- CUTTA.	FORT WILLIAM (CAL- CUTTA).	HAZA- REE- BAUGH.†	BERHAM- PORE.	BENARES	DAR- JEELING.	KUR- RACHEE.	DEESA.‡	BARODA§	MEERUT.	UM- BALLA.	PESHA- WUR.
Latitude	20° 18' N.	22° 34' N.	22° 34' N.	22° 34' N.	24° 0' N.	24° 5' N.	25° 17' N.	27° 2' N.	24° 51' N.	25° 14' N.	25° 30' N.	28° 59' N.	30° 23' N.	34° 20' N.
Longitude	92° 46' E.	88° 25' E.	88° 25' E.	88° 25' E.	85° 24' E.	88° 17' E.	83° 4' E.	88° 18' E.	67° 2' E.	72° 5' E.	76° 49' E.	77° 46' E.	76° 44' E.	71° 29' E.
Height .	240 feet.	80 feet.	80 feet.	. . .	1,900 feet.	76 feet.	270 feet.	7,000 feet.	27 feet.	400 feet.	A few ft.	900 feet.	1,050 feet.	1,056 feet.
MONTH.	1 Year, 1859.	2 Years, 1843 and 1844.	1 Year, 1848.	5 Years, 1854 to 1859.	3 Years, 1858 to 1860.	3 Years, 1857 to 1859.	2 Years, 1858 and 1859.	3 Years, 1857 to 1859.	4 Years, 1856 to 1859.	3 Years, 1857 to 1859.	7 Years, 1847 to 1853.	1 Year, 1859.	2 Years, 1851 and 1852.	3 Years, 1858 to 1860.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January -	29·85	29·94	30·00	30·02	27·87	29·94	29·85	23·16	30·16	29·67	30·22	29·27	29·17	28·86
February -	29·86	29·92	29·98	29·96	27·82	29·90	29·78	23·14	30·08	29·59	30·22	29·27	29·11	28·76
March -	29·81	29·79	29·84	29·86	27·76	29·86	29·70	23·14	29·98	29·56	(30·04)	29·19	29·02	28·78
April -	29·76	29·66	29·72	29·77	27·70	29·74	29·61	23·12	29·90	29·45	29·85	29·07	28·97	28·69
May -	29·70	29·56	29·64	29·65	27·64	29·62	29·43	23·07	29·73	29·52	29·80	29·01	28·87	28·56
June -	29·59	29·48	29·52	29·53	27·59	29·51	29·41	23·02	29·62	29·35	29·76	28·75	28·71	28·35
July -	29·62	29·52	29·53	29·54	27·57	29·50	29·41	23·02	29·58	29·33	29·65	28·85	28·77	28·36
August -	29·68	29·52	29·54	29·60	27·58	29·57	29·44	23·06	29·66	29·44	29·73	28·59	28·81	28·49
September -	29·70	29·61	29·71	29·70	27·66	29·67	29·51	23·12	29·81	29·55	29·79	29·00	28·81	28·52
October -	29·74	29·73	29·88	29·83	27·78	29·79	29·67	23·18	29·97	29·68	29·87	29·20	29·06	28·61
November -	29·85	29·86	30·01	29·98	27·88	29·92	29·85	23·21	30·04	29·77	30·22	29·30	29·16	28·75
December -	29·86	29·95	30·02	30·03	27·90	29·95	29·88	23·18	30·16	29·85	30·09	29·37	29·19	28·93
Means -	29·75	29·71	29·78	29·79	27·73	29·75	29·63	23·12	29·89	29·56	29·92	29·07	28·97	28·64

* Calcutta.—The reading in June has been altered from 29·18 to 29·48. The reading in October has been altered from 29·63 to 29·73.
† Hazareebaugh.—The reading in April has been altered conjecturally from 27·80 to 27·70. The reading in December has been altered conjecturally from 27·80 to 27·90.
‡ Deesa.—The reading in May seems to be in error as compared with April and June ; it should be 29·42.
§ Baroda.—The reading in March has been altered conjecturally from 30·54 to 30·04 ; and the reading in October from 29·67 to 29·87.

TABLES showing the OBSERVED MONTHLY, QUARTERLY, HALF YEARLY, and YEARLY MEANS, and DIFFERENCES between the HOTTEST and COLDEST MONTHS, and SEASONS, of OBSERVATIONS taken for the most part in the PRESIDENCY of MADRAS arranged in the order of LATITUDE, of the following METEOROLOGICAL ELEMENTS:—

1. Maximum Temperature of the Air.
2. Minimum Temperature of the Air.
3. Daily Range of Temperature.
4. Temperature of the Air.
5. Readings of the Dry and Wet Bulb Thermometers.
6. Temperature of the Dew Point.
7. Amount of Vapour in a Cubic Foot of Air.
8. Additional Weight of Vapour required for Saturation.
9. Degree of Humidity.
10. Sun Temperature.

MADRAS PRESIDENCY.—1. *Maximum Temperature of the Air.*

TABLE CIX., showing the AVERAGE MAXIMUM TEMPERATURE for every MONTH and QUARTER as well as for the Periods October to March, and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and Mean Maximum Temperature for the Year, between Latitudes 5° 21' N. and 18° 56' N., and Longitudes 75° 30' E. and 100° 25' E. arranged in the order of Latitude, at Stations for the most part in the Presidency of Madras.

Place	PENANG . . .			COLOMBO . . .			TRINCOMALEE . . .			PALAMCOTTAH.		
Latitude	5° 21' N.			6° 57' N.			8° 34' N.			8° 43' N.		
Longitude	100° 25' E.			80° 0' E.			81° 19' E.			77° 48' E.		
Height	A few feet									120 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1859.		April to September.	1853.		April to September.	1854.		April to September.	1855 to 1859.		April to September.
January - - -	83	83	83	84	84	84	81	82	83	86	87	89
February - - -	84			85			84			90		
March - - -	85	85		87	86		86	88		93	94	
April - - -	85			86			90			94		
May - - -	84	85	85	85	83	84	89	89	89	94	93	93
June - - -	86			84			90			93		
July - - -	85	85		83	83		88	89		92	93	
August - - -	84			83			88			93		
September - - -	84	83		84	83		89	85		93	90	
October - - -	83			83			85			91		
November - - -	83	82		83	84		81	80		87	86	
December - - -	82			84			80			86		
Difference between Hottest and Coldest Months. Hottest and Coldest Seasons.	4	2	2	4	3	0	10	7	6	8	7	4
Mean for Year -	84			84			86			91		
Highest in -	June.			March.			April and June.			April and May.		
Lowest in -	December.			July, August, Oct. and Nov.			December.			January and December.		

(continued)

Place	WELLINGTON . . .			CANNANORE . . .			MERGUI . . .			BANGALORE.		
Latitude	11° 25' N.			11° 52' N.			12° 27' N.			12° 57' N.		
Longitude	77° 5' E.			75° 30' E.			98° 42' E.			77° 38' E.		
Height	6,000 feet			15 feet.			200 feet.			3,000 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	7 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1859.		April to September.	1850 to 1859.		April to September.	1853 to 1859.		April to September.	1859.		April to September.
January - - -	68	70	70	87	87	87	86	82	82	79	81	82
February - - -	66			87			78			83		
March - - -	71	70		89	89		84	88		88	88	
April - - -	67			90			90			86		
May - - -	73	74	73	88	83	85	90	83	85	91	83	85
June - - -	73			83			84			84		
July - - -	74	72		83	85		84	81		84	81	
August - - -	75			82			80			81		
September - - -	75	75		83			80			82		
October - - -	74			84			80			82		
November - - -	68	75		87			84			79		
December - - -	75			86			82			80		
Difference between Hottest and Coldest Months. Hottest and Coldest Seasons.	9	4	3	8	6	2	12	7	3	12	7	3
Mean for Year -	72			86			84			83		
Highest in -	August.			April.			April.			May.		
Lowest in -	February.			August.			February.			January.		

MADRAS PRESIDENCY.—1. Maximum Temperature of the Air—*continued.*

Place	GUNTOOR			BELLARY			SAMULCOTTAH.		
Latitude	16° 20' N.			17° 0' N.			17° 4' N.		
Longitude	80° 30' E.			77° 0' E.			82° 14' E.		
Height	100 feet			1,500 feet			50 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1855 to 1859.		April to September.	1851 to 1859.		April to September.	1857 to 1859.		April to September.
January - - -	82	82	83	78	79	80	78	80	82
February - - -	84			81			83		
March - - -	91	92	89	85	89	86	88	92	89
April - - -	91			90			92		
May - - -	94	89	81	92	83	81	95	87	83
June - - -	94			86			90		
July - - -	86	82	80	82	81	78	85	83	78
August - - -	87			82			85		
September - - -	84	81	79	84	80	80	85	80	80
October - - -	81			80			83		
November - - -	81	79	78	80	78	78	80	78	78
December - - -	79			78			78		
Difference between Hottest and Coldest Months.		15	10	6	14	10	6	17	12
Hottest and Coldest Seasons.		6	7	7	6	6	6	6	6
Mean for Year - -	86			83			85		
Highest in - -	May.			May.			May.		
Lowest in - -	December.			January.			December.		

(continued.)

Place	SECUNDERABAD			VIZAGAPATAM			TONGHOO.		
Latitude	17° 28' N.			17° 41' N.			18° 57' N.		
Longitude	78° 32' E.			83° 21' E.			96° 30' E.		
Height	1,800 feet . . . . .			. . . . .			300 feet.		
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1850 to 1859.		April to September.	1859.		April to September.	1859.		April to September.
January - - -	78	79	81	76	77	80	82	85	86
February - - -	82			78			90		
March - - -	87	91	87	86	91	89	90	93	88
April - - -	92			97			99		
May - - -	95	84	81	89	88	83	91	84	85
June - - -	86			89			84		
July - - -	83	81	79	88	80	78	84	80	78
August - - -	83			86			85		
September - - -	82	77	76	85	76	76	86	76	76
October - - -	82			84			86		
November - - -	79	77	76	80	76	76	84	76	76
December - - -	77			76			82		
Difference between Hottest and Coldest Months.		18	12	6	21	14	9	17	9
Hottest and Coldest Seasons.		6	7	7	6	6	6	6	6
Mean for Year - -	84			85			87		
Highest in - -	May.			April.			April.		
Lowest in - -	December.			January.			January.		

MADRAS PRESIDENCY.—2. Minimum Temperature of the Air.

TABLE CX., showing the AVERAGE MINIMUM TEMPERATURE for every MONTH and QUARTER, as well as for the Periods October to March, and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and Minimum Temperature for the Year, between the Latitudes 5°21' N. and 18° 57' N., and Longitudes 75° 30' and 100° 25' E., arranged in the order of Latitude, at Stations for the most part in the Presidency of Madras.

Place . . . . .	. . . . PENANG . . . .			. . . . COLOMBO . . . .			. . . . TRINCOMALEE . . . .			. . . . PALAMCOTTAH.											
Latitude . . . . .	. . . . 5° 21' N. . . .			. . . . 6° 57' N. . . .			. . . . 8° 34' N. . . .			. . . . 8° 43' N.											
Longitude . . . . .	. . . . 100° 25' E. . . .			. . . . 80° 0' E. . . .			. . . . 81° 19' E. . . .			. . . . 77° 48' E.											
Height . . . . .	. . . . A few feet . . . .			. . . . . . . . . . . . . . . .			. . . . . . . . . . . . . . . .			. . . . 120 feet.											
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.																			
	1859.		April to September.	1853.		April to September.	1854.		April to September.	1855 to 1859.		April to September.																			
January - - -	77	76	77	73	74	75	75	75	75	76	77	79																			
February - - -	78			75			76			77																					
March - - -	79	79	78	77	78	79	76	78	79	82	84	83																			
April - - -	79			77			79			79			84																		
May - - -	78	79	79	79	79	77	80	78	77	84	83	81																			
June - - -	79			80			79			84																					
July - - -	79	77	77	78	77	76	78	77	77	83	79	74																			
August - - -	78			79			77			82																					
September - - -	78	77	77	78	77	75	78	77	77	83	79	74																			
October - - -	76			77			76			82																					
November - - -	77	74	74	75	73	74	75	74	74	79	77	77																			
December - - -	74			73			74			77																					
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.		5		3		1		7		5		4		6		3		4		8		7		4					
Mean for Year -		78		77		77		81		March.		December.		June.		January.		May.		December.		April.		January.							
Highest in -		March.		June.		January.		May.		December.		April.		January.																	
Lowest in -		December.		January.		December.		January.																							

(continued.)

Place	WELLINGTON			CANNANORE			MERGUI			BANGALORE.																							
Latitude	11° 25' N.			11° 52' N.			12° 27' N.			12° 57' N.																							
Longitude	77° 5' E.			75° 30' E.			98° 42' E.			77° 38' E.																							
Height	6,000 feet			15 feet			200 feet			3,000 feet.																							
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	7 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.																					
	1859.		April to September.	1850 to 1859.		April to September.	1853 to 1859.		April to September.	1859.		April to September.																					
January - - -	60	62	63	78	78	78	74	74	74	59	61	65																					
February - - -	60			79			74			63																							
March - - -	63	63	63	81	81	78	76	75	74	70	71	70																					
April - - -	62			82			76			71																							
May - - -	65	64	64	80	77	77	74	73	74	72	69	69																					
June - - -	65			77			74			69																							
July - - -	62	63	63	77	77	76	72	74	74	70	69	62																					
August - - -	65			78			72			69																							
September - - -	59	64	64	77	77	74	74	74	74	70	69	62																					
October - - -	65			76			74			69																							
November - - -	64	65	65	77	76	72	74	72	72	67	62	62																					
December - - -	65			76			72			62																							
Difference between		Hottest and Coldest Months.		Hottest and Coldest Seasons.		6		2		0		6		4		0		4		2		0		13		10		5					
Mean for Year -		63		74		67		May.		September.		April.		October.		March.		July.		May.		January.											
Highest in -		May.		April.		October.		March.		July.		May.		January.																			
Lowest in -		September.		October.		July.		January.																									

MADRAS PRESIDENCY.—2. Minimum Temperature of the Air—continued.

Place	POONAMALLEE . . . . .			.FORT ST. GEORGE			FORT ST. GEORGE. . . . .			. . . . .MADRAS.		
Latitude	13° 2' N.			13° 4' N.			13° 4' N.			13° 6' N.			
Longitude	80° 10' E.			80° 14' E.			80° 14' E.			80° 21' E.			
Height	2 feet.			....			....			....
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	31 Years.	Winter, Spring, Summer, Autumn.	October to March.	30 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1855 to 1859.		April to September.	1777 and 1778.		April to September.	1811 to 1841.		April to September.	1796 to 1825.		April to September.	
January - - -	74	75	76	64	65	67	65	66	68	69	70	72	
February - - -	76			65			66			70			
March - - -	78	80	81	68	73	76	69	74	76	72	77	79	
April - - -	80			73			75			77			
May - - -	81	82	81	77	76	76	79	77	76	81	80	79	
June - - -	82			79			79			81			
July - - -	82	77	76	75	72	72	79	70	70	79	76	76	
August - - -	82			75			73			79			
September - - -	79	77	76	76	72	72	72	70	70	78	76	76	
October - - -	78			76			71			76			
November - - -	75	76	76	65	66	66	68	66	66	73	71	71	
December - - -	76			66			66			71			
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.		8	7	5	15	11	9	14	11	8	
Mean for Year -		78		72		72		76		76		76	
Highest in -		June.		June.		May.		May and June.		May and June.		January.	
Lowest in -		January.		January.		January.		January.		January.		January.	

(continued.)

Place	TAVOY.			NELLORE.			KURNOOL.		
Latitude	14° 7' N.			14° 20' N.			15° 50' N.		
Longitude	98° 18' E.			80° 0' E.			78° 5' E.		
Height	12 feet.			50 feet.			800 feet.		
MONTH.	11 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn,	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1849 to 1859.		April to September.	1859 and 1860.		April to September.	1857 to 1859.		April to September.
January - - -	61	61	66	72	74	76	75	76	78
February - - -	63		75	79					
March - - -	73	73	72	77	79	79	86	88	84
April - - -	72			..			90		
May - - -	73	72	72	..	79	79	88	79	79
June - - -	74			..			84		
July - - -	72	70	70	..	79	79	82	79	79
August - - -	70			..			81		
September - - -	73	70	70	79	79	79	81	79	79
October - - -	72			81			81		
November - - -	66	59	59	76	74	74	76	74	74
December - - -	59			74			74		
Difference between Hottest and Coldest Months.		15	12	6	..	..	16	12	6
Hottest and Coldest Seasons.									
Mean for Year -	69			...			81		
Highest in -	June.			....			April.		
Lowest in -	December.			....			December.		

MADRAS PRESIDENCY.—2. Minimum Temperature of the Air—*continued.*

<i>Place</i> . . . . .	. . . . . GUNTOOR . . . . .			. . . . . SAMULCOTTAH . . . . .			. . . . . BELLARY.		
<i>Latitude</i> . . . . .	. . . . . 16° 20' N. . . . .			. . . . . 17° 4' N. . . . .			. . . . . 17° 0' N.		
<i>Longitude</i> . . . . .	. . . . . 80° 30' E. . . . .			. . . . . 82° 14' E. . . . .			. . . . . 77° 0' E.		
<i>Height</i> . . . . .	. . . . . 100 feet . . . . .			. . . . . 50 feet . . . . .			. . . . . 1,500 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.							
	1855 to 1859.		April to September.	1857 to 1859.		April to September.	1851 to 1859.		April to September.							
January - - -	68	} 69	70	55	} 56	62	68	} 67	68							
February - - -	73			60			65									
March - - -	72	} 79	81	65	} 73	77	68	} 73	74							
April - - -	81			75			75									
May - - -	84	} 82		80	} 78		77	} 73								
June - - -	84			78			76									
July - - -	80	} 73		78	} 71		72	} 72								
August - - -	81			77			73									
September - - -	79	} 73		76			73	} 72								
October - - -	70			74			70									
November - - -	72	} 73		63			72									
December - - -	65			53			68									
Difference between Hottest and Coldest Months.		} 19	13	27	22	15	12	6	6							
Hottest and Coldest Seasons.																
Mean for Year -				76			69			71						
Highest in -				May and June.			May.			May.						
Lowest in -				December.			December.			February.						

(continued.)

<i>Place</i> . . . . .	. . . . SECUNDERABAD . . . . .			. . . . VIZAGAPATAM . . . . .			. . . . TONGHOO.		
<i>Latitude</i> . . . . .	. . . . 17° 28' N. . . . .			. . . . 17° 41' N. . . . .			. . . . 18° 57' N.		
<i>Longitude</i> . . . . .	. . . . 78° 32' E. . . . .			. . . . 83° 21' E. . . . .			. . . . 96° 30' E.		
<i>Height</i> . . . . .	. . . . 1,800 feet . . . . .			. . . . . . . . . . .			. . . . 300 feet.		
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.			
	1850 to 1859.		April to September.	1859.		April to September.	1859.		April to September.			
January - - -	64	} 65	67	71	} 74	77	57	} 62	67			
February - - -	66			76			63					
March - - -	73	} 77	76	81	} 86	86	70	} 76	78			
April - - -	76			90			81					
May - - -	82	} 75		87	} 86		78	} 77				
June - - -	77			87			78					
July - - -	75	} 70		85	} 82		77	} 73				
August - - -	74			85			77					
September - - -	73	} 70		85			76	} 73				
October - - -	71			83			75					
November - - -	67	} 70		78			69					
December - - -	64			75			66					
Difference between Hottest and Coldest Months.		} 18	12	19	12	9	24	15	11			
Hottest and Coldest Seasons.												
Mean for Year -	72			82			72					
Highest in -	May.			April.			April.					
Lowest in -	January.			January.			January.					

MADRAS PRESIDENCY.—3. *Daily Range of Temperature.*

TABLE CXI., showing the AVERAGE DAILY RANGE for every MONTH and QUARTER, as well as the Periods October to March, and April to September, with the Difference between the greatest and least Months, and the Mean Daily Range for the Year, between the Latitudes 5° 21' N. and 18° 57' N., and between the Longitudes 75° 30' E. and 100° 25' E., arranged in the order of Latitude, at Stations, for the most part, in the Presidency of Madras.

Place . . .	. . . PENANG . . .			. . . COLOMBO . . .			. . . TRINCOMALEE . . .			. . . PALAMCOTTAH.		
Latitude . . .	. . . 5° 21' N. . . .			. . . 6° 57' N. . . .			. . . 8° 34' N. . . .			. . . 8° 43' N.		
Longitude . . .	. . . 100° 25' E. . . .			. . . 80° 0' E. . . .			. . . 81° 19' E. . . .			. . . 77° 48' E.		
Height . . .	. . . A few feet. . . .			. . . . .			. . . . .			. . . 120 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years. 1855 to 1859.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1859.			1853.			1854.					
January - -	6	7	6	11	11	9	6	7	7	10	11	10
February - -	6			10			8			13		
March - -	6			10			10			11		
April - -	6	6		9	8		11	10		10	10	
May - -	6			6			9			10		
June - -	7		6	4		6	11		11	9		10
July - -	6	6		5	4		10	11		9	10	
August - -	6			4			11			11		
September - -	6			6			11			10		
October - -	7	6		6	7		9	9		9	9	
November - -	6			8			6			8		
December - -	8			11			6			9		
Difference between Greatest and Least Monthly Ranges.		2	0	7	7	3	5	4	4	5	2	0
Greatest and Least Seasonal Ranges.												
Mean for Year -	6			8			9			10		
Greatest in -	December.			January and December.			April, June, Aug., Sept.			February.		
Least in -	Several months.			June and August.			January, Nov., and Dec.			November.		

(continued.)

Place . . .	. . . WELLINGTON . . .			. . . CANNANORE . . .			. . . MERGUI . . .			. . . BANGALORE.		
Latitude . . .	. . . 11° 25' N. . . .			. . . 11° 52' N. . . .			. . . 12° 27' N. . . .			. . . 12° 57' N.		
Longitude . . .	. . . 77° 5' E. . . .			. . . 75° 30' E. . . .			. . . 98° 42' E. . . .			. . . 77° 38' E.		
Height . . .	. . . 6,000 feet. . . .			. . . 15 feet . . . .			. . . 200 feet . . . .			. . . 3,000 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	10 Years. 1850 to 1859.	Winter, Spring, Summer, Autumn.	October to March. April to September.	7 Years. 1853 to 1859.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year. 1859.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1859.			1850 to 1859.			1853 to 1859.					
January - -	8	8	8	9	9	9	12	8	8	20	19	17
February - -	6			8			4			20		
March - -	8			8			8			18		
April - -	5	7		8	8		14	13		15	17	
May - -	8			8			16			19		
June - -	8		10	6		6	10		11	15		15
July - -	12	10		6	5		12	10		14	14	
August - -	10			4			8			12		
September - -	16			6			6			12		
October - -	9	10		8	8		6	7		13	12	
November - -	4			10			10			12		
December - -	10			10			10			18		
Difference between Greatest and Least Monthly Ranges.		12	2	6	4	3	12	6	3	8	7	2
Greatest and Least Seasonal Ranges.												
Mean for Year -	9			7			9			16		
Greatest in -	September.			November and December.			May.			January and February.		
Least in -	November.			August.			February.			August, Sept., and Nov.		

MADRAS PRESIDENCY.—3. Daily Range of Temperature—*continued.*

Place . . . .	. . . POONAMALLEE . . .			. . . FORT ST. GEORGE . . .			. . . FORT ST. GEORGE . . .			. . . MADRAS.		
Latitude . . . .	. . . 13° 2' N. . . .			. . . 13° 4' N. . . .			. . . 13° 4' N. . . .			. . . 13° 6' N.		
Longitude . . . .	. . . 80° 10' E. . . .			. . . 80° 14' E. . . .			. . . 80° 14' E. . . .			. . . 80° 21' E.		
Height . . . .	. . . ° 2 feet . . . .			. . . . .			. . . . .			. . . . .
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	31 Years.	Winter, Spring, Summer, Autumn.	October to March.	30 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1855 to 1859.		April to September.	1777 and 1778.		April to September.	1811 to 1841.		April to September.	1796 to 1825.		April to September.	
January - - -	6	} 5	5	18	} 20	19	21	} 20	20	15	} 15	16	
February - - -	5			21			21			18			
March - - -	4	} 5		20	} 21		21	} 20		19	} 18		
April - - -	5			18			20			16			
May - - -	5	} 4	4	26	} 23	21	20	} 15	18	19	} 16	16	
June - - -	5			21			19			17			
July - - -	4	} 4		24	} 16		6	} 20		16	} 15		
August - - -	2			23			20			15			
September - - -	4	} 4		15			21			15			
October - - -	4			12			21			16			
November - - -	5	} 4		20			19			14			
December - - -	5			21			18			13			
Difference between		} 4	1	1	14	7	2	15	5	2	6	3	0
Greatest and Least Monthly Ranges.	Greatest and Least Seasonal Ranges.												
Mean for Year -		4			20			19			16		
Greatest in -		January.			May.			Several.			March and May.		
Least in -		August.			October.			July.			December.		

(continued.)

Place	TAVOY			NELLORE			KURNOOL.		
Latitude	14° 7' N. . . .			14° 20' N. . . .			15° 50' N.		
Longitude	98° 18' E. . . .			80° 0' E. . . .			78° 5' E.		
Height	12 feet			50 feet. . . .			800 feet.		
MONTH.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1851 to 1859.		April to September.	1859 and 1860.			1857 to 1859.		April to September.
January - -	38	} 30	24	4	} 4	4	5	} 5	5
February - -	29			5			6		
March - -	21	} 23		8			5	} 4	
April - -	26			.			3		
May - -	21	} 15	18	.			5	} 3	3
June - -	16			.			4		
July - -	9	} 17		.	} 5		3	} 4	
August - -	19			.			2		
September - -	17	} 17		8			3		
October - -	11			4			4		
November - -	23	} 17		2			4		
December - -	23			3			5		
Difference between		} 29	15	6	..	..	..	4	2
Greatest and Least Monthly Ranges.	Greatest and Least Seasonal Ranges.								
Mean for Year -	21			....			4		
Greatest in -	January.			....			February.		
Least in -	July.			....			August.		

MADRAS PRESIDENCY.—3. Daily Range of Temperature—continued.

Place . . . .	. . . . . GUNTOOR . . . . .			. . . . . SAMULCOTTAH . . . . .			. . . . . BELLARY.		
Latitude . . . .	. . . . . 16° 20' N. . . . .			. . . . . 17° 4' N. . . . .			. . . . . 17° 0'.		
Longitude . . . .	. . . . . 80° 30' E. . . . .			. . . . . 82° 14' E. . . . .			. . . . . 77° 0'.		
Height . . . .	. . . . . 100 feet . . . . .			. . . . . 50 feet . . . . .			. . . . . 1,500 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1855 to 1859.		April to September.	1857 to 1859.		April to September.	1831 to 1859.		April to September.	
January - - -	14	13	13	23	24	20	10	12	12	
February - - -	11		23	16						
March - - -	19	13	8	23	18	11	17	16	12	
April - - -	10			17			15			
May - - -	10	7	8	15	9	11	15	10	12	
June - - -	10			12			10			
July - - -	6	8	9	7	12	9	10	10	12	
August - - -	6			8			9			
September - - -	5	8	9	9	12	9	11	10	12	
October - - -	11			9			10			
November - - -	9	14	10	17	12	9	8	10	12	
December - - -	14			25			10			
Difference between Greatest and Least Monthly Ranges.		14	6	5	18	15	9	9	6	0
Greatest and Least Seasonal Ranges.										
Mean for Year -	10			16			12			
Greatest in -	March.			December.			March.			
Least in -	September.			July.			November.			

(continued.)

Place	SECUNDERABAD			VIZAGAPATAM			TONGHOO.			
Latitude	17° 28' N. . . .			17° 41' N. . . .			18° 57' N.			
Longitude	78° 32' E. . . .			83° 21' E. . . .			96° 30' E.			
Height	1,800 feet . . . .			....			....
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	
	1850 to 1859.		April to September.			1859.			April to September.	1859.	April to September.
January - - -	14	14	13	5	3	3	25	23	19	
February - - -	16			2			27			
March - - -	14	14		5	5		20	17		
April - - -	16			7			18			
May - - -	13	9	11	2	2	2	13	7	10	
June - - -	9			2			6			
July - - -	8	11		3	1		7	12		
August - - -	9			1			8			
September - - -	9	11		0			10			
October - - -	11			1			11			
November - - -	12	8	5	4	4	1	15	16	9	
December - - -	13			1			16			
Difference between		8	5	2	7	4	1	21	16	9
Greatest and Least Monthly Ranges.	Greatest and Least Seasonal Ranges.									
Mean for Year -	12			3			14			
Greatest in -	February and April.			April.			February.			
Least in -	July.			September.			June.			

MADRAS PRESIDENCY.—4. *Temperature of the Air.*

TABLE CXII., showing the AVERAGE TEMPERATURE of the AIR for every MONTH and QUARTER, as well as for the Period October to March, and April to September, and the Difference between the Hottest and Coldest Months and Seasons, and Mean Temperature for the Year, between the Latitudes 1° 16' N. and 17° 41' N., and Longitudes 75° 30' E. and 103° 53' E., arranged in the order of Latitude, at Stations, for the most part, in the Presidency of Madras.

Place	SINGAPORE			PENANG			COLOMBO			COLOMBO.							
Latitude	1° 16' N.			5° 21' N.			6° 57' N.			6° 57' N.							
Longitude	103° 53' E.			100° 25' E.			80° 0' E.			80° 0' E.							
Height	30 feet			A few feet . . . . .			...			...	
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.					
	1859.		April to September.	1859.		April to September.	1812 and 1815.		April to September.	1853 and 1854.		April to September.					
January - - -	80	80	81	80	80	80	79	79	80	81	80	81					
February - - -	80			81			80			83							
March - - -	82	82	82	82	82	82	82	83	82	85	85	83					
April - - -	81			82			84			85							
May - - -	82	82	82	81	82	82	84	81	82	84	82	82					
June - - -	82			83			82			83							
July - - -	83	82	82	82	80	80	81	80	80	82	82	82					
August - - -	81			81			80			82							
September - - -	82	81	81	81	80	80	81	80	80	82	82	82					
October - - -	81			78			79			82							
November - - -	80	81	81	80	81	81	80	81	81	82	82	82					
December - - -	81			78			78			76							
Difference between																	
Hottest and Coldest Months.	Hottest and Coldest Seasons.	3		2		1	5	2		2		6	4	2	9	5	2
Mean for Year -		81				81				81			82				
Hottest in -	July.					June.				April.			March.				
Coldest in -	January.					October.				December.			December.				

MADRAS PRESIDENCY.—4. Temperature of the Air—*continued.*

<i>Place</i> . . . . .	. . . DODABETTA . . .			. . . OOTACAMUND . . .			. . . ANJARA KANDY . . .			. . . MANANTODDY.		
<i>Latitude</i> . . . . .	. . . 11° 25' N. . . .			. . . 11° 35' N. . . .			. . . 11° 40' N. . . .			. . . 11° 48' N.		
<i>Longitude</i> . . . . .	. . . 77° 5' E. . . . .			. . . 76° 45' E. . . . .			. . . 75° 40' E. . . . .			. . . 76° 4' E.		
<i>Height</i> . . . . .	. . . 8,640 feet . . . .			. . . 7,361 feet . . . .			. . . . .			. . . . .
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	
	1817 and 1818.		April to September.	1831 to 1833.		April to September.	1810 to 1813, and 1818 to 1823.		April to September.	1832.		April to September.	
January - - -	52	52	53	53	54	56	80	81	81	57	62	66	
February - - -	52			55			82			64			
March - - -	55	56	54	60	62	60	84	85	81	71	72	69	
April - - -	56			63			86			72			
May - - -	57	53	54	62	59	60	84	79	81	72	68	69	
June - - -	53			60			80			69			
July - - -	53	53	54	58	57	57	78	80	80	67	68	65	
August - - -	53			58			79			67			
September - - -	53	53	54	58			79	80	80	68	68	65	
October - - -	53			58			81			68			
November - - -	52	51	51	56			81	80	80	68			
December - - -	51			53			80			65			
Difference between Hottest and Coldest Months.		6	4	1	10	8	4	8	6	0	15	10	3
Hottest and Coldest Seasons.													
Mean for Year -		54			58			81			68		
Hottest in -		May.			April.			April.			April.		
Coldest in -		December.			January.			July.			January.		

(continued.)

<i>Place</i> . . . . .	. . . CANNANORE . . .			. . . MERCARA . . .			. . . SERINGAPATAM . . .			. . . BANGALORE.		
<i>Latitude</i> . . . . .	. . . 11° 52' N. . . .			. . . 12° 24' N. . . .			. . . 12° 45' N. . . .			. . . 12° 57' N.		
<i>Longitude</i> . . . . .	. . . 75° 30' E. . . . .			. . . 75° 48' E. . . . .			. . . 76° 51' E. . . . .			. . . 77° 38' E.		
<i>Height</i> . . . . .	. . . 15 feet . . . . .			. . . 4,500 feet . . . . .			. . . 2,412 feet . . . . .			. . . 3,000 feet.		
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	
	1850 to 1859.		April to September.	1838 to 1840.		April to September.	1814 to 1816.		April to September.	1835.		April to September.	
January - - -	82	82	82	67	67	68	71	73	75	70	71	72	
February - - -	82			71			77			73			
March - - -	84	85	81	74	73	69	81	83	79	79	74	76	
April - - -	86			73			84			79			
May - - -	85	79	81	72	67	69	85	76	79	78	72	74	
June - - -	80			69			79			75			
July - - -	79	81	81	67	67	67	75	76	76	74	72	74	
August - - -	79			66			74			73			
September - - -	79	81	81	66	67	67	77	76	76	74	72	74	
October - - -	81			67			77			71			
November - - -	82	81	81	67			74	72	72	71			
December - - -	81			64			72			69			
Difference between Hottest and Coldest Months.		7	6	1	8	6	1	14	10	4	10	8	4
Hottest and Coldest Seasons.													
Mean for Year -		82			68			77			74		
Hottest in -		April.			March.			May.			March and April.		
Coldest in -		July.			August.			January.			December.		

MADRAS PRESIDENCY.—4. Temperature of the Air—continued.

Place . . . . .	. . . BANGALORE . . .			. . . FORT ST. GEORGE . . .			. . . FORT ST. GEORGE . . .			. . . MADRAS.		
Latitude . . . . .	. . . 12° 57' N.. . .			. . . 13° 4' N. . . .			. . . 13° 4' N. . . .			. . . 13° 6' N.		
Longitude . . . . .	. . . 77° 38' E.. . .			. . . 80° 14' E.. . .			. . . 80° 14' E.. . .			. . . 80° 21' E.		
Height . . . . .	. . . 3,000 feet.			. . . . .			. . . . .			. . . . .
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	31 Years.	Winter, Spring, Summer, Autumn.	October to March.	55 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859.		April to September.	1777 and 1778.		April to September.	1811 to 1841.		April to September.	1796 to 1850.		April to September.	
January - - -	69	} 71	73	73	} 76	77	76	} 77	79	76	} 77	79	
February - - -	73			77			78			78			
March - - -	79	} 80	78	82	} 83	87	80	} 84	85	80	} 83	85	
April - - -	79			82			84			83			
May - - -	82	} 76	78	90	} 88	82	87	} 86	82	87	} 85	82	
June - - -	77			89			88			87			
July - - -	77	} 75	78	87	} 80	82	85	} 82	82	85	} 82	82	
August - - -	75			87			85			84			
September - - -	76	} 75	78	84	} 80	82	84	} 82	82	84	} 82	82	
October - - -	75			82			82			82			
November - - -	73	} 71	78	75	} 76	77	79	} 76	76	79	} 77	77	
December - - -	71			77			76			77			
Difference between		} 13	9	5	17	12	10	12	9	6	11	8	6
Hottest and Coldest Months.	Hottest and Coldest Seasons.												
Mean for Year -	76			82			82			82			
Hottest in -	May.			April.			June.			May and June.			
Coldest in -	January.			January.			January.			January.			

(continued.)

Place	TAVOY.			NELLORE			HURRYHUR.					
Latitude	14° 7' N.			14° 20' N.			14° 31' N.					
Longitude	98° 18' E.			80° 0' E.			75° 51' E.					
Height	12 feet			50 feet			1,831 feet.					
MONTH.	11 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.			
	1849 to 1859.		April to September.	1859 and 1860.		April to September.	1857 to 1860.		April to September.			
January - -	80	} 76	78	74	} 76	78	74	} 76	78			
February - -	78			77			79					
March - -	84	} 84	82	80	} 86	87	81	} 82	80			
April - -	85			85			81					
May - -	84	} 80	82	92	} 87	87	84	} 80	80			
June - -	82			91			81					
July - -	77	} 79	82	85	} 81	81	79	} 79	79			
August - -	80			85			78					
September - -	82	} 71	78	83	} 76	76	79	} 76	76			
October - -	78			82			80					
November - -	78	} 14	8	77	} 11	9	78	} 6	2			
December - -	71			76			76					
Difference between												
Hottest and Coldest Months.	} 4			} 18			} 10					
Hottest and Coldest Seasons.	} 2			} 9			} 6					
Mean for Year -	80			82			79					
Hottest in -	April.			May.			May.					
Coldest in -	December.			January.			January.					

MADRAS PRESIDENCY.—4. Temperature of the Air—continued.

Place	KURNOOL			GUNTOOR			BELLARY.			
Latitude	15° 50' N.			16° 20' N.			17° 0' N.			
Longitude	78° 5' E.			80° 30' E.			77° 0' E.			
Height	800 feet			100 feet			1,500 feet.			
MONTH.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1857 to 1859.		April to September.	1855 to 1859.		April to September.	1851 to 1859.		April to September.	
January - - -	78	} 79	81	75	} 75	77	74	} 75	77	
February - - -	82			79			79			
March - - -	88	} 90	86	82	} 86	85	85	} 86	82	
April - - -	91			86			88			
May - - -	90	} 84	86	89	} 85	85	86	} 81	82	
June - - -	86			89			83			
July - - -	82	} 81	86	83	} 78	85	80	} 77	82	
August - - -	84			84			79			
September - - -	83	} 81	86	82	} 78	85	79	} 77	82	
October - - -	83			76			78			
November - - -	78	} 81	86	76	} 78	85	74	} 77	82	
December - - -	77			72			73			
Difference between Hottest and Coldest Months. Hottest and Coldest Seasons.		} 14	11	5	17	11	8	15	11	5
Mean for Year -	84			81			80			
Hottest in -	April.			May.			April.			
Coldest in -	December.			December.			December.			

(continued.)

Place	SAMULCOTTAH			SECUNDERABAD			VIZAGAPATAM			
Latitude	17° 4' N.			17° 28' N.			17° 41' N.			
Longitude	82° 14' E.			78° 32' E.			83° 21' E.			
Height	50 feet			1,800 feet.			....		
MONTH-	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	
	1858 and 1859.		April to September.	1850 to 1859.		April to September.	1859.		April to September.	
January - - -	67	} 68	72	73	} 74	76	74	} 75	79	
February - - -	71			76			76			
March - - -	77	} 83	83	81	} 85	83	83	} 88	88	
April - - -	84			86			93			
May - - -	87	} 82	83	89	} 84	83	88	} 87	88	
June - - -	84			83			88			
July - - -	82	} 77	83	80	} 77	83	86	} 83	88	
August - - -	81			79			86			
September - - -	80	} 77	83	78	} 77	83	86	} 83	88	
October - - -	79			78			84			
November - - -	72	} 77	83	76	} 77	83	80	} 83	88	
December - - -	66			73			76			
Difference between Hottest and Coldest Months. Hottest and Coldest Seasons.		} 21	15	11	16	11	7	19	13	9
Mean for Year -	78			80			84			
Hottest in -	May.			May.			April.			
Coldest in -	December.			January.			January.			

MADRAS PRESIDENCY.—5. *Readings of the Dry and Wet Bulb Thermometers.*

Place	SINGAPORE				DODABETTA				MADRAS.				
Latitude	1° 16' N.				11° 25' N.				13° 6' N.				
Longitude	103° 53' E.				77° 5' E.				80° 21' E.				
Height	30 feet				8,640 feet . . . . .				....
MONTH.	5 Years.		Winter, Spring, Summer, Autumn.		1 Year.		Winter, Spring, Summer, Autumn.		18 Years.		Winter, Spring, Summer, Autumn.		
	1841 to 1845.		Dry.	Wet.	1847.		Dry.	Wet.	1833 to 1850.		Dry.	Wet.	
	Dry.	Wet.			Dry.	Wet.			Dry.	Wet.			
January - - -	79	75	} 79	75	52	46	} 52	49	76	71	} 77	72	
February - - -	79	75			52	51			78	72			
March - - -	80	77	} 81	77	55	50	} 56	53	81	75	} 84	78	
April - - -	81	77			56	53			84	79			
May - - -	82	78	} 81	77	57	55	} 53	52	87	80	} 85	78	
June - - -	82	78			53	52			86	78			
July - - -	81	77	} 80	77	53	52	} 53	52	85	78	} 81	76	
August - - -	81	77			53	52			84	78			
September - - -	81	77	} 80	77	53	52	} 53	52	83	78	} 81	76	
October - - -	80	77			53	52			82	77			
November - - -	80	76	} 80	77	52	51	} 53	52	78	74	} 81	76	
December - - -	79	76			51	49			77	72			
Difference between Highest and Lowest Monthly Readings.		Highest and Lowest Seasonal Readings.		3		3		2		2		6	
Means - - -		80		77		80		77		53		51	
Highest - - -		May and June.		May.		May.		May.		May.		May.	
Lowest - - -		Jan., Feb., and Dec.		January and February.		December.		January.		January.		January.	

(continued.)

Place	BELLARY				SECUNDERABAD				TONGHOO.				
Latitude	17° 0' N.				17° 28' N.				18° 57' N.				
Longitude	77° 0' E.				78° 32' E.				96° 30' E.				
Height	1,500 feet				1,800 feet				300 feet.				
MONTH.	9 Years.		Winter, Spring, Summer, Autumn.		10 Years.		Winter, Spring, Summer, Autumn.		1 Year.		Winter, Spring, Summer, Autumn.		
	1851 to 1859.		Dry.	Wet.	1850 to 1859.		Dry.	Wet.	1859.		Dry.	Wet.	
	Dry.	Wet.			Dry.	Wet.			Dry.	Wet.			
January - - -	78	64	} 77	66	75	63	} 76	63	70	61	} 74	65	
February - - -	80	68			80	63			77	65			
March - - -	90	70	} 89	72	83	69	} 87	71	80	69	} 85	75	
April - - -	84	75			88	70			90	79			
May - - -	82	70	} 82	73	91	73	} 84	74	84	77	} 81	78	
June - - -	85	75			87	74			81	78			
July - - -	79	73	} 78	70	83	74	} 78	71	80	77	} 79	75	
August - - -	81	72			81	75			81	78			
September - - -	82	68	} 78	70	80	76	} 78	71	81	77	} 79	75	
October - - -	79	72			79	71			81	76			
November - - -	73	69	} 78	70	75	65	} 78	71	76	71	} 79	75	
December - - -	72	65			73	62			74	68			
Difference between Highest and Lowest Monthly Readings.		Highest and Lowest Seasonal Readings.		18		11		12		7		18	
Means - - -		81		70		81		70		20		18	
Highest in - -		March.		April and June.		May.		September.		April.		April	
Lowest in - -		December.		January.		December.		December.		January.		December.	

MADRAS PRESIDENCY.—6. *Temperature of the Dew Point.*

TABLE CXIV., showing the AVERAGE TEMPERATURE of the DEW POINT for every MONTH and QUARTER, as well as for the period October to March, and April to September, with the Difference between the highest and lowest Month and Season and Mean Temperature of the Dew Point for the Year, between the Latitudes 1° 16' N. and 18° 57' N., and Longitudes 75° 50' E. and 103° 53' E., arranged in the order of Latitude, at Stations for the most part in the Presidency of Madras.

Place	SINGAPORE			DODABETTA			MADRAS			
Latitude	1° 16' N.			11° 25' N.			13° 6' N.			
Longitude	103° 53' E.			77° 5' E.			80° 21' E.			
Height	30 feet			8,640 feet . . . . .			....
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year. 1847.	Winter, Spring, Summer, Autumn.	October to March.	18 Years. 1833 to 1850.	Winter, Spring, Summer, Autumn.	October to March.	
	1841 to 1845.		April to September.			April to September.			April to September.	
January - - -	72	73	74	40	46	47	67	68	70	
February - - -	72			50			68			
March - - -	75	75	74	45	49	51	71	74	74	
April - - -	74			50			76			
May - - -	75	74	74	53	51	51	76	73	73	
June - - -	75			51			73			
July - - -	74	75	74	51	51	51	73	73	73	
August - - -	74			51			74			
September - - -	74	75	74	51	51	51	75	73	73	
October - - -	75			51			74			
November - - -	75	74	74	50	47	47	71	69	69	
December - - -	74			47			69			
Difference between Highest and Lowest Monthly Readings of the Dew Point.		3	2	0	13	5	4	9	6	4
Highest and Lowest Seasonal Readings of the Dew Point.										
Mean for Year -		74			49			72		
Highest in Lowest in		May, June, October, and November. January and February.			May. January.			April and May. January.		

(continued.)

Place	BELLARY			SECUNDERABAD			'TONGHOO.			
Latitude	17° 0' N.			17° 28' N.			18° 57' N.			
Longitude	77° 0' E.			78° 32' E.			96° 30' E.			
Height	1,500 feet			1,800 feet			300 feet.			
MONTH.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	
	1851 to 1859.		April to September.	1850 to 1859.		April to September.	1859.		April to September.	
January - - -	54	58	61	54	53	57	54	58	63	
February - - -	60			51			57			
March - - -	58	63	66	60	60	67	62	69	74	
April - - -	69			59			72			
May - - -	62	68	66	62	68	67	72	76	71	
June - - -	69			66			76			
July - - -	69	64	64	68	66	66	75	71	71	
August - - -	66			71			76			
September - - -	59	60	60	73	54	54	74	67	64	
October - - -	67			66			73			
November - - -	66	60	60	58	60	60	67	64	64	
December - - -	60			54			64			
Difference between Highest and Lowest Monthly Readings of the Dew Point.		15	10	5	22	15	10	22	18	11
Highest Seasonal Readings of the Dew Point.										
Mean for Year -		64			62			69		
Highest in Lowest in		April, June, and July. January.			September, February.			June and August, January.		

MADRAS PRESIDENCY.—7. Amount of Vapour in a Cubic Foot of Air.

TABLE CXV., showing the AVERAGE AMOUNT of VAPOUR in a CUBIC FOOT of AIR for every MONTH and QUARTER, as well as for the period October to March, and April to September, with the Difference between the greatest and least Months and Seasons, and the Mean for the Year, between the Latitudes 1° 56' N. and 18° 57' N., and Longitudes 75° 51' E. and 103° 53' E., at Stations for the most part in the Presidency of Madras.

Place	SINGAPORE . . .			DODABETTA . . .			MADRAS			HURRYHUR.			
Latitude	1° 16' N. . . .			11° 25' N. . . .			13° 6' N.			14° 31' N.			
Longitude	103° 53' E. . . .			77° 5' E.			80° 21' E.			75° 51' E.			
Height	30 feet			8,640 feet						1,831 feet.			
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	18 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1841 to 1845.		April to September.	1847.		April to September.	1833 to 1850.		April to September.	1857 to 1860.		April to September.	
January - - -	grs. 8·5	} 8·7	9·0	grs. 2·8	} 3·5	3·7	grs. 7·2	} 7·3	7·8	grs. 4·7	grs. ..	grs. ..	
February - - -	8·5			4·1			7·3			..			
March - - -	9·3	} 9·3	9·2	3·4	} 4·0	4·2	8·1	} 8·9	8·9	..	..	..
April - - -	9·1			4·1			9·4			..			
May - - -	9·4	} 9·2	9·2	4·5	} 4·2	4·2	9·3	} 8·7	8·9	..	..	..
June - - -	9·4			4·2			8·5			..			
July - - -	9·1	} 9·2	9·2	4·2	} 4·2	4·2	8·7	} 8·7	8·9	..	..	..
August - - -	9·1			4·2			8·9			..			
September - - -	9·1	} 9·2	9·2	4·2	} 4·2	4·2	9·1	} 8·7	8·9	..	..	..
October - - -	9·3			4·2			8·9			..			
November - - -	9·3	} 9·2	9·2	4·1	} 4·2	4·2	8·2	} 8·7	8·9	5·8	..	..
December - - -	9·0			3·6			7·5			5·1			
Difference between													
Greatest and Least Monthly Amount.	} 0·9		0·6	0·2	1·7	0·7	0·5	2·2	1·6	1·1	..	..
Greatest and Least Seasonal Amount.													
Mean for Year -			9·1		4·0			8·4		..			
Greatest - - -	May and June.	Spring.	..	May.	Summer and Autumn.	..	April.	Spring.	..	..	..	..
Least - - -	Jan. and Feb.	Winter.	..	Jan.	Winter.	..	Jan.	Winter.	..	..	..	..

(continued.)

Place	BELLARY			SECUNDERABAD			TONGHOO.			
Latitude	17° 0' N.			17° 28' N.			18° 57' N.			
Longitude	77° 0' E.			78° 32' E.			96° 30' E.			
Height	1,500 feet			1,800 feet			300 feet.			
MONTH.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	
	1851 to 1859.		April to September.	1850 to 1859.		April to September.	1859.		April to September.	
January - - -	grs. 4·5	} 5·2	grs. 5·8	grs. 4·6	} 4·4	grs. 5·1	grs. 4·6	} 5·3	6·2	
February - - -	5·5		4·1	4·9						
March - - -	5·0	} 6·1	6·7	5·4	} 5·5	6·9	5·8	} 7·5	9·0	
April - - -	7·5			5·2			8·3			
May - - -	5·9	} 7·3	7·3	5·8	} 7·3	6·9	8·5	} 9·4	9·4	
June - - -	7·4			6·6			9·5			
July - - -	7·6	} 6·5	6·5	7·3	} 6·9	6·9	9·3	} 8·3	8·3	
August - - -	6·8			8·1			9·5			
September - - -	5·2	} 6·5	6·5	8·8	} 6·9	6·9	9·1	} 8·3	8·3	
October - - -	7·2			6·8			8·6			
November - - -	7·0	} 6·5	6·5	5·2	} 6·9	6·9	7·2	} 8·3	8·3	
December - - -	5·6			4·5			6·4			
Difference between										
Greatest and Least Monthly Amount.	} 3·1		2·1	0·9	4·7	2·9	1·8	4·9	4·1	2·8
Greatest and Least Seasonal Amount.										
Mean for Year -			6·3		6·0			7·6		
Greatest - - -	July.	Summer.	..	September.	Summer.	..	June and August.	Summer.	..	
Least - - -	January.	Winter.	..	February.	Winter.	..	January.	Winter.	..	

MADRAS PRESIDENCY.—8. *Additional Weight of Vapour required for Saturation.*

TABLE CXVI., showing the AVERAGE AMOUNT of VAPOUR required to SATURATE a CUBIC FOOT of AIR, for every MONTH and QUARTER, as well as for the period October to March, and April to September, with the Difference between the greatest and least Months and Seasons, and Mean for the Year, between the Latitudes $1^{\circ} 56' N.$ and $18^{\circ} 57' N.$, and Longitudes $75^{\circ} 51' E.$ and $103^{\circ} 53' E.$, arranged in the order of Latitude, at Stations for the most part in the Presidency of Madras.

Place	SINGAPORE			DODABETTA			MADRAS			HURRYHUR.		
Latitude	1° 16' N.			11° 25' N.			13° 6' N.			14° 31' N.		
Longitude	103° 53' E.			77° 5' E.			80° 21' E.			75° 51' E.		
Height	30 feet			8,640 feet						1,831 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	18 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1841 to 1845.		April to September.	1847.		April to September.	1833 to 1850.		April to September.	1857 to 1860.		April to September.
January - -	grs. 2.1	} 1.9	1.8	grs. 1.6	} 0.8	0.8	grs. 2.5	} 2.7	2.7	grs. 4.4	..	..
February - -	2.1			0.3			3.0			..		
March - -	1.7	} 2.1		1.5	} 1.0		3.2	} 3.5		..	..
April - -	2.2			0.9			3.0			..		
May - -	2.3	} 2.2	2.2	0.7	} 0.3	0.4	4.3	} 4.1	3.7	..	..	..
June - -	2.3			0.3			4.7			..		
July - -	2.2	} 1.9		0.3	} 0.3		4.1	} 2.6		..	..
August - -	2.2			0.3			3.5			..		
September - -	2.2	} 1.9		0.3	} 0.3		2.9	} 2.6		..	..
October - -	1.7			0.3			2.8			..		
November - -	1.7	} 1.9		0.3	} 0.3		2.1	} 2.6		4.5	..	
December - -	1.6			0.6			2.5			4.6		
Difference between Greatest and Least Monthly Amount.		} 0.7	0.3	0.4	1.3	0.7	0.4	2.6	1.5	1.0	..	..
Mean for Year -												
Greatest -	April and May.	Summer.	..	January.	Spring.	..	June.	Summer.	..	..	..	..
Least -	Dec.	Autumn and Winter.	..	Feb., June, July, Aug., Sept., Oct., and Nov.	Summer and Autumn.	..	Nov.	Autumn.	..	..	..	..

(continued.)

Place	BELLARY			SECUNDERABAD			TONGHOO.			
Latitude	17° 0' N.			17° 28' N.			18° 57' N.			
Longitude	77° 0' E.			78° 32' E.			96° 30' E.			
Height	1,500 feet			1,800 feet			300 feet.			
MONTH.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	
	1851 to 1859.		April to September.	1850 to 1859.		April to September.	1859.		April to September.	
January - -	grs. 5·8	} 4·7	4·8	grs. 4·8	} 5·3	5·1	grs. 3·4	} 3·7	3·9	
February - -	5·5			6·9			5·1			
March - -	9·8	} 6·8		6·6	} 8·3		5·2	} 5·2		
April - -	4·9			8·8			6·5			
May - -	5·8	} 4·3	5·0	9·5	} 5·0	5·9	3·9	} 1·8	2·9	
June - -	5·4			7·0			1·8			
July - -	3·0	} 3·9		4·7	} 3·4		1·7	} 2·5		
August - -	4·5			3·2			1·8			
September - -	6·5	} 3·9		2·2	} 3·4		2·2	} 2·5		
October - -	3·4			3·8			2·7			
November - -	1·8	} 3·9		4·2	} 3·4		2·5	} 2·5		
December - -	2·9			4·3			2·7			
Difference between		} 8·0	2·9	0·2	7·3	4·9	0·8	4·8	3·4	1·0
Greatest and Least Monthly Amount.	Greatest and Least Seasonal Amount.									
Mean for Year -			4·9			5·5			3·3	
Greatest -	March.	Spring.	..	May.	Spring.	..	April.	Spring.	..	
Least -	November.	Autumn.	..	September.	Autumn.	..	July.	Summer.	..	

MADRAS PRESIDENCY.—9. Degree of Humidity.

TABLE CXVII., showing the AVERAGE DEGREE OF HUMIDITY for every MONTH and QUARTER, as well as for the period October to March, and April to September, with the Difference between the most Humid and least Humid Months and Seasons, and Mean for the Year, between the Latitudes 1° 16' N. and 18° 57' N., and between the Longitudes 75° 51' E. and 103° 53' E., arranged in the order of Latitude, at Stations for the most part in the Presidency of Madras.

Place	SINGAPORE . . .			DODABETTA . . .			MADRAS . . .			HURRYHUR.						
Latitude . . .	1° 16' N. . . .			11° 25' N. . . .			13° 6' N. . . .			14° 31' N.						
Longitude . . .	103° 53' E. . . .			77° 5' E. . . .			80° 21' E. . . .			75° 51' E.						
Height	30 feet			8,640 feet . . . .			. . . . .			1,831 feet.			
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	18 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.				
	1841 to 1845.		April to September.	1847.		April to September.	1833 to 1850.		April to September.	1857 to 1860.		April to September.				
January - - -	80	82	84	64	81	83	75	74	74	52	..	..		
February - - -	80			93			71			..						
March - - -	85	82	80	70	79	90	72	72	71	..	..	..	
April - - -	80			81			76			..						
May - - -	80	80	80	87	93	90	69	68	68	..	..	..	
June - - -	80			93			64			..						
July - - -	80	83	83	93	93	93	68	77	77	..	..	..	
August - - -	80			93			72			..						
September - - -	80	83	83	93	93	93	76			..	..	..	
October - - -	85			93			76			..						
November - - -	85	85	85	93	86	86	79	75	75	56	52	52				
December - - -	85			86			75			52						
Difference between Most Humid and Least Humid Months.		Most Humid and Least Humid Seasons.		5	3	4	29	14	7	15	9	3	
Mean for Year -		82		87	73	
Most Humid -	March, Oct., Nov., and Dec.	Spring, Autumn, Winter.	..	Feb., June, July, Aug., Sept., Oct., and Nov.	Summer and Autumn.	Spring.	Nov.	Autumn.	
Least Humid -	Jan., Feb., Ap., May, June, July, Aug., and Sept.	Summer.	..	January	June	Summer.	

(continued.)

Place	BELLARY			SECUNDERABAD			TONGHOO.		
Latitude . . .	17° 0' N.			17° 28' N.			18° 57' N.		
Longitude . . .	77° 0' E.			78° 32' E.			96° 30' E.		
Height	1,500 feet			1,800 feet			300 feet.		
MONTH.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1851 to 1859.		April to September.	1850 to 1859.		April to September.			1859.	April to September.
January - -	44	53	56	49	46	50	57	59	64
February - -	50			37			50		
March - -	34	48	57	45	40	56	53	59	77
April - -	60			37			68		
May - -	51	63	64	38	60	66	85	85	77
June - -	58			49			85		
July - -	71	64	64	60	66	77	85	77	70
August - -	60			72			80		
September - -	45	64	64	80	66	77	80	77	70
October - -	67			63			76		
November - -	79	65	65	55	51	51	75	70	70
December - -	65			51			70		
Difference between Most Humid and Least Humid Months.		Most Humid and Least Humid Seasons.		45	16	1	35	26	13
Mean for Year -		57		53	70	..	..	..	..
Most Humid -	November.	Autumn.	..	August.	Autumn.	..	June, July, and August.	Summer.	..
Least Humid -	March.	Spring.	..	February and April.	Spring.	..	February.	Spring and Winter.	..

MADRAS PRESIDENCY.—10. *Sun Temperature.*

TABLE CXVIII., showing the AVERAGE SUN TEMPERATURE for every MONTH and QUARTER, as well as for the Period from October to March, and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and the Mean for the Year, between the Latitudes 8° 43' N. and 17° 41' N., and Longitudes 75° 51' E. and 98° 42' E., arranged in the order of Latitude, and for the most part in the Presidency of Madras.

Place	PALAMCOTTAH		. . . MERGYI . . .		. . . TAVOY . . .		. HURRYHUR .		. . . KURNOOL.				
Latitude	8° 43' N. .		. . . 12° 27' N. . .		. . . 14° 7' N. . .		. 14° 31' N. .		. . . 15° 50' N.				
Longitude . . . . .	. 77° 48' E. .		. . . 98° 42' E. . .		. . . 98° 18' E. . .		. 75° 51' E. .		. . . 78° 5' E.				
Height . . . . .	. 120 feet .		. . . 200 feet . .		. . . 12 feet . . .		. 1,831 feet .		. . . 800 feet.				
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	7 Years.	Winter, Spring, Summer, Autumn.	Oct. to March.	11 Years.	Winter, Spring, Summer, Autumn.	Oct. to March.	4 Years.	Winter, Spring, Summer, Autumn.	3 Years.	Winter, Spring, Summer, Autumn.	Oct. to March.	
	1855 to 1859.		1853 to 1859.		April to Sept.	1849 to 1859.		April to Sept.	1857 to 1860.		1857 to 1859.		April to Sept.	
January - - -	104	} 104	100	} 100	99	110	} 110	109	102	} 97	99	} 97	94	
February - - -	104		100			110			92		100			
March - - -	107	} 107	114	} 115	99	115	} 108	104	96 ?	} ..	110	} 113	103	
April - - -	107		115			115			91 ?		116			
May - - -	108	} ..	115	} 93	99	105	} 102	104	94 ?	} ..	112	} 97	93	
June - - -	106		100			100			88 ?		103			
July - - -	? 83	} ..	90	} 90	99	100	} 104	104	89	} 98	96	} 93	93	
August - - -	? 85		89			105			92		92			
September - - -	106	} 105	89	} 90	99	100	} 104	104	97	} 98	97	} 93	93	
October - - -	104		80			100			100		94			
November - - -	105	} 103	100	} 100	99	112	} 110	110	98	} 98	88	} 93	93	
December - - -	103		100			110			102		93			
Difference between		} ..	} ..	35	25	0	15	8	5	28	20	9
Hottest and Coldest Months.	Hottest and Coldest Seasons.													
Mean for Year -	..		100			106			..		100			
Highest in -	..		April and May.			March and April.			..		April.			
Lowest in -	..		October.			June, July, Sept. and Oct.			..		November.			

(continued.)

Place . . . . .	. . . GUNTOOR . . .			. . . BELLARY . . .			. . . SECUNDERABAD . . .			. . . VIZAGAPATAM.		
Latitude . . . . .	. . . 16° 20' N. . .			. . . 17° 0' N. . .			. . . 17° 28' N. . .			. . . 17° 41' N.		
Longitude . . . . .	. . . 80° 30' E. . .			. . . 77° 0' E. . .			. . . 78° 32' E. . .			. . . 83° 21' E.		
Height . . . . .	. . . 100 feet . . .			. . . 1,500 feet . . .			. . . 1,800 feet			
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October. to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	
	1855 to 1859.		April to September.	1851 to 1859.		April to September.	1850 to 1859.		April to September.	1859.		April to September.	
January - - -	85	88	89	102	98	96	93	91	93	91	..	..
February - - -	92			104			99			90			
March - - -	96	105	101	105	106	100	104	107	97	88	96	..	
April - - -	118			107			104			102			
May - - -	101	97	97	106	98	91	113	94	90	99	..	..
June - - -	106			99			98			? 75			
July - - -	94	90	90	97	91	91	92	90	90	? 54	..	..
August - - -	91			97			92			? 55			
September - - -	93	88	88	94	88	88	86	82	82	? 61	84	84	
October - - -	89			91			92			? 86			
November - - -	88	88	88	89	88	88	91	82	82	? 76	84	84	
December - - -	88			88			82			? 84			
Difference between Hottest and Coldest Months.		33	17	12	19	15	4	31	17	4
Hottest and Coldest Months.													
Mean for Year -		95			98			96				
Highest in		April.			April.			May.				
Lowest in		January.			December.			December.				

TABLES showing the MONTHLY, QUARTERLY, HALF YEARLY, and YEARLY MEANS, and DIFFERENCES between the HOTTEST and COLDEST MONTHS and SEASONS, of OBSERVATIONS taken for the most part in the PRESIDENCY of BOMBAY, arranged in the order of LATITUDE, of the following METEOROLOGICAL ELEMENTS :—

1. Maximum Temperature of the Air.

2. Minimum Temperature of the Air.

3. Daily Range of Temperature.

4. Temperature of the Air.

5. Readings of the Dry and Wet Thermometers.
6. Temperature of the Dew Point.

7. Amount of Vapour in a Cubic Foot of Air.

8. Amount of Vapour required for Saturation.

9. Degree of Humidity.

10. Sun Temperature.

BOMBAY PRESIDENCY.—1. *Maximum Temperature of the Air.*

TABLE CXIX., showing the AVERAGE MAXIMUM TEMPERATURE for every MONTH and QUARTER, as well as for the Periods October to March, and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and Mean Maximum Temperature for the Year, between the Latitudes 15° 50' N. and 26° 20' N., and between the Longitudes 67° 2' E. and 76° 0' E., arranged in the order of Latitude, and for the most part in the Presidency of Bombay.

Place	VINGORLA			DHARWAR			BELGAUM			KULLADGHEE.		
Latitude	15° 50' N.			15° 50' N.			15° 52' N.			16° 11' N.		
Longitude	73° 41' E.			75° 10' E.			74° 42' E.			75° 33' E.		
Height	20 feet			2,482 feet.			2,260 feet.			1,750 feet.		
MONTH.	4 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	4 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1856 to 1859.			1859 and 1860.			1856 to 1859.			1855 to 1859.		
January - - -	84	85	85	83	84	85	85	86	87	89	89	91
February - - -	85			89			91			92		
March - - -	87	88		92	91		94	90		101	102	
April - - -	88			91			97			104		
May - - -	88			91			89			101		
June - - -	85	83	85	83	80	83	81	79	84	96	93	96
July - - -	83			80	80		79			91		
August - - -	82	83		77	81		78	83		93	90	
September - - -	82			77			80			91		
October - - -	84	83		82			85			91		
November - - -	83			85			84			88		
December - - -	85			80			83			85		
Difference between												
Hottest and Coldest Months.	6	5	0	15	10	2	19	11	3	19	12	5
Hottest and Coldest Seasons.												
Mean for Year -	85			84			85			93		
Highest in	April.			March.			April.			April.		
Lowest in	August, September.			August, September.			August.			December.		

(continued.)

Place	KOLAPORE			RUTNAGHERRY			SHOLAPORE			SATTARA.		
Latitude	16° 42' N.			17° 0' N.			17° 40' N.			17° 40' N.		
Longitude	74° 18' E.			73° 20' E.			76° 0' E.			74° 2' E.		
Height	1,797 feet			150 feet			1,821 feet			2,320 feet.		
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	11 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	4 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1850 to 1859.			1855 to 1859.			1850 to 1860.			1844 to 1847.		
January - - -	77	79	80	86	87	87	80	81	83	82	81	83
February - - -	82			87			84			82		
March - - -	87	88		90	92		91	92		92	94	
April - - -	88			92			93			96		
May - - -	89			93			93			95		
June - - -	81	78	81	89	86	88	88	85	88	80	77	83
July - - -	77			85			84			76		
August - - -	77	79		84	86		84			74		
September - - -	78			85			84			78		
October - - -	80			87			83	83		83	80	
November - - -	78			87			81			78		
December - - -	77			87			78			80		
Difference between												
Hottest and Coldest Months.	12	10	1	9	6	1	15	11	5	22	17	0
Hottest and Coldest Seasons.												
Mean for Year -	81			88			85			83		
Highest in	May.			May.			April.			April.		
Lowest in	January.			August.			December.			August.		

BOMBAY PRESIDENCY.—1. Maximum Temperature of the Air—*continued.*

Place . . . . .	. . . . SATTARA . . . .			. . . . DAPOOLEE . . . .			. . . . MAHABLESHWUR . . . .			. . . . POORUNDHUR.		
Latitude . . . .	. . . . 17° 40' N. . . .			. . . . 17° 48' N. . . .			. . . . 17° 59' N. . . .			. . . . 18° 12' N.		
Longitude . . . .	. . . . 74° 2' E. . . .			. . . . 73° 16' E. . . .			. . . . 73° 30' E. . . .			. . . . 73° 54' E.		
Height . . . . .	. . . . 2,320 feet . . . .			. . . . 600 feet . . . .			. . . . 4,500 feet . . . .			. . . . 4,200 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter Spring, Summer, Autumn.	October to March.	
	1855 to 1859.		April to Sep- tember.	1858 and 1859.		April to Sep- tember.	1834.		April to Sep- tember.	1852 and 1853.		April to Sep- tember.	
January - - -	81	} 81	°	88	} 88	°	71	} 70	°	71	} 73	°	
February - - -	82		80	89		89	74		72	77		74	
March - - -	85	} 86	80	91	} 92	86	82	} 82	72	81	} 81	75	
April - - -	88			93			91			82			83	78
May - - -	85	} 77	80	91	} 83	86	81	} 68	72	80	} 73	73	
June - - -	80			86			83			69			71	73
July - - -	75	} 77	80	83	} 87	86	67	} 68	72	68	} 73	73	
August - - -	75			80			88			67			74	73
September - - -	77	} 77	80	83	} 87	86	66	} 68	72	73	} 73	73	
October - - -	75			88			69			74			73
November - - -	80	} 77	80	92	} 87	86	70	} 68	72	73	} 73	73	
December - - -	79			87			68			70			73
Difference between Hottest and Coldest Months.		} 13	9	0	13	9	3	16	14	0	15	8	1
Hottest and Coldest Seasons.													
Mean for Year -	80			88			72			75			
Highest in -	April.			April.			March.			April.			
Lowest in -	July.			August.			September.			August.			

(continued.)

Place	POONA			SEROOR			MULLIGAUM			DHOOLIA.		
Latitude	18° 30' N. . . .			18° 50' N. . . .			20° 32' N. . . .			20° 54' N. . . .		
Longitude	74° 0' E. . . .			77° 25' E. . . .			74° 30' E. . . .			74° 45' E. . . .		
Height	1,800 feet			1,752 feet			1,300 feet			1,000 feet. . . .		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	6 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1856 to 1860.			1854 to 1858.			1860.			1853 to 1858.		
January - - -	81	°	°	94	°	°	°	°	°	80	°	°
February - - -	87	°	83	94	°	96	°	°	°	86	°	84
March - - -	91	°		101	°		°	°	°	92	°	
April - - -	95	°	93	107	°	102	99	°	°	98	°	97
May - - -	93	°		98	°		104	°	°	101	°	
June - - -	85	°	85	96	°	94	100	°	°	94	°	91
July - - -	80	°	81	91	°	92	92	°	95	85	°	88
August - - -	78	°		88	°		92	°	°	84	°	
September - - -	79	°		84	°		°	°	°	84	°	
October - - -	84	°	82	96	°	92	°	°	°	86	°	84
November - - -	83	°		95	°		°	°	°	83	°	
December - - -	80	°		99	°		°	°	°	81	°	
Difference between Hottest and Coldest Months.		17	12	1	23	10	2	°	°	21	15	7
Hottest and Coldest Seasons.												
Mean for Year -	85			95			°			88		
Highest in -	April.			April.			°			May.		
Lowest in -	August.			September.			°			January.		

BOMBAY PRESIDENCY.—1. Maximum Temperature of the Air—continued.

Place . . . . .	. . . SURAT . . .			. . . BARODA . . .			. . . RAJCOTE . . .			. . . MHOW.		
Latitude . . . .	. . . 21° 10' N. . .			. . . 22° 16' N. . .			. . . 22° 18' N. . .			. . . 22° 33' N.		
Longitude . . . .	. . . 72° 52' E. . .			. . . 73° 14' E. . .			. . . 70° 50' E. . .			. . . 75° 46' E.		
Height . . . . .	. . . 33 feet . . .			. . . 90 feet . . .			. . . 450 feet . . .			. . . 1,862 feet.		
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	7 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1850 to 1859.		April to September.	1847 to 1853.		April to September.	1857 to 1860.		April to September.	1859 and 1860.		April to September.	
January - - -	87	} 89	91	84	} 88	89	78	} 80	84	75	} 75	78	
February - - -	91			90			83			77			
March - - -	98	} 100		96	} 98		89	} 95		85	} 91		
April - - -	101			94			97			92			
May - - -	100	} 90	94	105	} 92	94	99	} 89	91	95	} 83	85	
June - - -	94			98			95			85			
July - - -	90	} 91		91	} 89		88	} 87		86	} 79		
August - - -	87			88			84			77			
September - - -	90	} 91		90	} 89		85	} 87		78	} 79		
October - - -	93			87			89			81			
November - - -	91	} 91		90	} 89		86	} 87		78	} 79		
December - - -	88			89			79			74			
Difference between Hottest and Coldest Months.		} 14	11	3	21	10	5	21	15	7	21	16	7
Hottest and Coldest Seasons.													
Mean for Year -		92			92			88			82		
Highest in -		April.			May.			May.			May.		
Lowest in -		August.			January.			January.			December.		

(continued.)

Place . . . . .	. . . AHMEDABAD . . .			. . . AHMEDNUGGUR . . .			. . . NEEMUCH . . .			. . . MOUNT ABOO.		
Latitude . . . .	. . . 23° 0' N. . .			. . . 23° 34' N. . .			. . . 24° 27' N. . .			. . . 24° 45' N.		
Longitude . . . .	. . . 72° 0' E. . .			. . . 73° 1' E. . .			. . . 74° 54' E. . .			. . . 72° 49' E.		
Height . . . . .	. . . 320 feet . . .			. . . 1,900 feet . . .			. . . 1,476 feet . . .			. . . 4,000 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years	Winter, Spring, Summer, Autumn.	October to March.									
	1858 and 1859.		April to Sep- tember.	1854 to 1859.		April to Sep- tember.	1860.		April to Sep- tember.	1855 to 1859.		April to Sep- tember.									
January - - -	78	} 84	86	83	} 83	85	62	} 70	76	71	} 74	77									
February - - -	96			87			71			78											
March - - -	94	} 102		94	} 97		80	} 89		82	} 87										
April - - -	104			98			92			87											
May - - -	108	} 97	99	98	} 84	88	94	} 78	83	92	} 83	84									
June - - -	94			88			82			92											
July - - -	104	} 89		83	} 82		76	} 78		81	} 79										
August - - -	92			82			75			76											
September - - -	90	} 89		81	} 82		79	} 78		78	} 79										
October - - -	90			84			77			79											
November - - -	87	} 89		82	} 82		78	} 78		79	} 79										
December - - -	79			80			76			73											
Difference between Hottest and Coldest Months.		} 30	18	13	18	15	3	32	19	7	21	13	7								
Hottest and Coldest Seasons.																					
Mean for Year -		93			87			79			81										
Highest in -		May.			April.			May.			May.										
Lowest in -		January.			December.			January.			January.										

BOMBAY PRESIDENCY.—1. Maximum Temperature of the Air—*continued.*

Place	KURRACHEE			KURRACHEE			DEESA.			
Latitude	24° 51' N.			24° 51' N.			25° 14' N.			
Longitude	67° 2' E.			67° 2' E.			72° 5' E.			
Height	27 feet			27 feet			400 feet.			
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1847.		April to September.			1856 to 1860.			April to September.	1857 to 1859.	April to September.
January - - -	83	80	85	75	78	83	79	82	87	
February - - -	74			79			85			
March - - -	84	86	90	86	89	90	94	101	96	
April - - -	84			89			102			
May - - -	90	93	90	91	92	90	106	93	96	
June - - -	94			95			100			
July - - -	90	91	90	92	88	90	93	90	96	
August - - -	95			88			87			
September - - -	90	91	90	87	88	90	89	90	96	
October - - -	93			90			93			
November - - -	91	91	90	87	88	90	89	90	96	
December - - -	83			79			82			
Difference between Hottest and Coldest Months.		21	13	5	20	14	7	27	19	9
Hottest and Coldest Seasons.										
Mean for Year -		87			86			92		
Highest in -		August.			June.			May.		
Lowest in -		February.			January.			January.		

(continued.)

Place.	HYDERABAD			NUSSEERABAD			JACOBABAD.			
Latitude	25° 30' N.			26° 20' N.			....		
Longitude	69° 5' E.			74° 50' E.			....		
Height	99 feet			1,500 feet			220 feet.			
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	12 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1856 and 1857.		April to September.	1859 and 1860.		April to September.	1848 to 1859.		April to September.	
January - - -	71	74	80	65	70	77	79	85		
February - - -	78		80	76		82		85		
March - - -	89	94	95	80	89	93	100	104		
April - - -	94			91		100				
May - - -	99	96	95	95	93	108	106	104		
June - - -	99			99		109				
July - - -	95	86	90	91	85	108	94	96		
August - - -	93			89		102				
September - - -	90	86	90	86	85	101	94	96		
October - - -	89			84		94				
November - - -	80	86	90	84	85	88	94	96		
December - - -	73			69		79				
Difference between										
Hottest and Coldest Months.		28	22	15	34	23	16	32	27	19
Hottest and Coldest Seasons.										
Mean for Year -	87			84			95			
Highest in -	May.			June.			June.			
Lowest in -	January.			January.			January.			

BOMBAY PRESIDENCY.—2. Minimum Temperature of the Air.

TABLE CXX., showing the AVERAGE MINIMUM TEMPERATURE for every MONTH and QUARTER, as well as for the Periods from October to March, and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and Mean Minimum Temperature for the Year, between the Latitudes 15° 50' N. and 26° 20' N., and Longitudes 67° 2' E. and 76° 0' E., arranged in the order of Latitude, and for the most part in the Presidency of Bombay.

Place . . . . .	. . . VINGORIA . . .			. . . DHARWAR . . .			. . . BELGAUM . . .			. . . KULLADGHEE.		
Latitude . . .	. . . 15° 50' N. . .			. . . 15° 50' N. . .			. . . 15° 52' N. . .			. . . 16° 11' N.		
Longitude . . .	. . . 73° 41' E. . .			. . . 75° 10' E. . .			. . . 74° 42' E. . .			. . . 75° 33' E.		
Height . . . . .	. . . 20 feet . . .			. . . 2,482 feet . . .			. . . 2,260 feet . . .			. . . 1,750 feet.		
MONTH.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.								
	1856 to 1859.		April to September.	1859 and 1860.		April to September.	1856 to 1859.		April to September.	1855 to 1859.		April to September.								
January - - -	72	} 73	74	61	} 65	68	57	} 58	60	60	} 64	65								
February - - -	73			71			59			66										
March - - -	76	} 78	77	74	} 75	73	62	} 65	65	74	} 74	73								
April - - -	79			78			66			74										
May - - -	80	} 76	77	77	} 73	73	66	} 66	65	74	} 73	68								
June - - -	77			75			66			72										
July - - -	76	} 76	77	73	} 70	73	66	} 63	63	73	} 68	60								
August - - -	76			70			65			73										
September - - -	76	} 76	77	70	} 70	73	64	} 63	63	73	} 68	60								
October - - -	77			71			62			68										
November - - -	75	} 76	77	69	} 70	73	62	} 63	63	63	} 68	60								
December - - -	73			64			57			60										
Difference between																				
Hottest and Coldest Months.	Hottest and Coldest Seasons.																			
} 8 5 3 16 10 5 9 8 5 14 12 8																				
Mean for Year -	76			70			63			69										
Highest in -	May.			May.			April.			March.										
Lowest in -	January.			January.			January.			January.										

(continued.)

Place. . . . .	. . . KOLAPORE . . .			. . . RUTNAGHERRY . . .			. . . SHOLAPORE . . .			. . . SATTARA.		
Latitude . . .	. . . 16° 42' N. . .			. . . 17° 0' N. . .			. . . 17° 40' N. . .			. . . 17° 40' N.		
Longitude . . .	. . . 74° 18' E. . .			. . . 73° 20' E. . .			. . . 76° 0' E. . .			. . . 74° 2' E.		
Height . . . . .	. . . 1,797 feet . . .			. . . 150 feet . . .			. . . 1,821 feet . . .			. . . 2,320 feet.		
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	11 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.									
	1850 to 1859.		April to September.	1855 to 1859.		April to September.	1850 to 1860.		April to September.	1844 to 1847.		April to September.									
January - - -	67	} 68	70	70	} 70	71	69	} 69	72	65	} 64	66									
February - - -	69			71			72			64											
March - - -	75	} 76	75	74	} 76	76	78	} 82	80	71	} 74	73									
April - - -	76			76			85			75											
May - - -	77	} 74	75	77	} 76	76	83	} 78	75	76	} 71	68									
June - - -	76			77			79			72											
July - - -	74	} 74	75	74	} 74	74	78	} 75	66	71	} 68	63									
August - - -	73			76			77			70											
September - - -	74	} 74	75	77	} 70	70	77	} 69	72	70	} 64	63									
October - - -	75			74			76			64											
November - - -	72	} 74	75	71	} 70	70	73	} 69	72	63	} 64	66									
December - - -	67			70			66			63											
Difference between																					
Hottest and Coldest Months.	Hottest and Coldest Seasons.			} 10			8			5			7	6	5	19	13	8	13	10	7
Mean for Year -				73			74			75			69								
Highest in -				May.			May.			April.			May.								
Lowest in -				January.			January.			December.			December.								

BOMBAY PRESIDENCY.—2. Minimum Temperature of the Air—*continued.*

Place . . . . .	. . . SATTARA . . .			. . . DAPPOOLEE . . .			. . . MAHABLESHWUR . . .			. . . POORUNDHUR.		
Latitude . . . .	. . . 17° 40' N. . . .			. . . 17° 45' N. . . .			. . . 17° 59' N. . . .			. . . 18° 12' N.		
Longitude . . . .	. . . 74° 2' E. . . .			. . . 73° 16' E. . . .			. . . 73° 30' E. . . .			. . . 73° 54' E.		
Height . . . . .	. . . 2,320 feet . . .			. . . 600 feet . . . .			. . . 4,500 feet . . .			. . . 4,200 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1855 to 1859.		April to September.	1858 and 1859.		April to September.	1834.		April to September.	1852 and 1853.		April to September.	
January - - -	63	} 64	66	61	} 61	65	60	} 59	60	62	} 63	65	
February - - -	67			62			61			67			
March - - -	72	} 74	72	69	} 73	74	66	} 67	64	70	} 70	66	
April - - -	75			74			67			71			
May - - -	74	} 72	72	76	} 74	74	67	} 63	64	68	} 65	66	
June - - -	73			75			63			65			
July - - -	71	} 68	72	75	} 69	74	63	} 61	64	65	} 66	66	
August - - -	71			73			64			64			
September - - -	70	} 68	72	72	} 69	74	64	} 61	64	65	} 66	66	
October - - -	69			70			62			67			
November - - -	65	} 68	72	66	} 69	74	57	} 61	64	65	} 66	66	
December - - -	62			61			56			59			
Difference between													
Hottest and Coldest Months.		} 13	10	6	15	13	9	11	8	4	12	7	1
Hottest and Coldest Season.													
Mean for Year -	69			69			62			65			
Highest in -	April.			May.			May.			April.			
Lowest in -	December.			January.			December.			December.			

(continued.)

Place	POONA			SEROOR			MULLIGAUM			DHOOOLIA.										
Latitude	18° 30' N.			18° 50' N.			20° 32' N.			20° 54' N.										
Longitude	74° 0' E.			77° 25' E.			74° 30' E.			74° 45' E.										
Height	1,800 feet			1,752 feet			1,300 feet			1,000 feet.										
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.								
	1856 to 1860.		April to September.	1854 to 1858.		April to September.	1860.		April to September.	1853 to 1858.		April to September.								
January - - -	58	} 60	62	50	} 50	56	..	} 75	60	62	} 63	66								
February - - -	63			51			..			65										
March - - -	68	} 71	70	59	} 64	67	..	} 75	75	72	} 78	79								
April - - -	71			64			78			79										
May - - -	74	} 70	70	69	} 68	67	76	} 75	75	83	} 79	79								
June - - -	72			69			76			81										
July - - -	70	} 65	72	68	} 64	67	76	} 75	75	79	} 71	79								
August - - -	69			68			74			77										
September - - -	68	} 65	72	66	} 64	67	..	} 75	75	76	} 71	79								
October - - -	66			68			..			73										
November - - -	61			59			..			65										
December - - -	58			50			..			61										
Difference between																				
Hottest and Coldest Month.	} 16			11			8			19			18	11	4	22	16	13
Hottest and Coldest Season.																				
Mean for Year -	66			62			76			73										
Highest in -	May.			May.			....			May.									
Lowest in -	January and December.			December.			....			December.									

BOMBAY PRESIDENCY.—2. Minimum Temperature of the Air—*continued.*

Place	SURAT			BARODA			RAJCOTE			MHOW.							
Latitude	21° 10' N. . . .			22° 16' N. . . .			22° 18' N. . . .			22° 33' N.							
Longitude	75° 52' E. . . .			73° 14' E. . . .			70° 50' E. . . .			75° 46' E.							
Height	33 feet			90 feet			450 feet			1,862 feet.							
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	7 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	4 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.					
	1850 to 1859.			1847 to 1853.			1857 to 1860.			1859 and 1860.							
January - - -	59	64	67	58	57	61	59	62	66	65	67	70					
February - - -	69			56			62			68							
March - - -	70	75		71	74		71	77		75	77						
April - - -	76			69			77			79							
May - - -	80	79	78	83	78	79	83	81	80	78	72	74					
June - - -	80			80			83			64							
July - - -	78	72		76	71		81	74		78	73						
August - - -	79			77			79			74							
September - - -	77	63		77	58		79	64		73	67						
October - - -	73			73			77			74							
November - - -	67	21	15	64	21	18	66	19	14	73	10	4					
December - - -	63			58			64			67							
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.															
Mean for Year -		72		69		73		72									
Highest in -		May.		May.		May.		April.									
Lowest in -		January.		February.		January.		January.									

(continued.)

Place	AHMEDABAD			AHMEDNUGGUR			NEEMUCH			MOUNT ABOO. . . .			
Latitude	23° 0' N. . . .			23° 34' N. . . .			24° 27' N. . . .			24° 45' N. . . .			
Longitude	72° 0' E. . . .			73° 1' E. . . .			74° 54' E. . . .			72° 49' E. . . .			
Height	320 feet			1,900 feet			1,476 feet			4,000 feet. . . .			
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	6 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	
	1858 and 1859.			1854 to 1859.			1860.			1855 to 1859.			
January - - -	65	63	68	59	60	64	49	51	56	43	44	51	
February - - -	65			62			50			47			
March - - -	73	80		69	73		60	68		60	63		
April - - -	82			75			70			61			
May - - -	86	79	71	76	73	73	75	75	73	66	65	64	
June - - -	84			74			78			66			
July - - -	77	75		73	67		73	64		65	59		
August - - -	77			71			73			64			
September - - -	77	26	17	70	13	9	71	24	17	62	21	13	
October - - -	77			69			66			61			
November - - -	70	74		63	68		56	64		55	57		
December - - -	60			59			55			43			
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.											
		26	17	3	17	13	9	29	24	17	23	21	13
Mean for Year -		74			68			64			57		
Highest in -		May.			May.			June.			May.		
Lowest in -		December.			January.			January.			January.		

BOMBAY PRESIDENCY.—2. Minimum Temperature of the Air—*continued.*

<i>Place</i> . . . . .	. . . . . KURRACHEE . . . . .			. . . . . KURRACHEE . . . . .			. . . . . DEESA.		
<i>Latitude</i> . . . . .	. . . . . 24° 51' N. . . . .			. . . . . 24° 51' N. . . . .			. . . . . 25° 14' N.		
<i>Longitude</i> . . . . .	. . . . . 67° 2' E. . . . .			. . . . . 67° 2' E. . . . .			. . . . . 72° 5' E.		
<i>Height</i> . . . . .	. . . . . 27 feet . . . . .			. . . . . 27 feet . . . . .			. . . . . 400 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1847.		April to September.	1856 to 1860.		April to September.	1857 to 1859.		April to September.
January - - -	53	} 52	58	50	} 54	59	50	} 51	55
February - - -	59			55			54		
March - - -	70	} 74	79	62	} 69	76	62	} 70	76
April - - -	75			70			71		
May - - -	77	} 80	68	76	} 79	73	78	} 78	63
June - - -	80			80			79		
July - - -	78	} 69	21	80	} 68	17	79	} 63	21
August - - -	82			77			76		
September - - -	80	} 28	30	76	} 25	31	73	} 27	65
October - - -	72			69			62		
November - - -	54	} 17	25	58	} 13	46	53	} 41	30
December - - -	44			58			48		
Difference between Hottest and Coldest Months. Hottest and Coldest Seasons.		38	28	30	25	17	31	27	21
Mean for Year -	68			67			65		
Highest in -	August.			June and July.			June and July.		
Lowest in -	December.			January.			December.		

(continued.)

<i>Place</i> . . . . .	. . . . . HYDERABAD . . . . .			. . . . . NUSSEERABAD . . . . .			. . . . . JACOBABAD.		
<i>Latitude</i> . . . . .	. . . . . 25° 30' N. . . . .			. . . . . 26° 20' N. . . . .			. . . . .
<i>Longitude</i> . . . . .	. . . . . 69° 5' E. . . . .			. . . . . 74° 50' E. . . . .			. . . . .
<i>Height</i> . . . . .	. . . . . 99 feet . . . . .			. . . . . 1,500 feet . . . . .			. . . . . 220 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	12 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1856 and 1857.		April to September.	1859 and 1860.		April to September.	1848 to 1859.		April to September.
January - - -	58	} 59	65	61	} 63	67	44	} 46	52
February - - -	62			69			48		
March - - -	72	} 78	82	73	} 80	80	56	} 69	82
April - - -	78			83			70		
May - - -	83	} 84	73	84	} 73	13	83	} 68	30
June - - -	85			88			90		
July - - -	84	} 25	30	84	} 20	46	87	} 41	67
August - - -	82			77			83		
September - - -	80	} 17	25	76	} 13	29	81	} 27	41
October - - -	76			78			69		
November - - -	65	} 13	29	66	} 20	46	53	} 41	30
December - - -	58			59			46		
Difference between Hottest and Coldest Months. Hottest and Coldest Seasons.		27	25	29	20	13	46	41	30
Mean for Year -	73			75			67		
Highest in -	June.			June.			June.		
Lowest in -	January and December.			December.			January.		

BOMBAY PRESIDENCY.—3. *Daily Range of Temperature.*

TABLE CXXI., showing the AVERAGE DAILY RANGE for every MONTH and QUARTER, as well as for the Periods October to March, and April to September, with the Difference between the Greatest and Least Months and Seasons, and Mean Daily Range for the Year, between the Latitudes 15° 50' N. and 26° 20' N., and between the Longitudes 67° 2' E. and 76° 0' E., arranged in the order of Latitude, and for the most part in the Presidency of Bombay.

Place . . . . .	. . . VINGORLA . . .			. . . DHARWAR . . .			. . . BELGAUM . . .			. . . KULLADGHEE.		
Latitude . . . .	. . . 15° 50' N. . . .			. . . 15° 50' N. . . .			. . . 15° 52' N. . . .			. . . 16° 11' N.		
Longitude . . . .	. . . 73° 41' E. . . .			. . . 75° 10' E . . . .			. . . 74° 42' E. . . .			. . . 75° 33' E.		
Height . . . . .	. . . 20 feet . . . .			. . . 2,482 feet . . . .			. . . 2,260 feet . . . .			. . . 1,750 feet.		
MONTH.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1856 to 1859.		April to September.	1859 and 1860.		April to September.	1856 to 1859.		April to September.	1855 to 1859.		April to September.
January - - -	12	} 12	10	22	} 19	17	28	} 29	27	29	} 27	26
February - - -	12			18			32			26		
March - - - -	11	} 9		18	} 17		32	} 29		27	} 28	
April - - - -	9			18			31			30		
May - - - - -	8	} 7	7	14	} 7	10	23	} 14	19	27	} 21	23
June - - - - -	8			8			15			24		
July - - - - -	7	} 7		7	} 11		13	} 20		18	} 22	
August - - - -	6			7			13			20		
September - - -	6	} 7		7			16			18		
October - - - -	7			11			23			23		
November - - -	8	} 7		16			22			25		
December - - -	12			16			26			25		
Difference between												
Greatest and Least Monthly Ranges.		6		15	12	7	19	15	8	12	7	3
Greatest and Least Seasonal Ranges.												
Mean for Year -	9			13			23			24		
Greatest in -	Jan., Feb., and Dec.			January.			February and March.			April.		
Least in -	August and September.			July, Aug., and Sept.			July and August.			July and September.		

(continued.)

Place . . . . .	. . . KOLAPORE . . .			. . . RUTNAGHERRY . . .			. . . SHOLAPORE . . .			. . . SATTARA.		
Latitude . . . .	. . . 16° 42' N. . . .			. . . 17° 0' N. . . .			. . . 17° 40' N. . . .			. . . 17° 40' N.		
Longitude . . . .	. . . 74° 18' E. . . .			. . . 73° 20' E. . . .			. . . 76° 0' E. . . .			. . . 74° 2' E.		
Height . . . . .	. . . 1,797 feet . . . .			. . . 150 feet . . . .			. . . 1,821 feet . . . .			. . . 2,320 feet.		
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	11 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1850 to 1859.		April to September.	1855 to 1859.		April to September.	1850 to 1860.		April to September.	1844 to 1847.		April to September.
January - - -	10	} 11	9	16	} 16	15	11	} 12	10	17	} 17	17
February - - -	13			16			12			18		
March - - - -	12	} 12		16	} 16		13	} 10		21	} 20	
April - - - -	12			16			8			21		
May - - - - -	12	} 7	8	16	} 10	12	10	} 7	8	19	} 5	11
June - - - - -	15			12			9			8		
July - - - - -	3	} 5		11	} 12		6	} 7		5	} 12	
August - - - -	3			8			7			3		
September - - -	4	} 5		8			7			8		
October - - - -	5			13			7			13		
November - - -	6	} 5		16			8			14		
December - - -	10			17			12			17		
Difference between												
Greatest and Least Monthly Ranges.		12		9	6	3	7	5	2	18	15	6
Greatest and Least Seasonal Ranges.												
Mean for Year -	9			14			9			13		
Greatest in -	June.			December.			March.			March and April.		
Least in -	July and August.			August and September.			Aug., Sept., and Oct.			August.		

BOMBAY PRESIDENCY.—3. Daily Range of Temperature—*continued.*

Place	SATTARA			DAPPOOLEE			MAHABLESHWUR			POORUNDHUR.			
Latitude	17° 40' N. . . .			17° 45' N. . . .			17° 59' N. . . .			18 12' N			
Longitude	74° 2' E. . . .			73° 16' E. . . .			73° 30' E. . . .			73° 54' E.			
Height	2,320 feet			600 feet			4,500 feet. . . .			4,200 feet.			
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	
	1855 to 1859.			1858 and 1859.			1834.			1852 and 1853.			
January - -	18	17	14	27	27	24	11	12	12	9	10	9	
February - -	15			27			13			10			
March - -	13	12		22	19		16	15		11	11		
April - -	13			19			15			12			
May - -	11	5	8	15	9	12	14	5	8	10	8	9	
June - -	7			11			6			15			
July - -	4	9		8	18		4	7		6	8		
August - -	4			7			4			4			
September - -	7	9		11	18		2	7		8	8		
October - -	6			18			7			7			
November - -	15	9		26	18		13	7		8	8		
December - -	17			26			12			11			
Difference between Greatest and Least Monthly Ranges.		14	12	6	20	18	12	14	10	4	11	3	0
Greatest and Least Seasonal Ranges.													
Mean for Year -	11			18			10			9			
Greatest in -	January.			January and February.			March.			June.			
Least in -	July and August.			August.			September.			August.			

(continued.)

Place	POONA			SEROOR			MULLIGAUM			DHOOLIA.		
Latitude	18° 30' N. . . .			18° 50' N. . . .			20° 32' N. . . .			20° 54' N. . . .		
Longitude	74° 0' E. . . .			77° 25' E. . . .			74° 30' E. . . .			74° 45' E. . . .		
Height	1,800 feet			1,752 feet			1,500 feet			1,000 feet. . . .		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	6 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1856 to 1860.			1854 to 1858.			1860.			1853 to 1858.		
January - -	23	23	22	44	45	40	..	19		18	20	18
February - -	24			43			..			21		
March - -	23	22		42	38		..	19		20	19	
April - -	24			43			21			19		
May - -	19	11	14	29	23	26	28	19		18	9	12
June - -	13			27			24			13		
July - -	10	17		23	27		16	19		6	13	
August - -	9			20			18			7		
September - -	11	17		18	27		..	19		8	13	
October - -	18			28			..			13		
November - -	22	17		36	27		..	19		18	13	
December - -	22			49			..			20		
Difference between Greatest and Least Monthly Ranges.		15	12	8	31	22	14	..	..	15	11	6
Mean for Year.	18			33			21			15		
Greatest in -	February and April.			December.			....			February.		
Least in -	August.			September.			....			July.		

BOMBAY PRESIDENCY.—3. Daily Range of Temperature—continued.

Place . . . . .	. . . SURAT . . . .			. . . BARODA . . . .			. . . RAJCOTE . . . .			. . . MHOW.		
Latitude . . . .	. . . 21° 10' N. . . .			. . . 22° 16' N. . . .			. . . 22° 18' N. . . .			. . . 22° 33' N.		
Longitude . . . .	. . . 72° 52' E. . . .			. . . 73° 14' E. . . .			. . . 70° 50' E. . . .			. . . 75° 46' E.		
Height . . . . .	. . . 33 feet . . . .			. . . 90 feet . . . .			. . . 450 feet . . . .			. . . 1,862 feet.		
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	7 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.								
	1850 to 1859.		April to September.	1847 to 1853.		April to September.	1857 to 1860.		April to September.	1859 to 1860.		April to September.								
January - - -	28	} 25	24	26	} 30	26	19	} 18	17	10	} 9	8								
February - - -	22			34			21			9										
March - - -	28	} 24		25	} 24		18	} 18		10	} 13									
April - - -	25			25			20			13										
May - - -	20	} 11	15	22	} 14	17	16	} 8	11	17	} 11	11								
June - - -	14			18			12			21										
July - - -	12	} 19		11	} 18		7	} 13		8	} 6									
August - - -	8			12			5			3										
September - - -	13	} 25		13	} 31		6	} 15		5	} 7									
October - - -	20			14			12			7										
November - - -	24	} 20		26	} 20		20	} 15		5	} 7									
December - - -	25			31			15			7										
Difference between Greatest and Least Monthly Ranges.		} 20		} 23		} 9		} 16		} 18		} 3								
Greatest and Least Seasonal Ranges.		} 14		} 16		} 9		} 10		} 6		} 15								
Mean for Year -	20			21			15			10										
Greatest in -	January and March.			February.			February.			June.										
Least in -	August.			July.			August.			August.										

(continued.)

Place . . . . .	. . . AHMEDABAD . . .			. . . AHMEDNUGGUR . . .			. . . NEEMUCH . . .			. . . MOUNT ABOO.		
Latitude . . . .	. . . 23° 0' N. . .			. . . 23° 34' N. . .			. . . 24° 27' N. . .			. . . 24° 45' N.		
Longitude . . . .	. . . 72° 0' E. . .			. . . 73° 1' E. . .			. . . 74° 54' E. . .			. . . 72° 49' E.		
Height . . . . .	. . . 320 feet . . .			. . . 1,900 feet . . .			. . . 1,476 feet . . .			. . . 4,000 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.								
	1858 and 1859.		April to September.	1854 to 1859.		April to September.	1860.		April to September.	1855 to 1859.		April to September.								
January - - -	13	} 21	19	24	} 23	21	13	} 18	18	28	} 30	25								
February - - -	31			25			21			31										
March - - -	21	} 22		25	} 23		20	} 20		22	} 25									
April - - -	22			23			22			26										
May - - -	22	} 17	18	22	} 12	15	19	} 3	10	26	} 18	18								
June - - -	10			14			4			26										
July - - -	27	} 14		10	} 15		3	} 14		26	} 19									
August - - -	15			11			2			16										
September - - -	13	} 21		11	} 21		8	} 21		12	} 30	25								
October - - -	13			15			11			16										
November - - -	17	} 19		19	} 21		22	} 21		18	} 24									
December - - -	19			21			21			30										
Difference between Greatest and Least Monthly Ranges.		} 21		} 15		} 6		} 20		} 19		} 7								
Greatest and Least Seasonal Ranges.		} 8		} 11		} 6		} 17		} 12		} 7								
Mean for Year -	18			18			14			23										
Greatest in -	February.			February and March.			April and November.			February.										
Least in -	June.			July.			August.			August.										

BOMBAY PRESIDENCY. 3. Daily Range of Temperature.—continued.

Place . . . . .	. . . . . KURRACHEE . . . . .			. . . . . KURRACHEE . . . . .			. . . . . DEESA.		
Latitude . . . . .	. . . . . 24° 51' N. . . . .			. . . . . 24° 51' N. . . . .			. . . . . 25° 14' N.		
Longitude . . . . .	. . . . . 67° 2' E. . . . .			. . . . . 67° 2' E. . . . .			. . . . . 72° 5' E.		
Height . . . . .	. . . . . 27 feet. . . . .			. . . . . 27 feet. . . . .			. . . . . 400 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1847.		April to September.	1856 to 1860.		April to September.	1857 to 1859.		April to September.	
January - - -	30	} 28	26	25	} 23	24	29	} 31	34	
February - - -	15			24			31			
March - - -	14	} 12	12	24	} 19	14	32	} 30	20	
April - - -	9			19			31			
May - - -	13	} 13	13	15	} 13	14	28	} 15	28	
June - - -	14			15			21			
July - - -	12	} 23	23	12	} 20	20	14	} 28	34	
August - - -	13			11			11			
September - - -	10			11			16			
October - - -	21			21			31			
November - - -	37			29			36			
December - - -	39			21			34			
Difference between Greatest and Least Monthly Ranges.		} 30	16	14	18	10	10	25	16	
Greatest and Least Seasonal Ranges.										
Mean for Year -		19			19			26		
Greatest in -		December.			November.			November.		
Least in -		April.			August and September.			August.		

(continued.)

Place	HYDERABAD			NUSSEERABAD			JACOBABAD.			
Latitude	25° 30' N.			26° 20' N.			Unknown.			
Longitude	69° 5' E.			74° 50' E.			ditto.			
Height	99 feet.			1,500 feet			220 feet			
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	12 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	
	1856 and 1857.			1859 and 1860.			1848 to 1859.			
January - - -	13	} 15	15	4	} 7	9	33	} 33	32	
February - - -	16			7			34			
March - - -	17	} 16	13	7	} 9	9	37	} 31	22	
April - - -	16			8			30			
May - - -	16	} 12	12	11	} 10	11	25	} 20	27	
June - - -	14			11			19			
July - - -	11	} 13	13	7	} 11	11	21	} 27	33	
August - - -	11			12			19			
September - - -	10			10			20			
October - - -	13			6			25			
November - - -	15			18			35			
December - - -	15			10			33			
Difference between Greatest and Least Monthly Ranges.		} 7	4	2	14	4	0	18	13	10
Greatest and Least Seasonal Ranges.										
Mean for Year -		14			9			27		
Greatest in -		March.			November.			March.		
Least in -		September.			January.			June and August.		

BOMBAY PRESIDENCY.—4. *Temperature of the Air.*

TABLE CXXII., showing the AVERAGE TEMPERATURE OF THE AIR, for every MONTH and QUARTER, as well as for the Periods from October to March and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and Mean Temperature for the Year, between the Latitudes 12° 45' N. and 26° 20' N., and between the Longitudes 45° 15' E. and 79° 11' E., arranged in the order of Latitude, and for the most part in the Presidency of Bombay.

<i>Place</i> . . .	. . . ADEN . . .			. . . VINGORLA . . .			. . . DHARWAR . . .			. . . BELGAUM.		
<i>Latitude</i> . . .	. . . 12° 45' N. . . .			. . . 15° 50' N. . . .			. . . 15° 50' N. . . .			. . . 15° 52' N.		
<i>Longitude</i> . . .	. . . 45° 15' E. . . .			. . . 73° 41' E. . . .			. . . 75° 10' E. . . .			. . . 74° 42' E.		
<i>Height</i> . . .	. . . 123 feet . . .			. . . 20 feet . . .			. . . 2,482 feet . . .			. . . 2,260 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859.		April to Sep- tember.	1856 to 1859.		April to Sep- tember.	1859.		April to Sep- tember.	1856 to 1859.		April to Sep- tember.	
January - -	76	} 77	79	78	} 78	79	72	} 75	77	72	} 72	73	
February - -	78			79			80			75			73
March - -	83	} 87	91	82	} 83	81	83	} 83	78	78	} 79	75	
April - -	87			83			84			83			78
May - -	90	} 93	91	85	} 80	81	84	} 76	78	78	} 73	75	
June - -	94			81			79			76			75
July - -	93	} 84	91	79	} 80	81	73	} 75	78	73	} 73	75	
August - -	93			79			76			73			74
September - -	89	} 84	91	79	} 80	81	73	} 75	78	74	} 73	75	
October - -	81			81			76			73			74
November - -	82	} 84	91	79	} 80	81	77	} 75	78	72	} 73	75	
December - -	76			78			76			72			70
Difference between													
Hottest and Coldest Months.		Hottest and Coldest Seasons.		Hottest and Coldest Months.		Hottest and Coldest Seasons.		Hottest and Coldest Months.		Hottest and Coldest Seasons.		Hottest and Coldest Months.	
} 18		16		12		7		5		2		12	
Mean for Year -													
85													
80													
77													
74													
Highest in -													
June.													
January and December.													
May.													
January and December.													
May.													
January and December.													
April.													
December.													

(continued.)

<i>Place</i> . . .	. . . KULLADGHEE . . .			. . . RUTNAGHERRY . . .			. . . SATTARA . . .			. . . SATTARA.		
<i>Latitude</i> . . .	. . . 16° 11' N. . . .			. . . 17° 0' N. . . .			. . . 17° 40' N.. . .			. . . 17° 40' N.		
<i>Longitude</i> . . .	. . . 75° 33' E. . . .			. . . 73° 20' E. . . .			. . . 74° 2' E.. . .			. . . 74° 2' E.		
<i>Height</i> . . .	. . . 1,750 feet . . .			. . . 150 feet . . .			. . . 2,320 feet . . .			. . . 2,320 feet		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.		
	1855 to 1859.		April to Sep- tember.	1855 to 1859.		April to Sep- tember.	1844 to 1847.		April to Sep- tember.	1855 to 1859.		April to Sep- tember.		
January - -	75	} 75	78	78	} 79	80	73	} 72	74	70	} 72	74		
February - -	79			79			80		73			75		75
March - -	88	} 88		82	} 84		81	} 84		78	} 80			
April - -	89			84					85			81		81
May - -	87	} 83	84	85	} 81	82	86	} 74	78	76	} 75	77		
June - -	84			83			82		76			76		76
July - -	82	} 79		80	} 81		74	} 74		73	} 74			
August - -	83			80					73			74		74
September - -	82	} 79		82	} 81		74	} 74		74	} 74			
October - -	79			83					77			75		75
November - -	76	} 79		79	} 81		71	} 74		74	} 74			
December - -	72			79					71			71		71
Difference between			} 17	13	6	7	5	2	15	12	4	11	8	3
Hottest and Coldest Months.														
Hottest and Coldest Seasons.														
Mean for Year -			81			81			76			75		
Highest in -			April.			May.			May.			April and May.		
Lowest in -			December.			January.			December.			January.		

BOMBAY PRESIDENCY.—4. Temperature of the Air—*continued.*

Place	SHOLAPORE . . .			DAPOOLEE . . .			MAHABLESHWUR . .			POONA . . .		
Latitude	17° 40' N. . . .			17° 48' N. . . .			17° 59' N. . . .			18° 30' N. . . .		
Longitude	76° 0' E. . . .			73° 16' E. . . .			73° 30' E. . . .			74° 0' E. . . .		
Height	1,821 feet . . .			600 feet			4,500 feet . . .			1,800 feet. . . .		
MONTH.	11 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	15 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	6 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1850 to 1860.			1858 and 1859.			1829 to 1843.			1825 to 1830.		
January - - -	75	75	78	75	—		64	64	66	72	73	76
February - - -	78			—			66			75		
March - - -	84	87		81	84		72	73		79	82	
April - - -	89			86			75			83		
May - - -	88	81	84	86	82		72	64	67	85	78	79
June - - -	83			83			66			81		
July - - -	81	79		82	80		63	65		77	77	
August - - -	80			80			63			76		
September - - -	81	72		79	—		64			77		
October - - -	80			80			67			79		
November - - -	77			80			64			76		
December - - -	72			—			63			73		
Difference between Hottest and Coldest Months. Hottest and Coldest Seasons.		17	12	6	11	—	12	9	1	13	9	3
Mean for Year -	81			81			66			78		
Highest in -	April.			....			April.			May.		
Lowest in -	December.						July, August, December.			January.		

(continued.)

Place	POONA			SEROOR			BOMBAY			MULLIGAUM.		
Latitude	18° 30' N. . . .			18° 50' N. . . .			18° 53' N. . . .			20° 32' N. . . .		
Longitude	74° 0' E. . . .			77° 25' E. . . .			72° 52' E. . . .			74° 30' E. . . .		
Height	1,800 feet . . .			1,752 feet . . .						1,300 feet. . . .		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	12 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1856 to 1860.			1854 to 1858.			1847 to 1858.			1860.		
January - - -	69	70	74	72	72	74	74	75	77	—		
February - - -	73			71			76			—		
March - - -	79	82		80	83		80	83		—		
April - - -	84			87			83			88		
May - - -	84	77	79	83	78	80	86	82	82	90	85	
June - - -	78			81			83			88		
July - - -	77	76		76	76		81	80		84		
August - - -	75			76			81			83		
September - - -	75			76	76		80			—		
October - - -	77			77			82			—		
November - - -	75	69		75			79			—		
December - - -	69			72			76			—		
Difference between Hottest and Coldest Months. Hottest and Coldest Seasons.		15	12	5	16	11	12	8	5	—	—	—
Mean for Year -	76			77			80			—		
Highest in -	April and May.			April.			May.			—		
Lowest in -	January and December.			February.			January.					

BOMBAY PRESIDENCY.—4. Temperature of the Air—*continued.*

Place . . . . .	. . . DHOOOLIA . . . .			. . . NAGPORE . . . .			. . . SURAT . . . .			. . . BARODA.		
Latitude . . . . .	. . . 20° 54' N. . . .			. . . 21° 8' N. . . . .			. . . 21° 10' N. . . .			. . . 22° 16' N.		
Longitude . . . . .	. . . 74° 45' E. . . .			. . . 79° 11' E. . . .			. . . 72° 52' E. . . .			. . . 73° 14' E.		
Height . . . . .	. . . 1,000 feet. . . .			. . . . .			. . . 33 feet . . . .			. . . 90 feet.		
MONTH.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	7 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1853 to 1858.		April to September.	1814 to 1817.		April to September.	1850 to 1859.		April to September.	1847 to 1853.		April to September.
January - - -	70	} 73	76	71	} 73	77	73	} 75	78	71	} 71	76
February - - -	76			75			77			70		
March - - -	82	} 87	84	84	} 90	86	84	} 87	84	83	} 86	86
April - - -	88			93			88			81		
May - - -	91	} 83	84	93	} 83	86	89	} 85	84	94	} 86	86
June - - -	87			86			87			89		
July - - -	82	} 79	84	81	} 80	86	84	} 81	84	85	} 80	86
August - - -	80			81			83			84		
September - - -	80	} 83	84	82	} 80	86	83	} 81	84	83	} 80	86
October - - -	80			82			83			80		
November - - -	76			75			78			77		
December - - -	72			73			74			73		
Difference between												
Hottest and Coldest Months. Hottest and Coldest Seasons.												
} 21 14 8 22 17 9 16 12 6 24 15 10												
Mean for Year -	81			81			82			81		
Highest in -	May.			April and May.			May.			May.		
Lowest in -	January.			January.			January.			February.		

(continued.)

Place . . . . .	. . . RAJCOTE . . . .			. . . MHOW . . . .			. . . AHMEDABAD . . .			. . . AHMEDNUGGUR.		
Latitude . . . . .	. . . 22° 18' N. . . .			. . . 22° 33' N. . . .			. . . 23° 0' N. . . . .			. . . 23° 34' N.		
Longitude . . . . .	. . . 70° 50' E. . . .			. . . 75° 46' E. . . .			. . . 72° 0' E. . . . .			. . . 73° 1' E.		
Height . . . . .	. . . 450 feet . . . .			. . . 1,862 feet. . . .			. . . 320 feet . . . .			. . . 1,900 feet.		
MONTH.	4 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	6 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.								
	1857 to 1860.			1859 and 1860.			1858 and 1859.			1854 to 1859.										
January - - -	69	} 72	78	70	} 71	74	71	} 73	77	71	} 72	74								
February - - -	75			72			80			75										
March - - -	82	} 86	85	86	} 84	79	83	} 91	89	82	} 85	80								
April - - -	86			86			93			87										
May - - -	90	} 85	85	87	} 77	79	97	} 88	89	87	} 78	86								
June - - -	89			74			89			81										
July - - -	85	} 80	85	82	} 76	79	90	} 81	89	77	} 75	80								
August - - -	82			75			84			76										
September - - -	81	} 83	85	75	} 80	79	83	} 81	89	76	} 80	86								
October - - -	83			77			83			77										
November - - -	77	} 85	85	75	} 83	79	78	} 85	89	73	} 86	86								
December - - -	73			71			69			70										
Difference between																				
Hottest and Coldest Months. Hottest and Coldest Seasons.																				
} 21 14 7 17 13 5 28 18 12 17 13 6																				
Mean for Year -	81			77			83			77										
Highest in -	May.			May.	Spring.		May.			April and May.										
Lowest in -	January.			January.	Winter.		December.			December.										

BOMBAY PRESIDENCY.—4. Temperature of the Air—*continued.*

<i>Place</i> . . .	NEEMUCH . . .			MOUNT ABOO . . .			KURRACHEE . . .			KURRACHEE.		
<i>Latitude.</i> . .	24° 27' N. . . .			24° 45' N. . . .			24° 51' N. . . .			24° 51' N.		
<i>Longitude</i> . .	74° 54' E. . . .			72° 49' E. . . .			67° 2' E. . . .			67° 2' E.		
<i>Height</i> . . .	1,476 feet . . .			4,000 feet . . .			27 feet . . .			27 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1860.			1855 to 1859.			1847.			1856 to 1860.		
January - -	55	60	65	57	59	64	67	66	71	62	65	70
February - -	60			63			67			67		
March - -	70			71			77			74		
April - -	81	78		72	74		79	80		84	81	
May - -	84			79			83			84		
June - -	80		78	79		74	87		84	88		84
July - -	74	76		74	74		84	86		88	86	
August - -	74			70			88			82		
September - -	75			70			86			81		
October - -	71	71		71	69		80	79		79	78	
November - -	67			67			72			73		
December - -	65			58			63			65		
Difference between Hottest and Coldest Months. Hottest and Coldest Seasons.												
	29	18	13	22	15	10	25	20	13	26	16	14
Mean for Year -	71			69			78			78		
Highest in -	May.			May and June.			August.			June and July.		
Lowest in -	January.			January.			Dec.			January.		

(continued.)

<i>Place</i> . . .	DEESA . . .			HYDERABAD . . .			NUSSEERABAD . . .			JACOBABAD.		
<i>Latitude.</i> . .	25° 14' N. . . .			25° 30' N. . . .			26° 20' N. . . .			Not known.		
<i>Longitude</i> . .	72° 5' E. . . .			69° 5' E. . . .			74° 50' E. . . .			ditto.		
<i>Height</i> . . .	400 feet . . .			99 feet . . .			1,500 feet. . . .			220 feet.		
MONTH.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	12 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1857 to 1859.			1856 and 1857.			1859 and 1860.			1848 to 1859.		
January - -	64	68		64	67	73	63	65	71	60	63	69
February - -	70			71			68			65		
March - -	80			81			77			74		
April - -	87	86		87	86		87	84		85	85	
May - -	91			91			89			95		
June - -	89			92		89	94		87	99		93
July - -	88	86		91	90		88	88		98	96	
August - -	82			88			83			92		
September - -	83			85			81			91		
October - -	81			82	80		79	78		81	81	
November - -	84?			73			75			70		
December - -	69			66			64			63		
Difference between Hottest and Coldest Months. Hottest and Coldest Seasons.												
	27	—	—	28	23	16	31	23	16	39	36	24
Mean for Year -	80			81			79			81		
Highest in -	May.			June.			June.			June.		
Lowest in -	January.			January.			January.			January.		

BOMBAY PRESIDENCY.—5. *Readings of the Dry and Wet Bulb Thermometers.*

TABLE CXXIII., showing the AVERAGE READINGS of the DRY and WET BULB THERMOMETERS for every MONTH and QUARTER as well as for the periods October to March and April to September, with the Difference between the Highest and Lowest Months and Seasons, and Mean for the Year between the Latitudes 15° 52' N. and 25° 30' N., and between Longitudes 69° 5' E. and 77° 25' E., arranged in the order of Latitude and for the most part in the Presidency of Bombay.

Place . . .	. . . BELGAUM . . .				. . . SATTARA . . .				. . . DAPOOLEE . . .				. . . MAHABLESHWUR.			
Latitude . . .	. . . 15° 52' N. . .				. . . 17° 40' N. . .				. . . 17° 48' N. . .				. . . 17° 59' N.			
Longitude . . .	. . . 74° 42' E. . .				. . . 74° 2' E. . .				. . . 73° 16' E. . .				. . . 73° 30' E.			
Height . . .	. . . 2,260 feet . . .				. . . 2,320 feet . . .				. . . 600 feet . . .				. . . 4,500 feet.			
MONTH.	2 Years.		Winter, Spring, Summer, Autumn.		5 Years.		Winter, Spring, Summer, Autumn.		2 Years.		Winter, Spring, Summer, Autumn.		9 Years.		Winter, Spring, Summer, Autumn.	
	1858 and 1859.				1855 to 1859.				1858 and 1859.				1835 to 1843.			
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
January - -	73	62	} 74	62	71	64	} 72	65	75	71	} 75	71	69	59	} 69	58
February - -	78	62			75	67			77	73			70	57		
March - -	81	67	} 81	69	78	68	} 80	70	81	77	} 84	80	75	60	} 76	63
April - -	82	69			82	69			85	81			78	63		
May - -	79	71	} 73	70	81	72	} 75	71	85	82	} 82	77	76	67	} 69	67
June - -	75	71			76	72			86	76			71	68		
July - -	73	70	} 74	68	76	71	} 74	69	81	78	} 77	75	69	67	} 68	64
August - -	72	69			73	71			79	77			67	66		
September - -	73	69	} 75	73	74	71	} 77	75	78	76	} 77	75	68	65	} 70	63
October - -	75	67			75	70			79	75			68	66		
November - -	75	67	} 72	62	74	67	} 74	68	75	73	} 74	68	67	60	} 70	63
December - -	72	62			71	65			74	68			67	59		
Difference between Highest and Lowest	} 10	9	} 8	8	} 11	8	} 8	5	} 12	14	} 9	9	} 11	10	} 8	9
Monthly Readings. Seasonal Readings.																
Mean for Year -	75	67	75	67	75	69	75	69	79	75	79	75	70	63	70	63
Highest in -	April.	May and June.	Spring	Summer.	April.	May and June.	Spring	Summer.	June.	May.	Spring	Spring	April.	May and July.	Spring	Summer.
Lowest in -	Dec.	Jan., Feb., and Dec.	Summer.	Winter	Jan. and Dec.	Jan.	Winter.	Winter.	Dec.	Dec.	Winter.	Winter.	Aug., Nov., and Dec.	Feb.	Autumn.	Winter.

(continued.)

Place . . .	. . . POONA . . .				. . . SEROOR . . .				. . . BOMBAY.			
Latitude . . .	. . . 18° 30' N. . .				. . . 18° 50' N. . .				. . . 18° 53' N.			
Longitude . . .	. . . 74° 0' E. . .				. . . 77° 25' E. . .				. . . 72° 52' E.			
Height . . .	. . . 1,800 feet . . .				. . . 1,752 feet.						
MONTH.	5 Years.		Winter, Spring, Summer, Autumn.		5 Years.		Winter, Spring, Summer, Autumn.		12 Years.		Winter, Spring, Summer, Autumn.	
	1856 to 1860.				1854 to 1858.				1847 to 1858.			
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
January - -	69	59	} 71	60	73	64	} 72	58	74	68	} 75	68
February - -	76	61			72	58			76	69		
March - -	78	64	} 81	68	81	52	} 84	61	80	73	} 83	76
April - -	84	69			87	63			83	77		
May - -	82	72	} 76	72	84	69	} 78	71	86	79	} 82	78
June - -	79	72			81	71			83	79		
July - -	76	72	} 75	67	76	70	} 76	65	81	78	} 80	75
August - -	74	71			76	70			80	77		
September - -	74	70	} 72	63	77	66	} 72	52	82	77	} 72	69
October - -	76	68			77	66			80	77		
November - -	74	63	} 15	13	75	59	} 12	13	79	72	} 12	11
December - -	69	59			72	52			76	69		
Difference between Highest and Lowest	} 15	13	} 10	12	} 15	19	} 12	13	} 12	11	} 8	10
Monthly Readings. Seasonal Readings.												
Mean for Year -	76	66	76	66	77	63	77	63	80	74	80	74
Highest in -	April.	May, June, and July.	Spring.	Summer.	April.	June and July.	Spring.	Summer.	May.	May and June.	Spring.	Summer.
Lowest in -	January and December.	January and December.	Winter.	Winter.	February and December.	March and December.	Winter.	Winter.	January.	January.	Winter.	Winter.

BOMBAY PRESIDENCY. 5. Readings of the Dry and Wet Thermometers—*continued.*

<i>Place</i> . . . .	. . . . DHOOOLIA . . . .				. . . . RAJCOTE . . . .				. . . . AHMEDNUGGUR.			
<i>Latitude</i> . . .	. . . . 20° 54' N. . . .				. . . . 22° 18' N. . . .				. . . . 23° 34' N.			
<i>Longitude</i> . . .	. . . . 74° 45' E. . . .				. . . . 70° 50' E. . . .				. . . . 73° 1' E.			
<i>Height</i> . . . .	. . . . 1,000 feet . . . .				. . . . 450 feet . . . .				. . . . 1,900 feet			
MONTH.	6 Years.		Winter, Spring, Summer, Autumn.		4 Years.		Winter, Spring, Summer, Autumn.		6 Years.		Winter, Spring, Summer, Autumn.				
	1853 to 1858.				1857 to 1860.				1854 to 1859.						
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.			
	°	°	°	°	°	°	°	°	°	°	°	°			
January - -	70	63	73	63	69	55	71	56	71	60	72	60			
February - -	76	65			74	57			75	61					
March - -	82	68	87	73	81	62	86	68	82	65	85	68			
April - -	88	74			87	68			87	72					
May - -	91	77	83	78	91	74	85	77	87	72	78	71			
June - -	87	79			89	78			80	72					
July - -	82	77	79	73	85	77	80	66	77	72	75	68			
August - -	80	77			82	76			76	70					
September - -	80	77	79	73	82	73	80	66	76	72					
October - -	80	74			83	69			77	69					
November - -	76	67	72	63	75	57	71	55	73	64					
December - -	72	63			71	55			70	60					
Difference between Highest and Lowest															
Monthly Readings.	21		14		22		15		17		13				
Seasonal Readings.	16		15		23		21		12		11				
Mean for Year -	80	72	80	72	81	66	81	66	77	67	77	67			
Highest in -	May.	June.	Spring.	Summer.	May.	June.	Spring.	Summer.	April and May.	May, June, July, & Sept.	Spring.	Summer.			
Lowest in -	January.	Jan. and Dec.	Winter.	Winter.	January.	Jan. and Dec.	Winter.	Winter.	Dec.	Jan. and Dec.	Winter.	Winter.			

(continued.)

Place	KURRACHEE				DEESA				HYDERABAD.						
Latitude	24° 51' N.				25° 14' N.				25° 30' N.						
Longitude	77° 2' E.				72° 5' E.				69° 5' E.						
Height	27 feet				400 feet				99 feet.						
MONTH.	5 Years.		Winter, Spring, Summer, Autumn.		3 Years.		Winter, Spring, Summer, Autumn.		2 Years.		Winter, Spring, Summer, Autumn.				
	1856 to 1860.		Dry.	Wet.	1857 to 1859.		Dry.	Wet.	1856 and 1857.		Dry.	Wet.			
	Dry.	Wet.			Dry.	Wet.			Dry.	Wet.					
January - -	68	57	70	59	68	58	71	59	64	56	67	58			
February - -	71	62			75	62			71	60					
March - -	79	68	83	73	85	67	90	72	81	67	86	72			
April - -	84	73			92	72			87	72					
May - -	87	79	86	80	93	78	85	78	91	76	90	80			
June - -	89	81			90	79			92	79					
July - -	86	80	82	71	85	79	82	71	91	81	80	71			
August - -	83	78			81	77			88	80					
September - -	83	76	82	71	82	76	82	71	85	78	80	71			
October - -	83	73			84	72			82	73					
November - -	79	63	71	59	81	64	71	58	73	61					
December - -	71	59			71	58			66	57					
Difference between Highest and Lowest															
Monthly Readings.	21		16		25		19		28		23				
Seasonal Readings.	24		21		21		19		25		22				
Mean for Year -	80	70	80	70	82	70	82	70	80	70	80	70			
Highest in -	June.	June.			May.	June and July.			June.	July.					
Lowest in -	January.	January.			January.	Jan. and Dec.			January.	January.					

BOMBAY PRESIDENCY.—6. *Temperature of the Dew-Point.*

TABLE CXXIV., showing the AVERAGE TEMPERATURE of the DEW-POINT, for every MONTH and QUARTER, as well as for the periods October to March and April to September, with the Difference between the Highest and Lowest Months and Seasons, and Mean for the Year, between the Latitudes 15° 52' N. and 25° 30' N., and between the Longitudes 69° 5' E. and 77° 2' E., arranged in the order of Latitude at Stations for the most part in the Presidency of Bombay.

Place	BELGAUM			SATTARA			DAPOOLEE			MAHABLESHWUR.			
Latitude	15° 52' N.			17° 40' N.			17° 48' N.			17° 59' N.			
Longitude	74° 42' E.			74° 2' E.			73° 16' E.			73° 30' E.			
Height	2,260 feet			2,320 feet			600 feet			4,500 feet.			
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1858 and 1859.		April to September.	1855 to 1859.		April to September.	1858 and 1859.		April to September.	1835 to 1843.		April to September.	
January - - -	54	53	57	59	60	61	68	67	70	51	50	53	
February - - -	51			61			70			47			
March - - -	58	61		61	62		74	77		49	54		
April - - -	60			60			78			53			
May - - -	66	68	66	66	69	67	80	74	76	61	65	62	
June - - -	68			69			70			66			
July - - -	68	63		67	66		76	73		65	60		
August - - -	67			70			76			65			
September - - -	66	61		69	62		75	64		63	54		
October - - -	61			66			72			64			
November - - -	61	55		62	60		72			54	53		
December - - -	55			60			64			53			
Difference between Highest and Lowest		17	15	9	11	9	6	16	10	6	19	15	9
Monthly Readings.	Seasonal Readings.												
Mean for Year -	61			64			72			57			
Highest in -	June and July.	Summer.		August.	Summer.		April.	Spring.		June.	Summer.		
Lowest in -	February	Winter.		January.	Winter.		Dec.	Winter.		February	Winter.		

(continued.)

Place	POONA			SEROOR			BOMBAY.			
Latitude	18° 30' N.			18° 50' N.			18° 53' N.			
Longitude	74° 0' E.			77° 25' E.			72° 52' E.			
Height	1,800 feet			1,752 feet.					
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	12 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1856 to 1860.		April to September.	1854 to 1858.		April to September.	1847 to 1858.		April to September.	
January - - -	51	51	54	57	47	47	64	64	67	
February - - -	50			48			64			
March - - -	54	59		32	46		68	72		
April - - -	59			48			73			
May - - -	65	68	66	59	66	61	75	75	75	
June - - -	67			64			76			
July - - -	69	61		67	57		76	72		
August - - -	69			66			74			
September - - -	67	55		66	48		75	67		
October - - -	62			58			74			
November - - -	55	51		48	37		67	64		
December - - -	51			37			64			
Difference between Highest and Lowest		19	17	12	27	20	14	12	11	8
Monthly Readings.	Seasonal Readings.									
Mean for Year -	59			54			71			
Highest in -	July and August.	Summer.		July.	Summer.		June and July.	Summer.		
Lowest in -	February.	Winter.		March.	Spring.		Jan., Feb., and Dec.	Spring.		

BOMBAY PRESIDENCY.—6. Temperature of the Dew Point—*continued*.

Place	DHOOOLIA			RAJCOTE			AHMEDNUGGUR.		
Latitude	20° 54' N.			22° 18' N.			23° 34' N.		
Longitude.	74° 45' E.			70° 50' E.			73° 1' E.		
Height	1,000 feet			450 feet			1,900 feet.		
MONTH.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1853 to 1858.		April to September.	1857 to 1860.		April to September.	1854 to 1859.		April to September.
January - - -	58	57	59	44	44	47	52	52	55
February - - -	57			45			51		
March - - -	59	64	72	49	56	67	54	57	65
April - - -	65			56			56		
May - - -	68	74	72	64	72	67	62	67	65
June - - -	74			71			67		
July - - -	74	69	69	72	57	69	69	63	63
August - - -	75			72			66		
September - - -	75	61	61	67	44	57	69		
October - - -	70			60			63		
November - - -	61	56	56	44	43	52	57	52	52
December - - -	56			43			52		
Difference between Highest and Lowest		19	17	13	29	28	20	18	15
Monthly Readings.	Seasonal Readings.								
Mean for Year -	66			57			59		
Highest in -	August and September.	Summer.		July and August. December.	Summer.		July and September. February.	Summer.	
Lowest in -	December.	Winter.			Winter.			Winter.	

(continued)

Place	KURRACHEE			DEESA			HYDERABAD.		
Latitude	24° 51' N.			25° 14' N.			25° 30' N.		
Longitude	77° 2' E.			72° 5' E.			69° 5' E.		
Height	27 feet			400 feet			99 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1856 to 1860.		April to September.	1857 to 1859.		April to September.	1856 and 1857.		April to September.
January - - -	48	50	55	50	50	54	49	50	54
February - - -	55			53			52		
March - - -	60	67	73	55	61	70	58	62	70
April - - -	66			60			62		
May - - -	74	76	76	69	74	67	67	74	64
June - - -	76			72			71		
July - - -	76	63	63	75	63	67	75	64	64
August - - -	75			74			75		
September - - -	71	52	52	72	53	50	73	52	50
October - - -	66			64			67		
November - - -	52	47	47	53	48	16	52	24	16
December - - -	47			48			50		
Difference between Highest and Lowest		29	26	18	25	24	16	24	16
Monthly Readings.	Seasonal Readings.								
Mean for Year -	64			62			62		
Highest in -	June and July.	Summer.		July.	Summer.		July and August.	Summer.	
Lowest in -	December.	Winter.		December.	Winter.		January.	Winter.	

BOMBAY PRESIDENCY.—7. *Amount of Vapour in a Cubic Foot of Air.*

TABLE CXXV., showing the AVERAGE AMOUNT of VAPOUR in a CUBIC FOOT of AIR for every MONTH and QUARTER as well as for the periods October to March and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and the Mean for the Year between the Latitudes 15° 52' N. and 25° 30' N., and between the Longitudes 69° 5' E. and 77° 2' E., arranged in the order of Latitude, at Stations for the most part in the Presidency of Bombay.

Place . . . .		. . . . BELGAUM . . . .		. . . . SATTARA . . . .		. . . . DAPOOLEE . . . .		. . . . MAHABLESHWUR.					
Latitude . . . .		. . . . 15° 52' N. . . .		. . . . 17° 40' N. . . .		. . . . 17° 48' N. . . .		. . . . 17° 59' N.					
Longitude . . . .		. . . . 74° 42' E. . . .		. . . . 74° 2' E. . . .		. . . . 73° 16' E. . . .		. . . . 73° 30' E.					
Height . . . .		. . . . 2,260 feet . . . .		. . . . 2320 feet . . . .		. . . . 600 feet . . . .		. . . . 4,500 feet.					
MONTH.		2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.								
		1858 and 1859.		April to Sep- tember.	1855 to 1859.		April to Sep- tember.	1858 and 1859.		April to Sep- tember.	1835 to 1843.		April to Sep- tember.								
January - -		grs. 4.5	} 4.4	grs. 4.9	grs. 5.4	} 5.6	grs. 5.9	grs. 7.4	} 7.3	grs. 7.9	grs. 4.1	} 4.0	grs. 4.5								
February - -		4.0			5.8			8.0			3.5										
March - -		5.1	} 5.8	6.9	5.8	} 6.1	7.1	9.1	} 10.1	9.5	3.8	} 4.6	6.4								
April - -		5.6			5.6			10.3			4.3										
May - -		6.8			6.8			10.9			5.7										
June - -		7.4	} 7.3	6.9	7.7	} 7.6	7.1	7.6	} 8.9	9.5	6.9	} 6.9	5.8								
July - -		7.4			7.2			9.5			6.9										
August - -		7.1	} 6.2	6.9	7.8	} 6.9	6.9	9.5	} 8.7	8.7	6.8	} 5.8	4.9								
September - -		7.0			7.6			9.2			6.2										
October - -		5.8			7.0			8.5			6.6										
November - -		5.8	} 4.7	4.9	6.0	5.7	5.7	8.4	6.4	6.4	4.7	4.4	4.4								
December - -		4.7			5.7			6.4			4.4										
Difference between Greatest and Least		} 3.4	2.9	2.0	2.4	2.0	1.2	4.5	2.8	1.6	3.4	2.9	1.9								
Monthly Amount.																					
Seasonal Amount,		} 3.4	2.9	2.0	2.4	2.0	1.2	4.5	2.8	1.6	3.4	2.9	1.9								
Mean for Year -														5.9			6.5			8.7			5.3
Highest in -		June and Summer.			August.			Summer.						May.	Spring.		June and Summer.				
Lowest in -		February Winter.			January.	Winter.		Dec.	Winter.		February Winter.										

(continued.)

Place	POONA			SEROOR			BOMBAY.			
Latitude	18° 30' N. . . .			18° 50' N. . . .			18° 53' N.			
Longitude	74° 0' E. . . .			77° 25' E. . . .			72° 52' E.			
Height. . . .	1,800 feet			1,752 feet.			....		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	12 Years.	Winter. Spring, Summer, Autumn.	October to March.	
	1856 to 1860.		April to September.	1854 to 1858.		April to September.	1847 to 1858.		April to September.	
January - -	grs. 4.1	} 4.0	grs. 4.5	grs. 5.1	} 3.7	grs. 3.3	grs. 6.4	} 6.4	grs. 7.1	
February - -	3.9			3.6			6.4			
March - -	4.5	} 5.5	} 6.9	1.6	} 3.5	} 6.0	7.4	} 8.3	} 9.2	
April - -	5.3			3.6			8.6			
May - -	6.7			5.3			9.0			
June - -	7.2	} 7.5	} 6.8	6.4	} 5.2	} 8.5	9.7	} 9.4	} 8.5	
July - -	7.7			7.2			9.5			
August - -	7.6	} 6.0	} 2.4	6.8	} 2.7	} 3.0	9.1	} 2.1	} 3.1	
September - -	7.2			6.8			9.3			
October - -	6.1			5.3			8.9			
November - -	4.7	} 4.1	} 4.9	3.6	} 4.8	} 4.7	7.2	} 4.6	} 4.5	
December - -	4.1			2.4			6.4			
Difference between Greatest and Least		} 3.8	} 3.5	} 2.4	} 5.6	} 3.3	} 2.7	} 3.3	} 3.0	
Monthly Amount.										} 3.8	} 3.5	} 2.4	} 5.6	} 3.3	} 2.7	} 3.3	} 3.0
Seasonal Amount.		} 3.8	} 3.5	} 2.4	} 5.6	} 3.3	} 2.7	} 3.3	} 3.0	
Mean for Year -										5.7			4.8			8.1
Highest in -	July.	Summer.		July.	Summer.		June.	Summer.		
Lowest in -	February.	Winter.		March.	Spring.		Jan., Feb., and Dec.	Winter.		

BOMBAY PRESIDENCY.—7. Amount of Vapour in a Cubic Foot of Air—*continued.*

Place	DHOOOLIA			RAJCOTE			AHMEDNUGGUR.					
Latitude	20° 54' N.			22° 18' N.			23° 34' N.					
Longitude. . . .	74° 45' E.			70° 50' E.			73° 1' E.					
Height	1,000 feet.			450 feet.			1900 feet.					
MONTH.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.			
	1853 to 1858.		April to September.	1857 to 1860.		April to September.	1854 to 1859.		April to September.			
January	grs. 5.2	} 5.1	grs. 5.7	grs. 3.2	} 3.1	grs. 3.6	grs. 4.2	} 4.2	grs. 4.7			
February	5.1		3.2	4.0								
March	5.2	} 6.3	8.3	3.7	} 4.8	7.1	4.4	} 5.0	6.2			
April	6.5			4.7			4.7					
May	7.2	} 9.0		6.1	} 8.2		5.9	} 7.1				
June	8.8			8.0			7.0					
July	8.9	} 7.6		8.3	} 5.2		7.5	} 6.4				
August	9.3			8.4			6.8					
September	9.3	} 7.6		7.1	} 5.2		7.7	} 6.4				
October	7.8			5.4			6.3					
November	5.7	} 7.6		3.1	} 5.2		5.1	} 6.4				
December	5.0			3.0			4.3					
Difference between Greatest and Least		} 4.3	3.9	2.6	5.4	5.1	3.5	3.7	2.9	1.5		
Monthly Amount.	Seasonal Amount.											
Mean for Year . .	7.0			5.3			5.7					
Greatest in . . .	August and September.	Summer.		August.	Summer.		September.	Summer.				
Least in	December.	Winter.		December.	Winter.		February.	Winter.				

(continued.)

Place	KURRACHEE			DEESA			HYDERABAD.					
Latitude	24° 51' N.			25° 14' N.			25° 30' N.					
Longitude. . . .	77° 2' E.			72° 5' E.			69° 5' E.					
Height	27 feet.			400 feet.			99 feet.					
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.			
	1856 to 1860.		April to September.	1857 to 1859.		April to September.	1856 and 1857.		April to September.			
January - - -	grs. 3·7	} 4·1	grs. 5·0	grs. 4·0	} 4·0	grs. 4·5	grs. 3·9	} 4·0	grs. 4·7			
February - - -	4·7		4·3	4·2								
March - - -	5·6	} 7·0	8·6	4·6	} 5·8	8·3	5·1	} 5·9	7·9			
April - - -	6·7			5·3			5·9					
May - - -	8·8	} 9·3		7·4	} 8·9		6·8	} 8·7				
June - - -	9·4			8·3			7·9					
July - - -	9·5	} 6·4		9·2	} 6·3		9·0	} 6·7				
August - - -	9·1			9·1			9·1					
September - - -	8·2	} 6·4		8·4	} 6·3		8·7	} 6·7				
October - - -	6·9			6·3			7·1					
November - - -	4·2	} 6·4		4·2	} 6·3		4·2	} 6·7				
December - - -	3·9			3·7			3·9					
Difference between Greatest and Least		} 5·8	5·2	3·6	5·5	4·9	3·8	5·2	2·8	3·2		
Monthly Amount.	Seasonal Amount.											
Mean for Year -	6·7			6·2			6·3					
Highest in -	July.	Summer.		July.	Summer.		August. January and December.	Summer.				
Lowest in -	January.	Winter.		December.	Winter.		Winter.					

BOMBAY PRESIDENCY.—8. *Amount of Vapour required for Saturation.*

TABLES CXXVI., showing the AVERAGE AMOUNT OF VAPOUR required to Saturate a Cubic Foot of Air, for every MONTH and QUARTER, as well as for the Periods from October to March and April to September, with the Difference between the Greatest and Least Months and Seasons, and the Mean for the Year, between the Latitudes 15° 52' N. and 25° 30' N., and between the Longitudes 69° 5' E. and 77° 2' E., arranged in the order of Latitude, at Stations for the most part in the Presidency of Bombay.

Place	BELGAUM			SATTARA			DAPOOLEE			MAHABLESHWUR.		
Latitude	15° 52' N.			17° 40' N.			17° 48' N.			17° 59' N.		
Longitude	74° 42' E.			74° 2' E.			73° 16' E.			73° 30' E.		
Height	2,260 feet			2,320 feet			600 feet			4,500 feet.		
MONTH.	2 Years.		October to March.	5 Years.		October to March.	2 Years.		October to March.	9 Years.		October to March.
	1858 and 1859.	Winter, Spring, Summer, Autumn.	April to September.	1855 to 1859.	Winter, Spring, Summer, Autumn.	April to September.	1858 and 1859.	Winter, Spring, Summer, Autumn.	April to September.	1835 to 1843.	Winter, Spring, Summer, Autumn.	April to September.
January	grs. 4.3	} 4.8	4.6	grs. 2.9	} 3.0	3.2	grs. 2.0	} 2.2	2.0	grs. 3.7	} 3.7	3.2
February	6.3			3.6			2.0			4.5		
March	6.2	} 5.4	2.9	4.5	} 5.0	2.9	2.2	} 2.2	2.3	5.6	} 5.2	2.3
April	6.1			6.1			2.5			6.0		
May	3.8			4.5			1.9			4.0		
June	2.0	} 1.6	2.9	2.0	} 1.8	2.9	5.6	} 2.8	2.3	1.4	} 0.9	2.3
July	1.4			2.5			1.8			0.9		
August	1.4			1.0			1.1			0.5		
September	1.8	} 3.0	2.9	1.5	} 2.3	2.9	1.1	} 1.4	2.3	1.3	} 1.6	2.3
October	3.6			2.4			2.1			0.9		
November	3.6			3.1			1.0			2.6		
December	3.8			2.6			2.7			2.9		
Difference between Greatest and Least												
Monthly Amount.	} 4.9		3.8	} 5.1		3.2	} 4.6		1.4	} 5.5		4.3
Seasonal Amount.			1.7			0.3			0.3			0.9
Mean for Year	3.7			3.0			2.2			2.8		
Greatest in	February	Spring.		April.	Spring.		June.	Summer.		April.	Spring.	
Least in	July and August.	Summer.		August.	Summer.		Nov.	Autumn.		August.	Summer.	

(continued.)

Place	POONA			SEROOR			BOMBAY.		
Latitude	18° 30' N.			18° 50' N.			18° 53' N.		
Longitude	74° 0' E.			77° 25' E.			72° 52' E.		
Height	1,800 feet.			1,752 feet.			..		
MONTH.	5 Years.		October to March.	5 Years.		October to March.	12 Years.		October to March.
	1856 to 1860.	Winter, Spring, Summer, Autumn.	April to September.	1854 to 1858.	Winter, Spring, Summer, Autumn.	April to September.	1847 to 1858.	Winter, Spring, Summer, Autumn.	April to September.
January	grs. 3.7	} 4.4	4.5	grs. 3.7	} 4.9	5.8	grs. 2.7	} 3.1	3.2
February	5.8			4.9			3.3		
March	5.8	} 6.0	3.5	9.7	} 8.2	4.5	3.6	} 3.7	2.6
April	7.1			7.7			3.4		
May	5.0			7.1			4.2		
June	3.4	} 2.3	3.5	4.9	} 3.4	4.5	2.3	} 2.1	2.6
July	2.0			2.5			1.8		
August	1.5			2.9			2.2		
September	1.9	} 3.3	3.5	2.9	} 4.5	4.5	1.7	} 2.6	2.6
October	3.6			4.7			2.8		
November	4.4			5.8			3.4		
December	3.7			6.1			3.3		
Difference between Greatest and Least									
Monthly Amount.	} 5.6		3.7	} 7.2		4.8	} 2.5		1.6
Seasonal Amount.			1.0			1.3			0.6
Mean for year	4.0			5.2			2.9		
Greatest in	April.	Spring.		March.	Spring.		May.	Spring.	
Least in	August.	Summer.		July.	Summer.		September.	Summer.	

BOMBAY PRESIDENCY.—8. Amount of Vapour required for Saturation—*continued.*

<i>Place</i>	DHOOLIA			RAJCOTE			AHMEDNUGGUR.					
<i>Latitude</i>	20° 54' N.			22° 18' N.			23° 34' N.					
<i>Longitude</i>	74° 45' E.			70° 50' E.			73° 1' E.					
<i>Height</i>	1,000 feet			450 feet			1,900 feet.					
MONTH.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.			
	1853 to 1858.		April to September.	1857 to 1860.		April to September.	1854 to 1859.		April to September.			
January - - -	grs. 2·8	} 3·6	grs. 4·1	grs. 4·6	} 5·3	grs. 6·0	grs. 4·1	} 4·4	grs. 4·6			
February - - -	4·6		5·9	5·4								
March - - -	6·5	} 7·4	4·7	7·6	} 8·6	6·1	7·3	} 8·0	4·8			
April - - -	7·5			8·9			8·9					
May - - -	8·1	} 3·1		9·2	} 4·7		7·7	} 3·1				
June - - -	4·8			6·4			4·0					
July - - -	2·8	} 3·0		4·5	} 5·8		2·5	} 3·1				
August - - -	1·7			3·3			2·9					
September - - -	1·7	} 3·0		4·6	} 5·8		2·0	} 3·1				
October - - -	3·2			6·6			3·7					
November - - -	4·0			6·3			3·7					
December - - -	3·5			5·3			3·7					
Difference between Greatest and Least		} 6·4	4·4	0·6	5·9	3·9	0·1	6·9	4·9	4·2		
Monthly Amount.	Seasonal Amount.											
Mean for Year -	4·3			6·1			4·7					
Greatest in -	May.	Spring.		May.	Spring.		April.	Spring.				
Least in -	August and September.	Autumn.		August.	Summer.		September.	Summer, Autumn.				

(continued.)

<i>Place</i>	KURRACHEE			DEESA			HYDERABAD.					
<i>Latitude</i>	24° 51' N.			25° 14' N.			25° 30' N.					
<i>Longitude</i>	77° 2' E.			72° 5' E.			69° 5' E.					
<i>Height</i>	27 feet			400 feet			99 feet.					
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.			
	1856 to 1860.		April to September.	1857 to 1859.		April to September.	1856 and 1857.		April to September.			
January - - -	grs. 3·8	} 3·9	grs. 4·7	grs. 3·5	} 4·4	grs. 5·7	grs. 2·7	} 3·3	grs. 4·2			
February - - -	3·6		5·1	4·1		5·1	4·1		4·1	4·2		
March - - -	5·0	} 5·2	4·1	8·2	} 9·1	5·8	6·2	} 7·5	6·5			
April - - -	5·7			10·4			7·7					
May - - -	4·8	} 3·9		8·8	} 4·1		8·5	} 6·3				
June - - -	5·0			6·5			7·8					
July - - -	3·7	} 5·1		3·6	} 5·5		6·3	} 4·4				
August - - -	2·9			2·2			4·9					
September - - -	3·8	} 5·1		3·3	} 5·5		4·1	} 4·4				
October - - -	5·1			6·1			4·6					
November - - -	6·4			7·1			4·6					
December - - -	4·4			4·6			3·1					
Difference between Greatest and Least		} 3·5	1·3	0·6	8·2	5·0	0·1	5·8	4·2			
Monthly Amount.	Seasonal Amount.											
Mean for Year -		4·5			5·8			5·4				
Greatest in -	November.	Spring.		April.	Spring.		May.	Spring.				
Least in -	August.	Summer and Winter.		August.	Summer.		January.	Winter.				

BOMBAY PRESIDENCY.—9. Degree of Humidity.

TABLE CXXVII., showing the AVERAGE DEGREE of HUMIDITY for every MONTH and QUARTER as well as for the Periods October to March and April to September, with the Difference between the Most Humid and Driest Months and Seasons, and Mean Degree of Humidity for the Year, between the Latitudes 15° 52' N. and 25° 30' N., and between the Longitudes 69° 5' E. and 77° 2' E., arranged in the order of Latitude, at Stations for the most part in the Presidency of Bombay.

Place . . .	. . . BELGAUM . . .			. . . SATTARA . . .			. . . DAPOOLEE . . .			. . . MAHABLESHWUR.		
Latitude. . .	. . . 15° 52' N. . .			. . . 17° 40' N. . .			. . . 17° 48' N. . .			. . . 17° 59' N.		
Longitude . . .	. . . 74° 42' E. . .			. . . 74° 2' E. . .			. . . 73° 16' E. . .			. . . 73° 30' E.		
Height . . .	. . . 2,260 feet . . .			. . . 2,320 feet . . .			. . . 600 feet. . . .			. . . 4,500 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1858 and 1859.		April to September.	1855 to 1859.		April to September.	1858 and 1859.		April to September.	1835 to 1843.		April to September.
January - -	51	} 48	52	65	} 65	65	79	} 76	79	53	} 52	58
February - -	39			62			79			44		
March - -	44	} 52		56	} 55		80	} 82		40	} 47	
April - -	48			48			80			41		
May - -	63	} 82	73	60	} 81	72	85	} 78	81	59	} 88	74
June - -	79			79			58			83		
July - -	84	} 68		75	} 75		85	} 86		88	} 78	
August - -	84			89			90			94		
September - -	79	} 54		84	} 69		89	} 70		83	} 60	
October - -	62			74			80			88		
November - -	62			66			89			64		
December - -	54			69			70			60		
Difference between Most Humid and Least Humid	} 45	34	21	41	26	7	32	10	2	54	41	16
Months. | Seasons.												
Mean for Year -	63			69			80			66		
Most humid -	July and August.	Summer.		August.	Summer.		August.	Autumn.		August.	Summer.	
Driest - -	February	Winter.		April.	Spring.		June.	Winter.		March.	Spring.	

(continued.)

Place.	POONA			SEROOR			BOMBAY.				
Latitude	18° 30' N.			18° 50' N.			18° 53' N.				
Longitude	74° 0' E.			77° 25' E.			72° 52' E.				
Height	1,800 feet.			1,752 feet.			...				
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	12 Years.	Winter, Spring, Summer, Autumn.	October to March.		
	1856 to 1860.		April to September.	1854 to 1858.		April to September.	1847 to 1858.		April to September.		
January - -	53	} 49	51	58	} 43	35	70	} 68	64		
February - -	40						42				67
March - -	44	} 48		15	} 27		67	} 69			
April - -	43						25				72
May - -	57	} 77	68	43	} 67	57	68	} 82	80		
June - -	67						56				80
July - -	79	} 65		75	} 54		85	} 76			
August - -	84						71				80
September - -	79	} 44	29	71	} 40	22	85	} 14	16		
October - -	63						53				76
November - -	52						38				67
December - -	53			28			67				
Difference between Most Humid and Least Humid	} 44	29	17	60	40	22	18	14	16		
Months. | Seasons.											
Mean for Year -	59			48			74				
Most humid -	August.	Summer.		July.	Summer.		July and September.	Summer.			
Driest - -	February.	Spring.		March.	Spring.		Feb., Mar., Nov. & Dec.	Winter.			

BOMBAY PRESIDENCY.—9. Degree of Humidity—continued.

Place	DHOOOLIA			RAJCOTE			AHMEDNUGGUR.			
Latitude	20° 54' N.			22° 18' N.			23° 34' N.			
Longitude	74° 45' E.			70° 50' E.			73° 1' E.			
Height	1,000 feet			450 feet			1,900 feet.			
MONTH.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1853 to 1858.		April to September.	1857 to 1860.		April to September.	1854 to 1859.		April to September.	
January - - -	65	} 58	58	41	} 37	37	50	} 49	51	
February - - -	52			35			43			
March - - -	45	} 46	67	33	} 36	54	38	} 39	61	
April - - -	46			35			35			
May - - -	47	} 75	67	40	} 64	54	43	} 70	61	
June - - -	65			55			63			
July - - -	76	} 72	67	64	} 46	54	75	} 67	61	
August - - -	85			72			71			
September - - -	85	} 72	67	60	} 46	54	79	} 67	61	
October - - -	71			45			63			
November - - -	59	} 72	67	33	} 46	54	58	} 67	61	
December - - -	57			36			53			
Difference between Most Humid and Least Humid		} 40	27	9	39	28	17	44	31	
Months. Seasons.										
Mean for Year -		63			46			56		
Most humid -		Aug. and September.	Summer.		August.	Summer.		September.	Summer.	
Driest - - -		March.	Spring.		March and November.	Spring.		April.	Spring.	

(continued.)

Place	KURRACHEE			DEESA			HYDERABAD.			
Latitude	24° 51' N.			25° 14' N.			25° 30' N.			
Longitude	77° 2' E.			72° 5' E.			69° 5' E.			
Height	27 feet.			400 feet.			99 feet.			
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1856 to 1860.		April to September.	1857 to 1859.		April to September.	1856 and 1857.		April to September.	
January - - -	49	} 51	50	52	} 47	43	59	} 55	53	
February - - -	57			46			50			
March - - -	53	} 57	67	36	} 38	59	44	} 44	55	
April - - -	54			34			43			
May - - -	65	} 71	67	45	} 69	59	44	} 58	55	
June - - -	65			56			50			
July - - -	72	} 55	67	72	} 53	59	59	} 59	55	
August - - -	76			80			65			
September - - -	68	} 55	67	72	} 53	59	68	} 59	55	
October - - -	57			51			60			
November - - -	39	} 55	67	37	} 53	59	48	} 59	55	
December - - -	47			44			56			
Difference between Most Humid and Least Humid		} 37	20	17	46	31	16	25	15	
Months. Seasons.										58	51	54
Mean for Year -										
Most humid -	August.	Summer.		August.	Summer.		September.	Autumn.		
Driest - - -	November.	Winter.		April.	Spring.		April.	Spring.		

BOMBAY PRESIDENCY.—10. *Sun Temperature.*

TABLE CXXVIII., showing the AVERAGE SUN TEMPERATURE, for every MONTH and QUARTER, as well as for the Periods October to March and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and Mean for the Year, between the Latitudes 15° 50' N. and 25° 30' N., and between the Longitudes 67° 2' E. and 77° 25' E., arranged in the order of Latitude, and for the most part in the Presidency of Bombay.

Place . . .	. . . VINGORLA. . .			. . . BELGAUM. . .			. . . KOLAPORE . . .			. . . SATTARA.		
Latitude . . .	. . . 15° 50' N.. . .			. . . 15° 52' N.. . .			. . . 16° 42' N.. . .			. . . 17° 40' N.		
Longitude . . .	. . . 73° 41' E.. . .			. . . 74° 42' E.. . .			. . . 74° 18' E.. . .			. . . 74° 2' E.		
Height . . .	. . . 20 feet . . .			. . . 2,260 feet . . .			. . . 1,797 feet . . .			. . . 2,320 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.					
	1856 and 1857.		April to September.	1856 to 1859.		April to September.	1850 to 1859.		April to September.	1855 to 1859.		April to September.					
January - - -	90	} 92	92	114	} 115	113	93	} 94	93	108	} 107						
February - - -	96			119			95			109							
March - - -	98	} 99		119	} 116		100	} 98		106	} 104						
April - - -	101			114			100			112							
May - - -	97	} 86	89	115	} 89	98	95	} 85	88	95	} 89						
June - - -	86			92			85			83							
July - - -	89	} 86		89	} 104		90	} 87		75	} 89						
August - - -	82			85			79			—							
September - - -	81	} 86		96			82			83							
October - - -	89			112			86			83							
November - - -	89			104			93			101							
December - - -	91			111			94			104							
Difference between Hottest and Coldest Months.		} 20		} 34		} 15		} 21		} —		} —					
Hottest and Coldest Seasons.		} 13		} 27		} 13		} 13		} —		} —					
Mean for Year -		91		106				91		—							
Highest in -	April.	Spring.		Feb. and March.	Spring.		Mar. and April.	Spring.									
Lowest in -	Sept.	Summer and Autumn.		August.	Summer.		August.	Summer.									

(continued.)

Place . . .	. . . DAPOOLEE . . .			. . . POONA . . .			. . . SEROOR . . .			. . . DHOOOLA.		
Latitude . . .	. . . 17° 48' N. . .			. . . 18° 30' N. . .			. . . 18° 50' N. . .			. . . 20° 54' N.		
Longitude . . .	. . . 73° 16' E. . .			. . . 74° 0' E. . .			. . . 77° 25' E. . .			. . . 74° 45' E.		
Height . . .	. . . 600 feet . . .			. . . 1,800 feet. . .			. . . 1,752 feet. . .			. . . 1,000 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	7 Years.	Winter, Spring, Summer, Autumn.	October to March.					
	1858 and 1859.		April to September.	1856 to 1860.		April to September.	1854 to 1858.		April to September.	1853 to 1859.		April to September.					
January - -	98	} 97	99	98	} 101	104	107	} 112	°	103	} 102	°					
February - -	99			107			111			106							
March - -	102	} 101		112	} 109		118	} 116		113	} 114						
April - -	104			111			119			115							
May - -	96	} 86	91	104	} 92	96	112	} 109		115	} 96						
June - -	89			95			106			103							
July - -	85	} 86		91	} 101		—			89	} 93	99					
August - -	84			89			—			86							
September - -	89	} 96		95			102	} 109		91							
October - -	99			105			111			98							
November - -	101			103			113			100							
December - -	95			98			117			96							
Difference between		} 20		} 23		} 8		} 7		} 29		} 4					
Hottest and Coldest Months.		} 15		} 17		} 8		} —		} 21		} —					
Hottest and Coldest Seasons.		} 15		} 17		} 8		} —		} 21		} —					
Mean for Year -	96			100			—			101							
Highest in -	April.	Spring.		March.	Spring.					April and May.	Spring.						
Lowest in -	August.	Summer.		August.	Summer.					August.	Summer.						

BOMBAY PRESIDENCY.—10. Sun Temperature—*continued.*

Place	RAJCOTE			AHMEDNUGGUR			NEEMUCH			MOUNT ABOO.			
Latitude	22° 18' N. . . .			23° 34' N. . . .			24° 27' N. . . .			24° 45' N.			
Longitude	70° 50' E. . . .			73° 1' E. . . .			74° 54' E. . . .			72° 49' E.			
Height	450 feet. . . .			1,900 feet. . . .			1,476 feet. . . .			4,000 feet.			
MONTH.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1857 to 1860.		April to September.	1854 to 1859.		April to September.	1860.		April to September.	1855 to 1858.		April to September.	
January - - -	103	} 108		106	} 107	107	75	} 82		78	} 86	88	
February - - -	111			110			84			86			
March - - -	117	} 118		114	} 112		97	} 96		91	} 96		
April - - -	119			114			97			97			
May - - -	117	} 118		109	} 89	96	94	} 87		100	} 87	89	
June - - -	111			94			82			95			
July - - -	—	} 100		86	} 104		—	} 115		83	} 107		
August - - -	—			87			—			83			
September - - -	—	} 104		89	} 117		82	} 107		80	} 107		
October - - -	119			103			—			91			
November - - -	123	} 107		106	} 108		89	} 92		90	} 92		
December - - -	110			105			87			93			
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.		28	23	11				22	10	1	
Mean for Year -				102			89						
Highest in -				March and April			May.						
Lowest in -				July.			January.						
		Spring.			Spring.								
		Summer.			Winter.								

(continued)

Place	KURRACHEE			DEESA			HYDERABAD.		
Latitude	24° 51' N. . . .			25° 14' N. . . .			25° 30' N.		
Longitude	67° 2' E. . . .			72° 5' E. . . .			69° 5' E.		
Height	27 feet. . . .			400 feet. . . .			99 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1856 to 1860.		April to September.	1857 to 1859.		April to September.	1856 and 1857.		April to September.
January - -	91	} 94	99	104	} 107	111	—	} 118	
February - -	96			109			102		
March - -	102	} 102	100	118	} 123	119	115	} 115	
April - -	103			126			117		
May - -	102	} 100		127	} 116	119	122	} 107	
June - -	107			122			123		
July - -	98	} 104		120	} 117		114	} 92	
August - -	95			106			108		
September - -	99	} 104		114	} 103		104	} 16	
October - -	106			122			113		
November - -	107	} 94		116	} 8		103	} 10	
December - -	94			108			92		
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.		23	16	8			
Mean for Year -		100			115				
Highest in -		June.	Spring.		May.	Spring.			
Lowest in -		January.	Winter.		January.	Winter.			

TABLES showing the MONTHLY, QUARTERLY, HALF YEARLY, and YEARLY MEANS, and DIFFERENCES between the HOTTEST and COLDEST MONTHS and SEASONS, of OBSERVATIONS taken for the most part in the PRESIDENCY of BENGAL, arranged in the order of LATITUDE, of the following METEOROLOGICAL ELEMENTS :—

1. Maximum Temperature of the Air.

2. Minimum Temperature of the Air.

3. Daily Range of Temperature.

4. Temperature of the Air.

5. Readings of the Dry and Wet Bulb Thermometers.
6. Temperature of the Dew Point.

7. Amount of Vapour in a Cubic Foot of Air.

8. Additional Weight of Vapour required for Saturation.

9. Degree of Humidity.

10. Sun Temperature.

BENGAL PRESIDENCY.—1. *Maximum Temperature of the Air.*

TABLE CXXIX., showing the AVERAGE MAXIMUM TEMPERATURE for every MONTH and QUARTER as well as for the Periods October to March, and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and Mean Maximum Temperature for the Year, between the Latitudes 20° 15' N. and 34° 20' N., and between the Longitudes 71° 29' E. and 92° 46' E., arranged in the order of Latitude, at Stations for the most part in the Presidency of Bengal.

Place . . .	THYET MYO . . .			SEETABULDEE . . .			FORT WILLIAM . . .			BERHAMPORE.					
Latitude . . .	20° 15' N. . .			21° 10' N. . .			22° 34' N. . .			24° 5' N.					
Longitude . . .	92° 46' E. . .			79° 9' E. . .			88° 25' E. . .			88° 17' E.					
Height . . .	240 feet. . .			939 feet . . .			8 feet . . .			76 feet.					
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.			
	1859.		April to September.	1858 to 1860.		April to September.	1855 to 1859.		April to September.	1857 to 1859.		April to September.			
January - -	89	89	89	80	79	82	78	79	83	76	78	82			
February - -	95			84			83			82					
March - -	98	97		88	95		90	92		91	96				
April - -	101			97			93			98					
May - -	93	86	90	99	86	89	94	89	88	99	94	95			
June - -	84			90			91			100					
July - -	87	87		84	83		88	86		92	87				
August - -	87			83			87			90					
September - -	88	87		84	83		88			91					
October - -	87			85			87			88					
November - -	85	74		79			82			81					
December - -	84			74			77			75					
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.		17	11	1	25	12	7	17	13	5	25	18	13
Mean for Year -		90			86			86			89				
Highest in -		April.			May.			May.			June.				
Lowest in -		December.			December.			December.			December.				

(continued.)

Place . . .	CHUNAR . . .			CHIRRAPOONGEE . . .			BENARES . . .			GHAZEEPORE.			
Latitude . . .	25° 5' N. . .			25° 14' N. . .			25° 17' N. . .			25° 49' N.			
Longitude . . .	83° 0' E. . .			91° 45' E. . .			83° 4' E. . .			80° 48' E.			
Height . . .	250 feet . . .			4,118 feet. . .			270 feet . . .			....
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1850 to 1859.		April to September.	1859 and 1860.		April to September.	1858 and 1859.		April to September.	1856 to 1859.		April to September.	
January - -	76	78	84	61	61	64	73	72	74	79	79	84	
February - -	82			65			74			84			
March - -	93	98		67	71		78	88		95	100		
April - -	98			72			88			99			
May - -	102	98	97	74	72	72	98	87	89	105	100	99	
June - -	103			71			90			103			
July - -	96	90		73	70		87	80		97	90		
August - -	94			71			83			100			
September - -	93	77		72			86			93			
October - -	91			73			81			91			
November - -	85			64			74			85			
December - -	77			58			68			74			
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.		27	20	13	30	16	15	31	21	15	
Mean for Year -		91			68			82			92		
Highest in -		June.			May.			May.			May.		
Lowest in -		January.			December.			December.			December.		

BENGAL PRESIDENCY.—1. Maximum Temperature of the Air—continued.

Place . . .	LUCKNOW . . .			GWALIOR . . .			KHERWARRAH . . .			DARJEELING.						
Latitude . . .	26° 0' N. . . .			26° 15' N. . . .			26° 42' N. . . .			27° 2' N. . . .						
Longitude . . .	82° 0' E. . . .			78° 0' E. . . .			79° 12' E. . . .			88° 18' E. . . .						
Height . . .	360 feet . . .						1,200 feet . . .			7,000 feet.						
MONTH.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer Autumn	October to March.				
	1858 to 1860.		April to September.	1859.		April to September.	1854 to 1858.		April to September.	1857 to 1859.		April to September.				
January - -	78	74	79	79	82	88	74	77	81	50	51	53				
February - -	78			95			82			51						
March - -	89	96	95	94	102	103	91	98	93	57	60	64				
April - -	98			102			99			60						
May - -	100	94	95	111	103	103	103	88	93	63	65	61				
June - -	98			110			93			65						
July - -	96	84	95	112	95	95	87	85	85	64	61	61				
August - -	88			87			85			65						
September - -	88	84	95	99	95	95	88	85	85	65	61	61				
October - -	86			93			87			61						
November - -	78	84	95	92	95	95	81	85	85	57	61	61				
December - -	66			73			74			52						
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.		34	22	16	39	21	15	29	21	12	15	14	11	
Mean for Year -				87			96			87			59			
Highest in -				May.			July.			May.			June, August, and September.			
Lowest in -				December.			December.			January and December.			January.			

(continued.)

Place . . .	AGRA . . .			MEERUT . . .			NYNEE TAL . . .			ROORKEE.		
Latitude . . .	27° 11' N. . . .			28° 59' N. . . .			29° 20' N. . . .			29° 53' N. . . .		
Longitude . . .	77° 53' E. . . .			77° 46' E. . . .			79° 30' E. . . .			77° 57' E. . . .		
Height . . .	800 feet . . .			900 feet . . .			6,400 feet . . .			. . . . .
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.		1 Year.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	
	1860.			1859.		April to September.	1846 to 1854.		April to September.	1860.		
January - -	73	104		72	72	77	64	65	69	.	97	
February - -	82			74			65			.		
March - -	95	104		76	90		72	78		.	97	
April - -	109			92			78			96		
May - -	109	104		103	96	94	83	78	78	98	97	
June - -	112			97			81			100		
July - -	102	104		99	96	94	77	78	78	94	97	
August - -	.			92			76			94		
September - -	.	104		95	85		76	74		94	97	
October - -	.			90			76			92		
November - -	.	104		81	85	94	71	74	74	.	97	
December - -	.			69			67			.		
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.		34	24	17	19	13	9	...	...	...
Mean for Year -		.....		86		74		.....			
Highest in -		.....		May.		May.		.....			
Lowest in		.....		December.		January.		.....			

BENGAL PRESIDENCY.—1. Maximum Temperature of the Air—*continued.*

Place		UMBALLA . . .		MEAN MEER . . .		FEROZEPORE . . .		PUNJAB, UMRTSIR, AND GOVINDGURH.					
Latitude		30° 23' N. . . .		30° 34' N. . . .		30° 55' N. . . .		31° 40' N. . . .					
Longitude		76° 44' E. . . .		74° 4' E. . . .		74° 35' E. . . .		74° 45' E. . . .					
Height		1,050 feet . . .		1,128 feet . . .		720 feet		800 to 900 feet.					
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	
	1851 and 1852.			1855 to 1859.			1855 to 1859.			1857 to 1859.			
January - - -	81	81	84	64	68	74	72	74	80	61	64	70	
February - - -	86			72			77			66			
March - - - -	84	98	105	80	90	94	89	96	99	76	83	88	
April - - - -	101			92			95			83			
May - - - - -	109	107	105	98	95	94	105	101	99	89	90	88	
June - - - - -	113			95			106			92			
July - - - - -	108	94	94	96	84	84	101	89	89	89	81	88	
August - - - -	100			95			96			88			
September - - -	100	94	94	91	84	84	96	89	89	86	81	88	
October - - - -	98			84			89			84			
November - - -	84	76	76	78	69	69	81	73	73	72	65	65	
December - - -	76			69			73			65			
Difference between Hottest and Coldest Months.		37	26	21	34	27	20	34	27	19	31	26	18
Hottest and Coldest Seasons.													
Mean for Year -		95			84			90			79		
Highest in -		June.			May.			June.			June.		
Lowest in -		December.			January.			January.			January.		

(continued.)

Place	SEALKOTE			JHELUM			PESHAWUR.		
Latitude	32° 29' N. . . .			32° 56' N. . . .			34° 20' N. . . .		
Longitude	74° 33' E. . . .			73° 47' E. . . .			71° 29' E. . . .		
Height	900 feet			1,000 feet			1,056 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	6 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.
	1859.			1859.			1855 to 1860.		
January - - -	63	64	72	..	..	..	60	62	71
February - - -	66			..			62		
March - - - -	80	88	93	..	100	99	73	85	96
April - - - -	89			..			87		
May - - - - -	94	94	94	100	98	99	96	100	85
June - - - - -	98			102			102		
July - - - - -	93	84	84	98	90	84	100	85	85
August - - - -	92			96			99		
September - - -	91	76	76	95	..	..	94	74	63
October - - - -	86			90			86		
November - - -	76	64	64	..	..	..	74	63	63
December - - -	64			..			63		
Difference between Hottest and Coldest Months.		35	30	21	..	..	42	38	25
Hottest and Coldest Seasons.									
Mean for Year -	83			..			83		
Highest in - -	June.			..			June.		
Lowest in - - -	January.			..			January.		

BENGAL PRESIDENCY.—2. *Minimum Temperature of the Air.*

TABLE CXXX., showing the AVERAGE MINIMUM TEMPERATURE of the AIR for every MONTH and QUARTER, as well as for the Periods October to March and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and Mean Minimum Temperature for the Year between the Latitudes 20° 15' N. and 34° 20' N., and between the Longitudes 71° 29' E. and 92° 46' E., arranged in the order of Latitude, and for the most part in the Presidency of Bengal.

Place . . .	. . . THYET MYO . . .			. . . SEETABULDEE . . .			. . . FORT WILLIAM . . .			. . . BERRHAMPORE.		
Latitude . . .	. . . 20° 15' N. . . .			. . . 21° 10' N. . . .			. . . 22° 34' N. . . .			. . . 24° 5' N.		
Longitude . . .	. . . 92° 46' E. . . .			. . . 79° 9' E. . . .			. . . 88° 25' E. . . .			. . . 88° 17' E.		
Height . . .	. . . 240 feet . . .			. . . 939 feet . . .			. . . . .			. . . 76 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859.		April to September.	1858 to 1860.		April to September.	1855 to 1859.		April to September.	1857 to 1859.		April to September.	
January - - -	53	59	64	61	67	71	60	61	68	51	53	58	
February - - -	62			75			65			54			
March - - -	67	74		78	86		73	76		61	67		
April - - -	77			87			77			69			
May - - -	78	77	77	92	82	84	79	80	79	71	77	74	
June - - -	75			86			81			77			
July - - -	77	73		80	75		80	75		76	69		
August - - -	78			80			79			77			
September - - -	78	73		80	75		80	75		78	69		
October - - -	76			77			77			70			
November - - -	66	73		69	75		67	75		60	69		
December - - -	62			65			59			55			
Difference between Hottest and Coldest Months.		25	18	13	31	19	13	22	19	11	27	24	16
Mean for Year -		71			78			73			67		
Highest in Lowest in		May, August, and September. January.			May. January.			June. December.			September. January.		

(continued.)

Place . . . .	. . . . CHUNAR . . . .			. . . . BENARES . . . .			. . . . GHAAZEEPORE . . . .			. . . . CHIRRAPOONGEE.		
Latitude . . . .	. . . . 25° 5' N. . . .			. . . . 25° 17' N. . . .			. . . . 25° 49' N. . . .			. . . . 25° 14' N.		
Longitude . . . .	. . . . 83° 0' E. . . .			. . . . 83° 4' E. . . .			. . . . 80° 48' E. . . .			. . . . 91° 45' E.		
Height . . . .	. . . . 250 feet . . . .			. . . . 270 feet . . . .			. . . . . . . . . .			. . . . 4,118 feet.		
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1850 to 1859.		April to September.	1858 and 1859.		April to September.	1856 to 1859.		April to September.	1859 and 1860.		April to September.	
January - - -	54	55	60	60	61	66	57	58	63	52	50	53	
February - - -	57			65			60			50			
March - - -	63	72		71	80		67	75		56	62		
April - - -	74			80			77			64			
May - - -	80	79	74	88	83	83	82	82	81	66	67	66	
June - - -	81			85			82			66			
July - - -	79	70		85	75		83	72		68	60		
August - - -	78			80			81			67			
September - - -	77	70		81	75		81	72		67	60		
October - - -	72			78			74			65			
November - - -	62	70		67	75		62	72		48	60		
December - - -	53			59			56			47			
Difference between Hottest and Coldest Months.		28	24	14	29	22	17	27	24	18	21	17	13
Hottest and Coldest Seasons.													
Mean for Year -		69			75			72			60		
Highest in -		June.			May.			July.			July.		
Lowest in -		December.			December.			December.			December.		

BENGAL PRESIDENCY.—2. Minimum Temperature of the Air—continued.

Place . . .	. . . LUCKNOW. . .			. . . GWALIOR. . .			. . . KILIERWARRAH . .			. . . DARJEELING.		
Latitude. . .	. . . 26° 0' N. . .			. . . 26° 15' N.. . .			. . . 26° 42' N.. . .			. . . 27° 2' N.		
Longitude . . .	. . . 82° 0' E. . .			. . . 78° 0' E. . .			. . . 79° 12' E.. . .			. . . 88° 18' E.		
Height . . .	. . . 360 feet . . .			. . . . .			. . . 1,200 feet. . .			. . . 7,000 feet.		
MONTH.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.				
	1858 to 1860.		April to September.	1859.		April to September.	1854 to 1858.		April to September.	1857 to 1859.		April to September.				
January - -	53	} 56	62	58	} 54	60	53	} 54	58	39	} 39	43				
February - -	59			53			58			39						
March - -	69	} 76		62	} 71		67	} 76		46	} 50					
April - -	78			71			76			50						
May - -	81	} 81	81	79	} 79	81	84	} 78	78	53	} 58	55				
June - -	82			80			81			58						
July - -	80	} 72		78	} 75		78	} 66		58	} 50					
August - -	81			78			76			58						
September - -	82			84			76			56						
October - -	73			76			68			50						
November - -	62			64			54			44						
December - -	55			50			52			39						
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.		29	25	19	34	25	21	32	24	20	19	19	12	
Mean for Year -		71			70			69			49					
Highest in -		June and September.			September.			May.			June, July, and August.					
Lowest in -		January.			December.			December.			Dec., Jan., and Feb.					

(continued.)

Place . . .	. . . AGRA . . .			. . . MEERUT . . .			. . . NYNEE TAL . . .			. . . ROORKEE.		
Latitude . . .	. . . 27° 11' N. . .			. . . 28° 59' N. . .			. . . 29° 20' N. . .			. . . 29° 53' N.		
Longitude . . .	. . . 77° 53' E. . .			. . . 77° 46' E. . .			. . . 79° 30' E. . .			. . . 77° 57' E.		
Height . . .	. . . 800 feet . . .			. . . 900 feet . . .			. . . 6,400 feet					
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.		1 Year.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.					
	1860.			1859.		April to September.	1846 to 1854.		April to September.	1860.						
January - -	43	} 68		50	} 53	55	28	} 31	36	...	} 79					
February - -	51			55			31			...						
March - -	58			58	} 69		38	} 45		...						
April - -	70			71			45			70						
May - -	77			77	} 83	78	52	} 58	55	79						
June - -	83			83			57			79						
July - -	82	} ...		85	} 63		59	} 46		80						
August - -	...			80			58			78						
September - -	...			76			54			77						
October - -	...			63			46			59						
November - -	...			50			38			...						
December - -	...			53			35			...						
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.		35	30	23	31	27	19	
Mean for Year -				67			45							
Highest in -				July.			July.							
Lowest in -					January and November.			January.								

BENGAL PRESIDENCY.—2. Minimum Temperature of the Air—*continued.*

Place . . .	UMBALLA . . .			MEAN MEER . . .			FEROZEPORE . . .			THE PUNJAB.		
Latitude. . .	30° 23' N. . .			30° 34' N. . .			30° 55' N. . .			31° 40' N. . .		
Longitude . . .	76° 44' E. . .			74° 4' E. . .			74° 35' E. . .			74° 15' E. . .		
Height . . .	1,050 feet . . .			1,128 feet . . .			720 feet . . .			800 to 900 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.
	1851 and 1852.			1855 to 1859.			1855 to 1859.			1857 to 1859.		
January -	37	40	44	45	48	55	47	52	57	47	48	52
February -	46			48			58			54		
March -	50	55	69	62	67	75	63	71	78	60	71	83
April -	54			66			67			71		
May -	62	75	82	74	79	84	83	80	85	82	85	88
June -	76			82			84			86		
July -	74	53	66	78	66	69	80	68	71	85	66	71
August -	76			77			76			84		
September -	65	53	66	74	66	69	78	68	71	80	66	71
October -	54			66			69			67		
November -	41	53	66	59	66	69	56	68	71	51	66	71
December -	37			51			52			44		
Difference between												
Hottest and Coldest Months.	39	35	25	37	31	20	37	28	21	42	37	29
Hottest and Coldest Seasons.												
Mean for Year -	56			65			68			68		
Highest in -	June and August.			June.			June.			June.		
Lowest in -	January and December.			January.			January.			December.		

(continued.)

Place	SEALKOTE			JHELM			PESHAWUR.		
Latitude	32° 29' N.			32° 56' N.			34° 20' N.		
Longitude.	74° 33' E.			73° 47' E.			71° 29' E.		
Height	900 feet			1,000 feet			1,056 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1859.		April to September.	1859.		April to September.	1855 to 1860.		April to September.
January - -	51	} 52	56	..	} 79	44	} 47	53	
February - -	51		..	49					
March - -	58	} 66	76	..		57	} 66	75	
April - -	67			..		64			
May - -	74	} 80	79	73	78	} 79	65		
June - -	81			80	79				
July - -	80	} 65	73	79	81	} 65	48		
August - -	78			79	77				
September - -	72	} 65	73	74	73	} 65	48		
October - -	64			73	67				
November - -	60	} 65	73	..	54	} 65	48		
December - -	54			..	48				
Difference between									
Hottest and Coldest Months.		Hottest and Coldest Seasons.		Hottest and Coldest Months.		Hottest and Coldest Seasons.		Hottest and Coldest Months.	
30		28		20		..		37	
Mean for Year -		66		..		64		..	
Highest in -		June.		..		July.		..	
Lowest in -		January and February.		..		January.		..	

BENGAL PRESIDENCY.—3. *Daily Range of Temperature.*

TABLE CXXXI., showing the AVERAGE DAILY RANGE for every MONTH and QUARTER, as well as for the Periods October to March, and April to September, with the Difference between the Greatest and Least Months and Seasons, and Mean for the Year, between the Latitudes 20° 15' N. and 34° 20' N., and between the Longitudes 71° 29' E. and 92° 46' E., arranged in the order of Latitude, at Stations for the most part in the Presidency of Bengal.

Place . . .	. . . THYET MYO . . .			. . . SEETA ^B ULDEE . . .			. . . FORT WILLIAM . . .			. . . BERTHAMPORE.		
Latitude . . .	. . . 20° 15' N. . .			. . . 21° 10' N. . .			. . . 22° 34' N. . .			. . . 24° 5' N.		
Longitude . . .	. . . 92° 46' E. . .			. . . 79° 9' E. . .			. . . 88° 25' E. . .			. . . 88° 17' E.		
Height . . .	. . . 240 feet . . .			. . . 939 feet . . .			. . . . .			. . . 76 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859.		April to September.	1858 to 1860.		April to September.	1855 to 1859.		April to September.	1857 to 1859.		April to September.	
January - -	36	} 30	25	19	} 12	11	18	} 18	16	25	} 24	24	
February - -	33			9			18			28			
March - - -	31	} 23		10	} 9		17	} 16		30	} 29		
April - - -	24			19			16			29			
May - - -	15	} 9	13	7	} 3	5	15	} 9	11	28	} 17	20	
June - - -	9			4			10			23			
July - - -	10	} 13		3	} 7		8	} 11		16	} 17		
August - - -	9			3			8			13			
September - -	10	} 13		4	} 7		8	} 11		13	} 17		
October - - -	11			8			10			18			
November - -	19	} 13		10	} 7		15	} 11		21	} 17		
December - -	22			9			18			20			
Difference between Greatest and Least Monthly Ranges.													
		27	21	12	16	9	6	10	9	5	17	12	4
Mean for Year -		19			8			13			22		
Greatest in -		January.			January.			Jan., Feb., and Dec.			March.		
Least in -		June and August.			July and August.			July, Aug., and Sept.			Aug. and Sept.		

(continued.)

Place . . .	. . . CHUNAR . . .			. . . BENARES . . .			. . . GHAZEIPORE . . .			. . . CHIRRAPOONGEE.		
Latitude . . .	. . . 25° 5' N. . . .			. . . 25° 17' N. . . .			. . . 25° 49' N. . . .			. . . 25° 14' N.		
Longitude . . .	. . . 83° 0' E. . . .			. . . 83° 4' E. . . .			. . . 80° 48' E. . . .			. . . 91° 45' E.		
Height . . .	. . . 250 feet . . . .			. . . 270 feet . . . .			. . . . .			. . . 4,118 feet.		
MONTH.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1850 to 1859.		April to September.	1858 and 1859.		April to September.	1856 to 1859.		April to September.	1859 and 1860.		April to September.	
January - -	22	} 24	24	13	} 10	8	22	} 21	22	9	} 12	12	
February - -	25			9			24			15			
March - - -	30	} 25		7	} 8		28	} 24		11	} 9		
April - - -	24			8			22			8			
May - - -	22	} 18	19	10	} 3	5	23	} 18	18	8	} 5	6	
June - - -	22			5			21			5			
July - - -	17	} 19		2	} 5		14	} 17		4	} 10		
August - - -	16			3			19			5			
September - -	16	} 19		5	} 5		12	} 17		4	} 10		
October - - -	19			3			17			5			
November - -	23	} 19		7	} 5		23	} 17		8	} 10		
December - -	24			9			18			16			
Difference between Greatest and Least Monthly Ranges.													
Greatest and Least Monthly Ranges.		14	7	5	11	7	3	16	7	4	12	7	6
Mean for Year -		22			7			20			9		
Greatest in -		March.			January.			March.			November.		
Least in -		Aug. and Sept.			July.			September.			August.		

BENGAL PRESIDENCY.—3. Daily Range of Temperature—continued.

Place . . .	LUCKNOW . . .			GWALIOR . . .			KHERWARAH . . .			DARJEELING.			
Latitude . .	26° 0' N. . .			26° 15' N. . .			26° 42' N. . .			27° 2' N.			
Longitude . .	82° 0' E. . .			78° 0' E. . .			79° 12' E. . .			88° 18' E.			
Height . . .	360 feet . . .						1,200 feet . . .			7,000 feet.			
MONTH.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	
	1858 to 1860.			1859.			1854 to 1858.			1857 to 1859.			
January - -	25	18	17	21	29	27	21	22	23	11	12	12	
February - -	19			42			24			12			
March - - -	20	20		32	32		24	22		11	10		
April - - -	20			31			23			10			
May - - - -	19	13	14	32	24	25	19	10	14	10	7	8	
June - - - -	16			30			12			7			
July - - - -	16	12		34	20		9	19		6	11		
August - - -	7			9			9			7			
September - -	6			15			12			9			
October - - -	13			17			19			11			
November - -	16			28			27			13			
December - -	11			23			22			13			
Difference between Greatest and Least Monthly Ranges.		Greatest and Least Seasonal Ranges.											
		19	8	3	33	12	2	18	12	9	7	5	4
Mean for Year -		16			26			18			10		
Greatest in -		January.			February.			November.			November and December.		
Least in -		September.			August.			July and August.			July.		

(continued.)

Place . . .	AGRA . . .			MEERUT . . .			NYNEE TAL . . .			ROORKEE.			
Latitude . .	27° 11' N. . .			28° 59' N. . .			29° 20' N. . .			29° 53' N.			
Longitude . .	77° 53' E. . .			77° 46' E. . .			79° 30' E. . .			77° 57' E.			
Height . . .	800 feet . . .			900 feet . . .			6,400 feet.			. . .			
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.		1 Year.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.		
	1860.			1859.		April to Sep- tember.	1846 to 1854.		April to Sep- tember.	1860.			
January - -	30	} 36		22	} 19	22	36	} 34	33	.	} 18		
February - -	31			19			34			.			
March - - -	37	} 22		18	} 22		34	} 33		.	} 24		
April - - -	39			21			33			28			
May - - - -	32	} 13	16	26	} 13		31	} 20		17	} 28		
June - - - -	29			14			24			19			
July - - - -	20	} 22		14	} 22		18	} 28		20	} 33		
August - - -	.			12			18			16			
September - -	.			9			22			17			
October - - -	.			27			30			33			
November - -	.			31			33			.			
December - -	.			16			32			.			
Difference between Greatest and Least Monthly Ranges.		Greatest and Least Seasonal Ranges.											
}		...	...	22	9	6	18	14	9	...	...	...
Mean for Year -		...			19			29			...		
Greatest in -				November.			January.				
Least in -					September.			July and August.					

BENGAL PRESIDENCY.—3. Daily Range of Temperature—continued.

Place	UMBALLA			MEAN MEER			FEROZEPORE			THE PUNJAB.			
Latitude.	30° 23' N.			30° 34' N.			30° 55' N.			31° 40' N.			
Longitude	76° 44' E.			74° 4' E.			74° 35' E.			74° 45' E.			
Height	1,050 feet			1,128 feet			720 feet			800 to 900 feet.			
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1851 and 1852.		April to Sep- tember.	1855 to 1859.		April to Sep- tember.	1855 to 1859.		April to Sep- tember.	1857 and 1859.		April to Sep- tember.	
January - - -	44	} 41	41	19	} 20	19	25	} 22	23	14	} 19	17	
February - - -	40			24			19			12			
March - - -	34	} 43		18	} 23		26	} 25		16	} 12		
April - - -	47			26			28			12			
May - - -	47	} 32	37	24	} 16	19	22	} 21	22	7	} 5	6	
June - - -	37			13			22			6			
July - - -	34	} 41		18	} 18		21	} 21		4	} 15		
August - - -	24			18			20			4			
September - - -	35	} 41		17	} 18		18	} 21		6	} 15		
October - - -	44			18			20			17			
November - - -	43	} 41		19	} 18		25	} 21		21	} 15		
December - - -	39			18			21			21			
Difference between Greatest and Least Monthly Ranges.		} 23	11	4	13	7	0	10	4	1	17	14	11
Greatest and Least Seasonal Ranges.													
Mean for Year -	39			19			22			13			
Greatest in -	April and May.			April.			April.			November and December.			
Least in -	August.			June.			September.			July and August.			

(continued.)

Place	SEALKOTE			JHELUM			PESHAWUR.										
Latitude	32° 29' N.			32° 56' N.			34° 20' N.										
Longitude	74° 33' E.			73° 47' E.			71° 29' E.										
Height	900 feet			1,000 feet			1,056 feet.										
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.								
	1859.		April to September.	1859.		April to September.	1855 to 1859.		April to September.								
January - - -	12	} 12	16	—	} 19		16	} 15	16								
February - - -	15			—			13										
March - - -	22	} 21		—	} 19		16	} 19									
April - - -	22			—			23										
May - - -	20	} 15	17	27	} 19		18	} 21	21								
June - - -	17			22			23										
July - - -	13	} 19		19	} 20		19	} 20									
August - - -	14			17			22										
September - - -	19	} 19		21	} 20		21	} 20									
October - - -	22			17			19										
November - - -	16	} 19		—	} 20		20	} 20									
December - - -	10			—			15										
Difference between		} 12		} 9		} 1		} 10		} 6		} 5					
Greatest and Least Monthly Ranges.	Greatest and Least Seasonal Ranges.																
Mean for Year -		17			...			19									
Greatest in -		March, April, and October.			...			April and June.									
Least in -		December.			...			February.									

BENGAL PRESIDENCY.—4. *Temperature of the Air.*

TABLE CXXXII., showing the AVERAGE TEMPERATURE of the AIR, for every MONTH and QUARTER, as well as for the Periods October to March, and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and Mean Temperature for the Year, between the Latitudes 20° 18' N. and 34° 20' N., and between the Longitudes 71° 29' E. and 92° 46' E., arranged in the order of Latitude, and for the most part in the Presidency of Bengal.

<i>Place</i> . . .	. . . THYET MYO . . .			. . . SEETABULDEE . . .			. . . CALCUTTA. . .			. . . BANCOORAH.		
<i>Latitude</i> . . .	. . . 20° 18' N. . .			. . . 21° 10' N. . .			. . . 22° 34' N. . .			. . . 23° 30' N.		
<i>Longitude</i> . . .	. . . 92° 46' E. . .			. . . 79° 9' E. . .			. . . 88° 25' E. . .			. . . 87° 12' E.		
<i>Height</i> . . .	. . . 240 feet . . .			. . . 939 feet								
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.		Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.							
	1859.		April to September.	1858 to 1860.		April to September.			April to September.	1827 and 1828.		April to September.							
January - -	71	74	77	71	73	76	70	72	77	67	69	73							
February - -	79			79			75			72									
March - -	82	85	84	83	90	87	83	87	86	79	84	84							
April - -	89			92			88			85									
May - -	85	81	84	95	84	87	89	86	83	88	84	84							
June - -	80			88			87			86									
July - -	82	80	79	83	79	72	85	83	79	83	79	79							
August - -	82			81			85			82									
September - -	83	73	69	82	69	69	85	72	69	82	69	69							
October - -	81			81			84			80									
November - -	75	18	11	74	17	11	78	15	9	74	15	11							
December - -	73			69			72			69									
Difference between Hottest and Coldest Months.		Hottest and Coldest Seasons.																	
Mean for Year -		80		82		82		79											
Hottest in -	April.			May.			May.			May.			May.						
Coldest in -	January.			December.			January.			January.			January.						

(continued.)

<i>Place</i> . . .	. . . Dacca . . .			. . . BERHAMPORE . . .			. . . UTTRA MULLAY . . .			. . . CHUNAR.		
<i>Latitude</i> . . .	. . . 23° 42' N.. . .			. . . 24° 5' N. . . .			. . . 24° 55' N.. . .			. . . 25° 5' N.		
<i>Longitude</i> . . .	. . . 90° 17' E.. . .			. . . 88° 17' E.. . .			. . . 85° 20' E.. . .			. . . 83° 0' E.		
<i>Height</i> . . .	. . . . .			. . . 76 feet . . .			. . . 4,600 feet. . .			. . . 250 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1840 and 1841.		April to September.	1857 to 1859.		April to September.	1845 and 1846.		April to September.	1850 to 1859.		April to September.	
January - -	71	} ..	°	64	} 66	°	63	} 64	°	65	} 67	°	
February - -	59?		82	68		70	65		70				
March - -	82	} 86		76	} 81		68	} 67	65	78	} 85		
April - -	89		83	86		68	86						
May - -	88	} 84		85	} 85		66	} 65	66	91	} 88		
June - -	87		89	85		64	92						
July - -	76	} 84		84	} 78		65	} 65	66	87	} 80		
August - -	88		83	85		65	86						
September - -	58?	} ..		84	} 78		66	} 65		85	} 80		
October - -	82		79	78		64	82						
November - -	79	} ..		70	} 78		65	} 65		74	} 80		
December - -	70		65	78		63	82						
Difference between		}	25	19	15	5	2	1	27	21	16
Hottest and Coldest Months.	Hottest and Coldest Seasons.												
Mean for Year -	..			77			65			80			
Hottest in -				June.			March and April.			June.			
Coldest in -				January.			January and December.			January and December.			

BENGAL PRESIDENCY.—4. Temperature of the Air—continued.

Place . . .	CHIRRAPOONGEE . . .			. . . BENARES . . .			. . . GHAAZEEPORE . . .			. . . LUCKNOW.		
Latitude . .	25° 14' N. . .			25° 17' N. . .			25° 49' N. . .			26° 0' N.			
Longitude . .	91° 45' E. . .			83° 4' E. . .			80° 48' E. . .			82° 0' E.			
Height . . .	4,118 feet . . .			270 feet. . . .			. . . . .			360 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859 and 1860.		April to Sep- tember.	1858 and 1859.		April to Sep- tember.	1856 to 1859.		April to Sep- tember.	1858 to 1860.		April to Sep- tember.	
January - -	57	} 56	59	66	} 66	70	68	} 68	74	66	} 65	70	
February - -	60			69			72			68			
March - - -	62	} 67		75	} 84		82	} 88		79	} 86		
April - - -	68			84			88			88			
May - - -	70	} 70	69	93	} 85	86	94	} 90	90	91	} 87	88	
June - - -	70			88			92			90			
July - - -	70	} 65		86	} 77		90	} 81		88	} 78		
August - - -	69			82			89			84			
September - -	70	} 65		83	} 77		87	} 81		85	} 78		
October - - -	68			79			82			79			
November - -	57	} 65		70	} 77		74	} 81		70	} 78		
December - -	52			64			65			60			
Difference between Hottest and Coldest Months.		} 18	14	10	29	19	16	29	22	16	31	22	18
Hottest and Coldest Seasons.													
Mean for Year -	64			78			82			79			
Hottest in -	May, June, July and September.			May.			May.			May.			
Coldest in -	December.			December.			December.			December.			

(continued.)

Place . . .	. . . MOZUFFERPUR . . .			. . . GWALIOR . . .			. . . NASIRABAD . . .			. . . CAWNPORE.		
Latitude . .	. . . 26° 7' N. . .			. . . 26° 15' N. . .			. . . 26° 18' N. . .			. . . 26° 29' N.		
Longitude . .	. . . 83° 24' E. . .			. . . 78° 0' E. . .			. . . 74° 45' E. . .			. . . 80° 22' E.		
Height . . .	. . . . .			. . . . .			. . . . .			500 feet.		
MONTH.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1833 to 1836.		April to September.	1859.		April to September.	1832 to 1834.		April to September.	1834 and 1835.		April to September.	
January - -	57	} 61	67	69	} 68	74	62	} 62	69	64	} 67	71	
February - -	65			74			65			70			
March - - -	74	} 81		78	} 87		75	} 84		72	} ...		
April - - -	82			87			83			89?			
May - - -	87	} 84	84	95	} 91	91	95	} 89	88	97	} 88		
June - - -	86			95			94			91			
July - - -	84	} 84		95	} 91		88	} 89		87	} 88		
August - - -	83			83			85			87			
September - -	83	} 76		92	} 85		87	} 81		85	} 80		
October - - -	78			85			82			79			
November - -	68	} 76		78	} 85		73	} 81		75	} 80		
December - -	60			62			59			68			
Difference between Hottest and Coldest Months.		} 30	23	17	33	23	17	36	27	19	33
Hottest and Coldest Seasons.													
Mean for Year -		76			83			79			97		
Hottest in -		May.			May, June, and July.			May.					
Coldest in -		January.			December.			December.					

BENGAL PRESIDENCY.—4. Temperature of the Air—continued.

Place	KHERWARAH . . .			FUTTYGHUR . . .			DARJEELING . . .			AGRA.		
Latitude	26° 42' N. . . .			27° 2' N. . . .			27° 2' N. . . .			27° 11' N.		
Longitude	79° 12' E. . . .			79° 30' E. . . .			88° 18' E. . . .			77° 53' E.		
Height	1,200 feet			600 feet			7,000 feet			800 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.
	1854 to 1858.			1832 and 1833.			1857 to 1859.			1860.		
January - - -	64	} 66	70	57	} 59	66	45	} 44	48	67	} 89	
February - - -	71			63			43			69		
March - - -	79	} 87		74	} 83		52	} 55		81		
April - - -	89			85			56			91		
May - - -	94	} 83	86	90	} 89	88	58	} 61	59	95		
June - - -	88			95			61			97		
July - - -	82	} 83		87	} 89		61	} 61		90		
August - - -	80			85			61			..		
September - - -	81	} 75		84	} 76		61	} 56		..		
October - - -	77			75			56			..		
November - - -	68	}		69	}		51	}		..	}	
December - - -	64			58			45			..		
Difference between Hottest and Coldest Months.		} 30	21	16	38	30	22	18	17	11	..	..
Hottest and Coldest Seasons.												
Mean for Year -	78			77			54			..		
Hottest in -	May.			June.			June, July, August, and September.			—		
Coldest in -	January and December.			January.			February.			—		

(continued.)

Place	SURROWLI.			MEERUT			NYNEE TAL			LOHOOGAT.											
Latitude.	28° 50' N.			28° 59' N.			29° 20' N.			29° 23' N.											
Longitude	77° 20' E.			77° 46' E.			79° 30' E.			82° 16' E.											
Height . . . . .	. . . . .			900 feet			6,400 feet . . . . .			....								
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.									
	1837 to 1841.		April to September.	1859.		April to September.	1846 to 1854.		April to September.	1830 to 1835.		April to September.									
January - - -	51	} 53	62	61	} 63	67	46	} 48	52	45	} 46	51									
February - - -	57			65			48			46											
March - - -	66	} 74		70	} 81		55	} 62		52											
April - - -	76			83			62			61											
May - - -	81	} 85	81	90	} 88	86	68	} 68	66	66											
June - - -	86			92			69			71											
July - - -	85	} 74		88	} 75		68	} 60		71		} 61									
August - - -	83			84			67			71											
September - - -	78			82			65			69											
October - - -	71			76			61			71											
November - - -	74			68			55			63											
December - - -	51			62			51			52	47										
Difference between Hottest and Coldest Months.		} 35	32	19	31	25	19	23	20	14	26	25									
Hottest and Coldest Seasons.																					
Mean for Year -				72			77			60			60								
Hottest in -				June.			June.			June.			June, July, and August.								
Coldest in -				January and December.			January.			January.			January.								

BENGAL PRESIDENCY.—4. Temperature of the Air—continued.

Place . . . .	. . . . ROORKEE. . . . .			. . . . KULSEA . . . . .			. . . . UMBALLA.		
Latitude . . .	. . . . 29° 53' N. . . . .			. . . . 30° 0' N. . . . .			. . . . 30° 23' N.		
Longitude . . .	. . . . 77° 57' E. . . . .			. . . . 77° 30' E. . . . .			. . . . 76° 44' E.		
Height . . . .	. . . . .			. . . . 1,100 feet . . . . .			. . . . 1,050 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1860.		April to September.	1837 and 1838.		April to September.	1851 and 1852.		April to September.
January - - -	—	} 88	—	58	} 60	—	60	} 64	—
February - - -	—		—	61		62	70		68
March - - - -	—		—	63	} 74	—	77*	} 80	—
April - - - -	84		—	78		—	83		—
May - - - - -	88		—	81	} 82	—	89		—
June - - - - -	89		—	86		80	97	} 93	90
July - - - - -	90		—	84	} 70	—	91		—
August - - - -	86		—	75		—	91	} 81	—
September - -	86		—	77		—	92		—
October - - -	76		—	71		—	84		—
November - - -	—		—	63		—	67		—
December - - -	—		—	60		—	62		—
Difference between Hottest and Coldest Months.		..	..	28	22	18	37	28	22
Hottest and Coldest Seasons.									
Mean for Year -	...			71			79		
Hottest in -	...			June.			June.		
Coldest in -				January.			January.		

(continued.)

Place . . . .	. . . . MEAN MEER. . . . .			. . . . FEROZEPORE . . . . .			. . . . THE PUNJAB.		
Latitude . . .	. . . . 30° 34' N. . . . .			. . . . 30° 55' N. . . . .			. . . . 31° 40' N.		
Longitude . . .	. . . . 74° 4' E. . . . .			. . . . 74° 35' E. . . . .			. . . . 74° 45' E.		
Height . . . .	. . . . 1,128 feet . . . . .			. . . . 720 feet . . . . .			. . . . 800 to 900 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1855 to 1859.		April to September.	1855 to 1859.		April to September.	1857 to 1859.		April to September.
January - - -	55	} 58	—	59	} 62	—	54	} 56	—
February - - -	60		65	68		68	60		62
March - - - -	71	} 79	—	76	} 84	—	68	} 77	—
April - - - -	79		—	81		—	77		—
May - - - - -	86	} 86	—	94	} 90	—	86	} 87	—
June - - - - -	86		84	95		88	89		84
July - - - - -	87	} 75	—	90	} 78	—	87	} 73	—
August - - - -	86		—	86		—	86		—
September - -	82	} 75	—	86	} 78	—	83		—
October - - -	75		—	79		—	76		—
November - - -	69		—	68		—	61		—
December - - -	60		—	58		—	55		—
Difference between Hottest and Coldest Months.		32	19	37	28	20	35	31	22
Hottest and Coldest Seasons.									
Mean for Year -	75			78			73		
Hottest in -	July.			June.			June.		
Coldest in -	January.			December.			January.		

* Reading in March altered conjecturally from 67° to 77°.

Bengal Presidency.—Temperature of the Air—continued.

Place	JHELUM			PESHAWUR			BENARES.			
Latitude	32° 56' N. . . .			34° 20' N. . . .			25° 17' N.			
Longitude	73° 47' E. . . .			71° 29 E. . . .			83° 4' E.			
Height	1,000 feet			1,056 feet. . . .			270 feet.			
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859.		April to September.			1855 to 1860.			April to September.	1824 to 1826.	April to September.
January - -	—	} 89		52	} 54	61	63	} 65	71	
February - -	—			55			69			
March - -	—			65	} 76	86	79	} 88	89	
April - -	—			75			90			
May - -	86			88	} 90		95	} 87		
June - -	91			91			90			
July - -	89			91	} 74		86	} 80		
August - -	88			88			86			
September - -	84			84			85			
October - -	81			73			82			
November - -	—	64		72						
December - -	—	56		63						
Difference between Hottest and Coldest Months.		39	36	25	32	23	18
Mean for Year -		...			74			80		
Hottest - -					June and July.			May.		
Coldest - -		...			January.			January and December.		

(continued.)

Place . . . .	. . . .	KHATMANDU . . . .	. . . .	. . . .	BAREILLY . . . .	. . . .	. . . .	KOTGURH.	
Latitude . . . .	. . . .	27° 42' N. . . .	. . . .	. . . .	28° 0' N. . . .	. . . .	. . . .	31° 0' N.	
Longitude . . . .	. . . .	87° 40' E. . . .	. . . .	. . . .	79° 0' E. . . .	. . . .	. . . .	77° 0' E.	
Height . . . .	. . . .	4,650 feet. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	6,634 feet.	
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.			
	1802 to 1835.		April to September.	1829 and 1830.		April to September.	1819 to 1821.		April to September.			
January - -	48	} 49	54	57	} 60	66	40	} 70				
February - -	52			64			45					
March - -	58	} 66	72	72	} 80	85	—	} 57				
April - -	67			86			—					
May - -	72	} 75		83	} 87		68	} 57				
June - -	74			91			72					
July - -	76	} 64		87	} 75		71	} 57				
August - -	74			84			67					
September - -	72			81			65					
October - -	65			77			56					
November - -	55			67			51					
December - -	46			58			—					
Difference between												
Hottest and Coldest Months.	Hottest and Coldest Seasons.	30	26	18	34	27	19					
Mean for Year -		63			76							
Hottest - -		July.			June.							
Coldest - -		December.			January.							

BENGAL PRESIDENCY.—5. Readings of Dry and Wet Bulb Thermometers.

TABLE CXXXIII., showing the AVERAGE READINGS of the DRY and WET BULB THERMOMETERS for every MONTH and QUARTER as well as for the periods October to March and April to September, with the Difference between the Highest and Lowest Months and Seasons, and Mean for the Year between the Latitudes 20° 18' N. and 34° 20' N., and between Longitudes 71° 29' E. and 92° 46' E., arranged in the order of Latitude and for the most part in the Presidency of Bengal.

Place	THYET MYO						CALCUTTA						FORT WILLIAM.					
Latitude	20° 18' N.						22° 34' N.						22° 34' N.					
Longitude	92° 46' E.						88° 25' E.						88° 25' E.					
Height	240 feet . . . .						. . . .						. . . .
MONTH.	1 Year.		Winter, Spring, Summer, Autumn.		October to March.		2 Years.		Winter, Spring, Summer, Autumn.		October to March.		5 Years.		Winter, Spring, Summer, Autumn.		October to March.	
	1859.				April to September.		1843 and 1844.				April to September.		1855 to 1859.				April to September.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
January - - -	71	57	74	61	77	65	75	69	77	70	80	75	68	62	70	63	74	68
February - - -	79	60					80	72					73	66				
March - - -	82	60	85	66			87	80	89	83			80	73	83	77		
April - - -	89	64					91	84					84	77				
May - - -	85	75	81	76	84	72	90	85	87	84	88	84	86	80	84	80		79
June - - -	80	72					89	85					85	81				
July - - -	82	78	80	75			86	83	84	81			83	80	79	75		
August - - -	82	77					85	83					83	80				
September - - -	83	78	80	75			86	84	84	81			83	80				
October - - -	81	77					85	81					81	77					81	77
November - - -	75	69	73	66			81	77	75	70			74	68				
December - - -	73	66					75	70					69	62				
Difference between Highest and Lowest																		
Monthly Readings of the Dry.	18	21	11	15	7	7	16	16	12	14	8	9	18	19	14	17	10	11
Seasonal Readings of the Wet.																		
Mean for the Year -	80	69	80	69	80	69	84	79	84	79	84	79	79	74	79	74	79	74
Highest in - -	Dry. April.		Wet. July and September.		April.		May and June.		May.		June.		January.		January and December.			
Lowest in - -	January.		January.		January and December.		January.		January.		January.		January.		January and December.			

(continued.)

Place	HAZAREEBAUGH						BENARES						KHERWARRAH.					
Latitude	24° 0' N.						25° 17' N.						26° 42' N.					
Longitude	85° 24' E.						83° 4' E.						79° 12' E.					
Height	1,900 feet						270 feet.						1,200 feet.					
MONTH.	3 Years.		Winter, Spring, Summer, Autumn.		October to March.		2 Years.		Winter, Spring, Summer, Autumn.		October to March.		5 Years.		Winter, Spring, Summer, Autumn.		October to March.	
	1858 to 1860.				April to September.		1858 and 1859.				April to September.		1854 to 1858.				April to September.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
January - - -	68	57	} 68	59	70	61	66	56	} 66	58	72	64	64	58	} 66	59	72	62
February - - -	71	61					69	60					71	62				
March - - -	73	62	} 78	68			84	68	} 88	73			79	67	} 87	71		
April - - -	80	68					91	72					89	71				
May - - -	81	76	} 84	75	82	74	90	79	} 87	83	88	80	94	74	} 83	76		74
June - - -	86	74					91	83					88	75				
July - - -	87	76	} 75	67			86	85	} 79	75			82	74	} 75	69		
August - - -	80	76					85	82					80	78				
September - - -	80	75	} 75	67			85	82	} 79	75			81	75				
October - - -	75	67					79	77					77	70				
November - - -	69	58	} 75	67			73	66	} 79	75			68	62				
December - - -	65	60					63	58					64	57				
Difference between Highest and Lowest																		
Monthly Readings of the Dry. Wet. Dry. Wet.																		
Mean for the Year -																		
Highest in - - -																		
Lowest in - - -																		
July. May, July, and August. April and June. July. May. August.																		
December. January. December. January. January and December. December.																		

BENGAL PRESIDENCY.—5. Readings of Dry and Wet Thermometers—continued.

Place	DARJEELING						AGRA						MEERUT.					
Latitude.	27° 2' N.						27° 11' N.						28° 59' N.					
Longitude	88° 10' E.						77° 53' E.						77° 46' E.					
Height	7,000 feet						800 feet						900 feet.					
MONTH.	3 Years.		Winter, Spring, Summer, Autumn.		October to March.		1 Year.		Winter, Spring, Summer, Autumn.		October to March.		1 Year.		Winter, Spring, Summer, Autumn.		October to March.	
	1857 to 1859.				April to September.		1860.				April to September.		1859.				April to September.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
January - - -	44	41	} 44	42	48	46	66	54	} 92	64	}	62	61	57	} 62	57	67	62
February - - -	45	43					72	60					65	60				
March - - -	51	48	} 54	52	59	58	85	61					70	64	} 81	70	86	79
April - - -	54	51					94	64					83	67				
May - - -	58	56	97	68			90	78										
June - - -	61	60	96	71			92	82					} 88	80				
July - - -	62	61	89	77			88	83										
August - - -	62	61	..	..			84	76					} 75	72				
September - - -	60	59	..	..			82	78										
October - - -	57	53	..	..			76	73										
November - - -	51	47	} 56	53			..	..					68	64	} 75	72		
December - - -	44	42			..	..	61	54										
Difference between Highest and Lowest																		
Monthly Read-ings of the Dry.	18	20	18	19	11	12	..	..	..	..	..	..	31	29	26	23	19	17
Seasonal Read-ings of the Dry.																		
Wet.																		
Wet.																		
Mean for the Year -	54	52	54	52	54	52	..	..	..	..	..	..	76	69	76	69	76	69
Highest in - - -	July and August.			July and August.			..		..		June.			July.				
Lowest in - - -	January and December.			January.			..		..		January and December.			December.				

(continued.)

Place	LANDOUR						PESHAWUR.									
Latitude.	30° 27' N.						34° 20' N.									
Longitude	78° 10' E.						71° 29' E.									
Height	7,000 feet						1,056 feet.									
MONTH.	4 Years.		Winter, Spring, Summer, Autumn.		October to March.		3 Years.		Winter, Spring, Summer, Autumn.		October to March.					
	—				April to September.		1858 to 1860.				April to September.					
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.				
January - - -	44	36	} 44	37	49	41	49	44	} 50	45	58	51				
February - - -	43	38					53	48								
March - - -	57	46	} 64	53	69	61	63	59	} 74	67	85	74				
April - - -	65	52					75	70								
May - - -	71	61	} 70	65			84	71	} 91	80						
June - - -	73	64					91	79								
July - - -	70	66	} 57	52			92	81	} 73	63						
August - - -	68	66					89	80								
September - - -	66	62	} 57	52			86	73	}							
October - - -	57	51					72	63								
November - - -	49	42					60	52								
December - - -	44	37					49	44								
Difference between Highest and Lowest																
Monthly Read- ings of the		30	30	26	28	20	20	43	37	41	35	27	23			
Dry.	Wet.															
Mean for the Year -		59	52	59	52	59	52	72	64	72	64	72	64			
Highest in - -		June.		July and August.		July.		July.		July.		July.				
Lowest in - -		February.		January.		January and December.		January and December.		January and December.		January and December.				

BENGAL PRESIDENCY.—6. *Temperature of the Dew Point.*

TABLE CXXXIV., showing the AVERAGE TEMPERATURE of the DEW POINT, for every MONTH and QUARTER, as well as for the Periods October to March, and April to September, with the Difference between the Highest and Lowest Months and Seasons, and the Mean for the Year between the Latitudes 20° 18' N. and 34° 20' N., and between the Longitudes 71° 29' E., and 92° 46' E., arranged in the order of Latitude at Stations for the most part in the Presidency of Bengal.

<i>Place</i> . . . . .	. . . THYET MYO . . .			. . . CALCUTTA . . .			. . . FORT WILLIAM . . .			. . . HAZAREEBAUGH.		
<i>Latitude</i> . . . .	. . . 20° 18' N.. . .			. . . 22° 34' N.. . .			. . . 22° 34' N.. . .			. . . 24° 0' N.		
<i>Longitude</i> . . . .	. . . 92° 46' E.. . .			. . . 88° 25' E.. . .			. . . 88° 25' E.. . .			. . . 85° 24' E.		
<i>Height</i> . . . . .	. . . 240 feet . . .			. . . . .			. . . . .			. . . 1,900 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October, to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1859.		April to Sep- tember.	1843 and 1844.		April to Sep- tember.	1855 to 1859.		April to Sep- tember.	1858 to 1860.		April to Sep- tember.
January - - -	46	51	56	65	66	71	57	58	60	48	52	55
February - - -	47			67			61			53		
March - - -	45	54	68	76	79	82	68	72	76	54	62	69
April - - -	48			80			72			60		
May - - -	69	72	76	82	82	82	76	78	76	73	69	69
June - - -	67			83			78			66		
July - - -	75	71	76	81	78	76	78	72	76	69	61	61
August - - -	74			82			78			73		
September - - -	75	71	76	83	78	76	78	72	76	72		
October - - -	74			78			74			61		
November - - -	65	71	76	74	78	76	64	72	76	49	61	61
December - - -	61			66			57			56		
Difference between Highest and Lowest		30	21	12	28	16	21	20	16	25	17	14
Monthly Readings.	Seasonal Readings.											
Mean for Year -	62			76			70			61		
Highest in -	July and September.			June and September.			June, July, Aug., and Sept.			May and August.		
Lowest in -	March.			January.			January and December.			January.		

(continued.)

<i>Place</i> . . . . .	. . . BENARES . . .			. . . KHERWARAH . . .			. . . DARJEELING . . .			. . . AGRA.		
<i>Latitude</i> . . . .	. . . 25° 17' N.. . .			. . . 26° 42' N.. . .			. . . 27° 2' N.. . .			. . . 27° 11' N.		
<i>Longitude</i> . . . .	. . . 83° 4' E.. . .			. . . 79° 12' E.. . .			. . . 88° 10' E.. . .			. . . 77° 53' E.		
<i>Height</i> . . . . .	. . . 270 feet . . .			. . . 1,200 feet . . .			. . . 7,000 feet . . .			. . . 800 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn	October to March.	5 Years.	Winter, Spring, Summer, Winter.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1858 and 1859.		April to September.	1854 to 1858.		April to September.	1857 to 1859.		April to September.	1860.		April to September.
January - - -	48	52	58	53	53	57	38	40	43	44	..	..
February - - -	53			55			41			51		
March - - -	57	63	76	59	60	68	45	49	55	..	..	..
April - - -	60			60			48			..		
May - - -	72	81	76	62	71	68	54	60	55	..	..	..
June - - -	78			67			59			..		
July - - -	84	72	76	69	64	68	60	50	55	69	..	..
August - - -	80			77			60			..		
September - - -	80	72	76	71	64	68	58	50	55	..	..	..
October - - -	76			65			49			..		
November - - -	61	72	76	57	64	68	43	50	55	..	..	..
December - - -	54			51			40			..		
Difference between Highest and Lowest		36	29	18	26	18	22	20	12	..	..	..
Monthly Reading.	Seasonal Readings.											
Mean for Year -	67			62			49			..		
Highest in -	July.			August.			July and August.			..		
Lowest in -	January.			December.			January.			..		

BENGAL PRESIDENCY.—6. Temperature of the Dew Point—continued.

Place	MEERUT			LANDOUR			PESHAWUR.			
Latitude	28° 59' N.			30° 20' N.			34° 20' N.			
Longitude.	77° 56' E.			78° 10' E.			71° 29' E.			
Height	900 feet.			7,000 feet.			1,056 feet.			
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859.		April to September.			April to September.			1858 to 1860.	April to September.
January - - -	54	53	58	27	29	34	39	40	46	
February - - -	56		32	36		43	43		56	61
March - - -	59	62	71	36	43	54	56	61	69	
April - - -	56			41			53			61	66	72	73
May - - -	71	76		57	61		72	73		
June - - -	76			63			64			74	74	73
July - - -	80	69		64	46		74	55		
August - - -	71			59			46			56	45	39
September - - -	75			34			65	55		
October - - -	71			46			56			45	39
November - - -	61			29			39			
December - - -	48			29			39			
Difference between Highest and Lowest		32	23	13	37	32	20	35	33	23
Monthly Readings.	Seasonal Readings.									
Mean for Year -	65			44			57			
Highest in -	July.			August.			July and August.			
Lowest in -	December.			January.			January and December.			

BENGAL PRESIDENCY.—7. Amount of Vapour in a Cubic Foot of Air.

TABLE CXXXV., showing the AVERAGE AMOUNT of VAPOUR in a CUBIC FOOT of AIR, for every MONTH and QUARTER, as well as for the Periods from October to March, and April to September, with the Difference between the Greatest and Least Months and Seasons, and Mean for the Year, between the Latitudes 20° 18' N. and 34° 30' N., and between the Longitudes 71° 29' E. and 92° 46' E., arranged in the order of Latitude, at Stations for the most part in the Presidency of Bengal.

Place	THYET MYO			CALCUTTA			FORT WILLIAM			HAZAREEBAUGH.			
Latitude	20° 18' N.			22° 34' N.			22° 34' N.			24° 0' N.			
Longitude	92° 46' E.			88° 25' E.			88° 25' E.			85° 24' E.			
Height	240 feet									1,900 feet.			
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859.		April to September.	1843 and 1844.		April to September.	1854 to 1859.		April to September.	1858 to 1860.		April to September.	
January - - -	grs. 3.4	4.2	5.3	grs. 6.6	6.9	8.2	grs. 5.2	5.3	6.5	grs. 3.7	4.3	4.5	
February - - -	3.5			7.0			5.8			4.4			
March - - -	3.2	5.3	7.5	9.3	10.4	11.4	7.4	8.5	9.8	4.5	6.2	7.5	
April - - -	3.5			10.6			8.5			5.5			
May - - -	7.4	8.4		11.4	11.5		9.5	10.2		8.6	7.7		
June - - -	7.0			11.7			10.3			6.8			
July - - -	9.4	8.3		11.2	10.4		10.2	8.6		7.4	6.0		
August - - -	8.9			11.5			10.2			8.8			
September - - -	9.1			11.8			10.2			8.3			
October - - -	9.1			10.3			9.1			5.8			
November - - -	6.6			9.1			6.4			3.9			
December - - -	5.8			7.0			5.0			4.9			
Difference between Highest and Lowest		7.2	4.2	3.2	5.2	4.6	3.2	5.3	4.9	3.3	5.1	3.4	3.0
Monthly Amount.	Seasonal Amount.												
Mean for Year -		6.5			9.8			8.1			6.0		
Greatest in -		July.			September.			June.			August.		
Least in -		March.			January.			December.			January.		

BENGAL PRESIDENCY.—7. Amount of Vapour in a Cubic Foot of Air—continued.

Place . . . . .	. . . BENARES . . .			. . . KHERWARRAH . . .			. . . DARJEELING . . .			. . . AGRA.		
Latitude . . . .	. . . 25° 17' N. . .			. . . 26° 42' N. . .			. . . 27° 2' N. . .			. . . 27° 11' N.		
Longitude . . . .	. . . 83° 4' E. . .			. . . 79° 12' E. . .			. . . 88° 10' E. . .			. . . 77° 53' E.		
Height . . . . .	. . . 270 feet . . .			. . . 1,200 feet . . .			. . . 7,000 feet. . .			. . . 800 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1858 and 1859.		April to September.	1854 to 1858.		April to September.	1857 to 1859.		April to September.	1860.		April to September.
January - - -	grs. 3·7	} 4·2	grs. 5·5	grs. 4·5	} 4·5	grs. 5·1	grs. 2·6	} 2·8	grs. 3·1	grs. 3·2	grs.	grs.
February - - -	4·4			4·7			2·9			4·1		
March - - -	5·0	} 6·3	grs. 9·7	5·3	} 5·5	grs. 7·2	3·4	} 4·0	grs. 5·2	..	grs.	grs.
April - - -	5·5			5·4			3·8			..		
May - - -	8·3	} 11·2	grs. 9·7	5·7	} 8·1	grs. 7·2	4·7	} 5·7	grs. 5·2	..	grs.	grs.
June - - -	10·1			6·9			5·6			..		
July - - -	12·5	} 8·7	grs. 9·7	7·5	} 6·7	grs. 7·2	5·8	} 4·1	grs. 5·2	7·5	grs.	grs.
August - - -	10·9			9·8			5·8			..		
September - - -	10·9	} 8·7	grs. 9·7	8·1	} 6·7	grs. 7·2	5·4	} 4·1	grs. 5·2	..	grs.	grs.
October - - -	9·5			6·7			3·9			..		
November - - -	5·8	} 8·7	grs. 9·7	5·2	} 6·7	grs. 7·2	3·1	} 4·1	grs. 5·2	..	grs.	grs.
December - - -	4·6			4·2			2·8			..		
Difference between Highest and Lowest		} 8·8	7·0	4·2	5·6	3·6	2·1	3·2	2·9	2·1	..	..
Monthly Amount.	Seasonal Amount.											
Mean for Year -	7·6			5·9			4·1			..		
Greatest in -	July.			August.			July and August.			..		
Least in -	January.			December.			January.			..		

(continued)

Place	MEERUT			LANDOUR			PESHAWUR.		
Latitude	28° 59' N.			30° 27' N.			34° 20' N.		
Longitude	77° 46' E.			78° 10' E.			71° 29' E.		
Height	900 feet			7,000 feet			1,056 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1859.		April to September.			April to September.			1858 to 1860.	April to September.
January - - -	grs. 4·6	} 4·4	grs. 5·4	grs. 1·7	} 1·9	grs. 2·3	grs. 2·7	} 2·8	grs. 3·6
February - - -	4·9		2·1	3·1					
March - - -	5·5	} 6·0	8·2	2·4	} 3·2	5·1	4·9	} 6·0	7·5
April - - -	4·8			2·9			7·0		
May - - -	7·8	} 9·4	8·2	4·4	} 6·0	5·1	6·0	} 8·6	4·9
June - - -	9·3			5·1			8·1		
July - - -	10·8	} 7·8	8·2	6·3	} 3·7	5·1	8·8	} 4·9	7·5
August - - -	8·0			6·6			8·9		
September - - -	9·4	} 7·8	8·2	5·5	} 3·7	5·1	6·4	} 4·9	7·5
October - - -	8·2			3·4			5·0		
November - - -	5·8	} 7·8	8·2	2·3	} 3·7	5·1	3·3	} 4·9	7·5
December - - -	3·7			1·8			2·7		
Difference between Highest and Lowest		} 7·1	5·0	2·8	4·9	4·1	2·8	6·2	5·8
Monthly Amount.	Seasonal Amount.								
Mean for Year -	6·9			3·7			5·6		
Greatest in -	July.			August.			August.		
Least in -	December.			January.			January and December.		

BENGAL PRESIDENCY.—8. *Additional Weight of Vapour required for Saturation.*

TABLE CXXXVI., showing the AVERAGE AMOUNT of VAPOUR required to saturate a CUBIC FOOT of AIR for every MONTH and QUARTER, as well as for the Periods October to March and April to September, with the Difference between the Greatest and Least Months and Seasons, and Mean for the Year, between the Latitudes 20° 18' N. and 34° 30' N., and between the Longitudes 71° 29' E. and 92° 46' E., arranged in the order of Latitude, and for the most part in the Presidency of Bengal.

Place . . . . .	. . . THYET MYO . . .			. . . CALCUTTA . . .			. . . FORT WILLIAM . . .			. . . HAZAREEBAUGH.		
Latitude . . . .	. . . 20° 18' N. . . .			. . . 22° 34' N. . . .			. . . 22° 34' N. . . .			. . . 24° 5' N.		
Longitude . . . .	. . . 92° 46' E. . . .			. . . 88° 25' E. . . .			. . . 88° 25' E. . . .			. . . 85° 24' E.		
Height . . . . .	. . . 240 feet . . . .			. . . . .			. . . . .			. . . 1,906 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859.		April to September.	1843 and 1844.		April to September.	1855 to 1859.		April to September.	1858 to 1860.		April to September.	
January - - -	grs. 4.9	5.0	4.7	grs. 2.8	3.1	3.0	grs. 2.3	2.7	2.8	grs. 3.8	3.2	3.6	
February - - -	7.1			4.0			3.0			3.9			
March - - -	8.5	8.3	4.7	4.3	4.1	2.6	3.6	3.7	2.6	4.3	4.2	4.3	
April - - -	10.9			4.7			3.9			5.5			
May - - -	5.4	3.0	4.7	3.4	2.0	2.0	3.7	2.0	2.6	2.7	4.9	4.3	
June - - -	4.0			2.7			2.5			6.4			
July - - -	2.3	2.6	4.7	2.0	2.0	2.0	1.8	2.2	2.6	6.2	3.4	4.3	
August - - -	2.8			1.3			1.8			2.2			
September - - -	2.9	2.6	4.7	1.4	2.0	2.0	1.8	2.2	2.6	2.7	3.4	4.3	
October - - -	2.2			2.5			2.2			3.6			
November - - -	2.8	2.6	4.7	2.2	2.0	2.0	2.7	2.2	2.6	3.9	3.4	4.3	
December - - -	3.0			2.4			2.8			1.9			
Difference between Highest and Lowest		8.7	5.7	0.0	3.4	2.1	0.4	2.1	1.7	0.2	4.5	1.0	
Monthly Amount.	Seasonal Amount.												
Mean for Year -		4.7			2.8			2.6			3.9		
Greatest in -		April.			April.			April.			June.		
Least in -		October.			August.			July, August, September.			December.		

(continued.)

Place	BENARES . . .			KHERWARRAH . . .			DARJEELING . . .			AGRA.		
Latitude	25° 17' N. . . .			26° 42' N. . . .			27° 2' N. . . .			27° 11' N.		
Longitude	83° 4' E. . . .			79° 12' E. . . .			88° 10' E. . . .			77° 53' E.		
Height	270 feet			1,200 feet			7,000 feet			800 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1858 and 1859.			1854 to 1858.			1857 to 1859.			1860.		
January - - -	grs. 3.3	2.8	3.3	grs. 2.1	2.7	3.2	grs. 0.7	0.6	0.8	grs. 3.8	4.4	..
February - - -	3.4			3.6			0.5			4.4		
March - - -	7.4	7.9	4.3	5.3	8.4	5.9	0.8	0.8	0.5	..	..	..
April - - -	9.8			9.0			0.9			..		
May - - -	6.5	2.6	4.3	11.0	4.2	4.2	0.7	0.4	0.5	..	..	..
June - - -	5.2			7.1			0.4			..		
July - - -	0.7	2.0	4.3	4.2	2.9	2.9	0.4	0.9	0.3	6.9	..	..
August - - -	1.9			1.2			0.4			..		
September - - -	1.9	2.0	4.3	3.2	2.9	2.9	0.4	0.9	0.3	..	..	..
October - - -	1.1			3.3			1.3			..		
November - - -	3.0	2.0	4.3	2.3	2.9	2.9	1.1	0.9	0.3	..	..	..
December - - -	1.8			2.4			0.5			..		
Difference between Highest and Lowest		9.1	5.9	1.0	9.8	4.5	2.7	0.9	0.5	0.3	..	..
Monthly Amount.	Seasonal Amount.											
Mean for Year -	3.8			4.5			0.7			..		
Greatest in -	April.			May.			October.			..		
Least in -	July.			August.			June, July, August, Sept.			..		

BENGAL PRESIDENCY.—8. Additional Weight of Vapour required for Saturation—*continued.*

<i>Place</i>	MEERUT			LANDOUR			PESHAWUR.			
<i>Latitude</i>	28° 59' N.			30° 27' N.			34° 20' N.			
<i>Longitude</i>	77° 46' E.			78° 10' E.			71° 29' E.			
<i>Height</i>	900 feet			7,000 feet			1,056 feet.			
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859.		April to September.			April to September.			1858 to 1860.	April to September.
January - - -	grs. 1·4	} 1·9	grs. 1·9	grs. 1·6	} 1·4	grs. 1·7	grs. 1·3	} 1·3	grs. 1·9	
February - - -	1·9			1·1			1·4			
March - - -	2·5			2·8			1·5			
April - - -	7·2	} 5·6	grs. 6·1	3·9	} 3·5	2·6	2·4	} 3·4	5·8	
May - - -	7·0			3·9			6·4			
June - - -	6·4			3·7			7·2			
July - - -	3·2	} 4·7		1·7	} 2·1		6·9	} 6·5		
August - - -	4·4			0·9			5·5			
September - - -	2·3			1·5			6·8			
October - - -	1·5	} 1·8		1·8	} 1·7		3·5	} 4·3		
November - - -	1·7			1·7			2·5			
December - - -	2·3			1·5			1·3			
Difference between Highest and Lowest		} 5·6	3·7	4·2	3·0	2·1	0·9	5·9	5·2	3·9
Monthly Means.	Seasonal Means.									
Mean for Year -		3·5			2·2			3·9		
Greatest in -		April.			April and May.			June.		
Least in -		January.			August.			January and December.		

BENGAL PRESIDENCY.—9. *Degree of Humidity.*

TABLE CXXXVII., showing the AVERAGE DEGREE of HUMIDITY for every MONTH and QUARTER, as well as for the Periods from October to March, and April to September, with Difference between the Driest and most Humid Months and Seasons, and Mean for the Year, between the Latitudes 20° 18' and 34° 30' N., and between the Longitudes 71° 29' and 92° 46' E., arranged in the order of Latitude, at Stations for the most part in the Presidency of Bengal.

<i>Place</i>	THYET MYO			CALCUTTA			FORT WILLIAM			HAZAREEBAUGH.			
<i>Latitude</i> . . . . .	. 20° 18' N. . . . .			. 22° 34' N. . . . .			. 22° 34' N. . . . .			. 24° 0' N.		
<i>Longitude</i> . . . . .	. 92° 46' E. . . . .			. 88° 25' E. . . . .			. 88° 25' E. . . . .			. 85° 24' E.		
<i>Height</i> . . . . .	. 240 feet . . . . .			. . . . .			. . . . .			. 1,900 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	
	1859.		April to September.	1843 and 1844.		April to September.	1855 to 1859.		April to September.	1858 to 1860.		April to September.	
January - - -	41	} 46	52	70	} 69	72	68	} 66	69	49	} 58	56	
February - - -	32			63			66			53			
March - - -	27			69			67			51			
April - - -	25	} 37	63	70	} 72	82	68	} 69	79	50	} 59	64	
May - - -	58			77			72			76			
June - - -	63			81			80			52			
July - - -	80	} 73		85	} 85		85	} 83		55	} 62		
August - - -	76			90			85			80			
September - - -	76			90			85			75			
October - - -	80	} 75		80	} 83		80	} 78		62	} 62		
November - - -	70			80			70			50			
December - - -	66			74			64			73			
Difference between Most Humid and Least Humid		} 55	38	11	27	14	10	21	17	10	27	4	8
Months. | Seasons.													
Mean for Year -	58			77			74			60			
Most Humid in	July and October.			August and September.			July, August, and September.			May.			
Least Humid in	April.			February.			December.			January.			

BENGAL PRESIDENCY.—9. Degree of Humidity—*continued.*

Place . . . . .	. . . . BENARES . . . .			. . . . KHERWARAH . . . .			. . . . DARJEELING . . . .			. . . . AGRA.		
Latitude. . . . .	. . . . 25° 17' N. . . .			. . . . 26° 42' N. . . .			. . . . 27° 2' N. . . .			. . . . 27° 11' N.		
Longitude . . . . .	. . . . 83° 4' E. . . .			. . . . 79° 12' E. . . .			. . . . 88° 10' E. . . .			. . . . 77° 53' E.		
Height . . . . .	. . . . 270 feet . . . .			. . . . 1,200 feet . . . .			. . . . 7,000 feet . . . .			. . . . 800 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1858 and 1859.		April to September.	1854 to 1858.		April to September.	1857 to 1859.		April to September.	1860.		April to September.
January - - -	52	60	63	67	62	62	77	82	79	45		
February - - -	56			57			85			48		
March - - -	41	44		50	41		80	82		..		
April - - -	36			37			80			..		
May - - -	56	82	70	35	68	58	87	94	90	..		
June - - -	66			49			94			52		
July - - -	95	80		64	69		94	81		52		
August - - -	85			90			94			..		
September - - -	85			72			94			..		
October - - -	90			67			75			..		
November - - -	66			68			74			..		
December - - -	72			63			84			..		
Difference between Most Humid and Least Humid	59	38	7	45	28	4	20	13	11	..	..	..
Months. | Seasons.												
Mean for Year -	67			60			84			..		
Most Humid in	July.			August.			June, July, August, Sept.			..		
Least Humid in	April.			May.			November.					

(continued.)

Place . . . . .	. . . . . MEERUT . . . . .			. . . . . LANDOUR . . . . .			. . . . . PESHAWUR.		
Latitude . . . . .	. . . . . 28° 59' N. . . . .			. . . . . 30° 27' N. . . . .			. . . . . 34° 20' N.		
Longitude . . . . .	. . . . . 77° 46' E. . . . .			. . . . . 78° 10' E. . . . .			. . . . . 71° 29' E.		
Height . . . . .	. . . . . 900 feet . . . . .			. . . . . 7,000 feet . . . . .			. . . . . 1,056 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1859.		April to September.			April to September.			1858 to 1860.	April to September.
January - - -	77	71	74	49	56	56	67	68	66
February - - -	73			65			69		
March - - -	69	54		45	47		77	66	
April - - -	40			42			74		
May - - -	53	67	62	53	75	63	48	57	57
June - - -	59			58			53		
July - - -	77	81		78	67		56	55	
August - - -	64			88			61		
September - - -	80			78			49		
October - - -	84			65			57		
November - - -	78			57			58		
December - - -	62			54			67		
Difference between Most Humid and Least Humid.	44	27	12	46	28	7	29	13	9
Months. | Seasons.									
Mean for Year -	68			61			61		
Most Humid in -	October.			August.			March.		
Least Humid in -	May.			April.			May.		

BENGAL PRESIDENCY.—10. *Sun Temperature.*

TABLE CXXXVIII., showing the Average Sun Temperature for every Month and Season, as well as for the Periods from October to March and April to September, with the Difference between the Hottest and Coldest Months and Seasons, and Mean for the Year, between the Latitudes 22° 34' N. and 34° 20' N., and between the Longitudes 71° 29' E. and 91° 45' E., arranged in the order of Latitude, and for the most part in the Presidency of Bengal.

Place	FORT WILLIAM (CALCUTTA)			. . . CHUNAR . . . .			. . . CHIRRAPOONGEE . .			. . . BENARES.		
Latitude . . . .	. . . 22° 34' N. . . .			. . . 25° 5' N. . . .			. . . 25° 14' N'. . . .			. . . 25° 17' N.		
Longitude . . . .	. . . 88° 25' E. . . .			. . . 83° 0' E. . . .			. . . 91° 45' E. . . .			. . . 83° 4' E.		
Height . . . . .	. . . . .			. . . 250 feet . . . .			. . . 4,118 feet. . . .			. . . 270 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1855 to 1859.		April to September.	1850 to 1859.		April to September.	1859 and 1860.		April to September.	1858 and 1859.		April to September.
January - - -	130	} 129	131	84	} 86	91	70	} 74	75	90	} 93	101
February - - -	132			90			74			97		
March - - -	135	} 135	133	100	} 106	109	77	} 84	87	102	} 116	115
April - - -	135			106			87			118		
May - - -	134	} 131	133	113	} 112	109	88	} 88	87	128	} 113	115
June - - -	133			120			88			114		
July - - -	133	} 134	133	110	} 95	109	91	} 79	87	116	} 113	115
August - - -	126			107			85			110		
September - - -	136	} 134	133	100	} 95	109	82	} 79	87	114	} 113	115
October - - -	136			95			78			116		
November - - -	129			90			77			109		
December - - -	124			85			77			92		
Difference between												
Hottest and Coldest Month.	} 12			} 36			} 21			} 38		
Hottest and Coldest Season.	} 6			} 26			} 14			} 23		
Mean for Year -	132			100			81			109		
Highest in -	September and October.			June.			July.			May.		
Lowest in -	December.			January.			January.			January.		

(continued.)

Place . . . . .	. . . GHAZEEPORE . . .			. . . KHERWARAH . . .			. . . DARJEELING . . .			. . . MEERUT.		
Latitude . . . .	. . . 25° 49' N. . . .			. . . 26° 42' N. . . .			. . . 27° 2' N. . . .			. . . 28° 59' N.		
Longitude . . . .	. . . 80° 48' E. . . .			. . . 79° 12' E. . . .			. . . 88° 18' E. . . .			. . . 77° 46' E.		
Height . . . . .	. . . . .			. . . 1,200 feet . . . .			. . . 7,000 feet . . . .			. . . 900 feet.		
MONTH.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1856 to 1859.		April to Sep- tember.	1854 to 1858.		April to Sep- tember.	1857 to 1859.		April to Sep- tember.	1859.		April to Sep- tember.
January - - -	90	} 93	100	88	} 91	94	91	} 91	94	87	} 85	93
February - - -	99			94			92			85		
March - - -	111	} 119	116	101	} 108	104	101	} 101	102	100	} 109	110
April - - -	121			111			101			109		
May - - -	125	} 113	116	111	} 100	104	102	} 102	102	119	} 110	110
June - - -	119			110			103			113		
July - - -	112	} 107	116	97	} 97	104	104	} 98	102	117	} 100	110
August - - -	108			94			99			99		
September - - -	111	} 107	116	99	} 97	104	102	} 98	102	101	} 100	110
October - - -	109			99			96			103		
November - - -	102	} 107	116	93	} 97	104	96	} 98	102	96	} 100	110
December - - -	90			90			90			84		
Difference between												
Hottest and Coldest Month.	} 35	26	16	23	17	10	14	11	8	35	25	17
Hottest and Coldest Season.												
Mean for Year -	108			99			98			101		
Highest in -	May.			April and May.			July.			May.		
Lowest in -	January and December.			January.			December.			December.		

BENGAL PRESIDENCY.—Sun Temperature—*continued.*

Place	DUDOOPORE			UMBALLA			FEROZEPORE.		
Latitude	30° 12' N.			30° 23' N.			30° 55' N.		
Longitude . . . . .	. . . . .			76° 44' E.			74° 35' E.		
Height . . . . .	. . . . .			1,050 feet			720 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1848.		April to September.	1851 and 1852.		April to September.	1859.		April to September.
January - - -	113	118	127	89	91	99	95	91	98
February - - -	130			95			98		
March - - -	132	142	138	91	103	116	103	116	121
April - - -	151			104			115		
May - - -	143	135	138	113	120	116	130	123	107
June - - -	138			117			125		
July - - -	134	136	138	122	116	116	130	107	107
August - - -	134			122			115		
September - - -	130	136	138	120	116	116	108	107	107
October - - -	139			128			118		
November - - -	138	136	138	100	116	116	96	107	107
December - - -	111			89			79		
Difference between Hottest and Coldest Months.		40	24	39	29	17	51	32	23
Hottest and Coldest Seasons.									
Mean for Year -	133			108			109		
Highest in -	April.			October.			May and July.		
Lowest in -	December.			January and December.			December,		

(continued.)

Place	PUNJAB			SEALKOTE			PESHAWUR.		
Latitude	31° 40' N.			32° 29' N.			34° 20' N.		
Longitude	74° 45' E.			74° 33' E.			71° 29' E.		
Height	800 to 930 feet			900 feet			1,056 feet.		
MONTH.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1857 to 1859.		April to September.	1859.		April to September.	1859 and 1860.		April to September.
January - - -	76	77	86	72	79	90	69	73	101
February - - -	78			78			74		
March - - -	94	100	105	98	111	118	79	101	94
April - - -	98			115			121		
May - - -	109	106	105	120	121	118	102	..	..
June - - -	106			124			112		
July - - -	102	100	105	125	108	118	114	94	94
August - - -	109			114			..		
September - - -	108	100	105	113	108	118	98	94	94
October - - -	101			111			97		
November - - -	90	100	105	99	108	118	87	94	94
December - - -	77			86			75		
Difference between Hottest and Coldest Months.]		33	29	53	42	28	..	..	..
Hottest and Coldest Seasons.									
Mean for Year -	96			106			....	
Highest in -	May and August.			July,			....	
Lowest in -	January.			January.			....	

TABLES showing the MONTHLY, QUARTERLY, HALF-YEARLY and YEARLY FALLS of RAIN at STATIONS in the MADRAS PRESIDENCY, arranged in the order of Latitude.

TABLE CXXXIX., showing the Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain at Stations situated in the Presidency of Madras and the Strait Settlements, between the Latitudes 1° 16' N. and 26° 48' N., and Longitudes 75° 30' E. and 103° 53' E.

<i>Place</i> . . . . .	. . . SINGAPORE . . .			. . . PENANG . . .			. . . PENANG . . .			. . . COLOMBO.		
<i>Latitude</i> . . . .	. . . 1° 16' N. . .			. . . 5° 21' N. . .			. . . 5° 21' N. . .			. . . 6° 57' N.		
<i>Longitude</i> . . . .	. . . 103° 53' E. . .			. . . 100° 25' E. . .			. . . 100° 25' E. . .			. . . 80° 0' E.		
<i>Height</i> . . . . .	. . . About 30 feet . . .			. . . A few feet . . .			. . . A few feet					
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.				
	1859.		April to September.	1833 to 1836.		April to September.	1859.		April to September.	1853 and 1854.		April to September.				
January - -	in. 0'0	} 0'1	in. 4'1	in. 3'3	} 10'1	in. 36'5	in. 1'8	} 9'8	in. 45'1	in. 5'4	} 10'5	in. 28'1				
February - -	0'0						2'6						2'4		2'5	
March - -	0'0	} 5'1	20'9	5'2	} 16'7	46'2	5'7	} 22'8	37'3	2'2	} 38'3	43'6				
April - -	1'3						7'0						6'6		10'6	
May - -	3'8			4'5			10'5			25'5						
June - -	1'6	} 12'6		6'9	} 25'0		2'3	} 8'3		2'0	} 6'7					
July - -	5'6													6'9		4'4		4'2
August - -	5'4			10'2			1'6			0'5	} 16'2					
September - -	3'2	} 7'2		9'7	} 30'9		11'9	} 41'5		0'8						
October - -	1'1												} 8'8	} 30'9	22'6	} 41'5	6'4
November - -	2'9										} 8'8							} 30'9	7'0	} 41'5	9'0
December - -	0'1			4'2			5'6			2'6						
Year - -	25'0	—		—	82'7		—	—		82'4	—		—	71'7	—	—

(continued.)

Place . . . . .	. . . ALLEPY . . .			. . . CAPE COMORIN . . .			. . . VAURIOR . . .			. . . TREVANDRUM.		
Latitude . . . .	. . . . .			. . . 8° 4' N. . . .			. . . . .			. . . 8° 28' N.		
Longitude . . . .	. . . . .			. . . 77° 34' E. . . .			. . . . .			. . . 77° 2' E.		
Height . . . . .	. . . 30 feet . . .			. . . 50 feet . . .			. . . 60 feet . . .			. . . 130 feet.		
MONTH.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.				
	1841 to 1846.		April to Sep- tember.	1843 to 1847.		April to Sep- tember.	1841 to 1846.		April to Sep- tember.	1842 to 1846.		April to Sep- tember.				
January - - -	in. 2·4	in.	in.	in. 0·2	in.	in.	in. 0·9	in.	in.	in. 1·8	in.	in.				
February - - -	1·2	} 6·5	29·6	0·0	} 3·0	16·6	0·4	} 4·2	16·2	0·2	} 6·5	24·7				
March - - -	4·3			0·9			1·1			1·8						
April - - -	3·4	} 33·8	89·9	0·8	} 6·3	11·5	0·4	} 5·5	8·5	3·5	} 15·5	40·0				
May - - -	26·1			4·6			4·0			10·2						
June - - -	26·0	} 53·4		4·6	} 5·7		2·0	} 3·2		13·1	} 22·8					
July - - -	18·2			0·7			1·1			6·4						
August - - -	9·2	} 25·8		0·4	} 13·1		0·1	} 11·8		3·3	} 19·9					
September - - -	7·0			0·4			0·9			3·5						
October - - -	12·8	}		8·8	}		7·3	}		12·3	}					
November - - -	6·0			3·9			3·6			4·1						
December - - -	2·9			2·8			2·9			4·5						
Year - - -	119·5	—		—	28·1		—	—		24·7	—		—	64·7	—	—

MADRAS PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i> . . . . .	. . . PALAMCOTTAH . . .			. . . PALAMCOTTAH . . .			. . . QUILON . . .			. . . COCHIN.		
<i>Latitude</i> . . . . .	. . . 8° 43' N.. . .			. . . 8° 43' N.. . .			. . . 8° 53' N.. . .			. . . 9° 11' N.		
<i>Longitude</i> . . . . .	. . . 77° 48' E.. . .			. . . 77° 48' E.. . .			. . . 76° 39' E.. . .			. . . 76° 0' E.		
<i>Height</i> . . . . .	. . . 120 feet . . .			. . . 120 feet . . .			. . . 40 feet . . .			. . . 4 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	6 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	6 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.
	1842 to 1846.			1855 to 1859.			1841 to 1846.			1841 to 1846.		
January - -	in. 1·3	} 6·0	in. 17·0	in. 4·1	} 13·5	in. 58·3	in. 0·9	} 2·9	in. 18·6	in. 0·7	} 4·2	in. 18·2
February - -	1·3		17·0	1·2		58·3	0·3		18·6	0·0		18·2
March - -	1·9	} 5·6	5·0	5·2	} 34·5	32·7	1·9	} 21·9	67·2	2·0	} 23·0	86·8
April - -	1·3			20·1			3·5			3·2		
May - -	2·4	9·2		16·5	17·8							
June - -	0·3	} 0·3		1·1	} 1·2		17·9	} 43·9		30·7	} 61·0	
July - -	0·0			0·0			19·9			17·3		
August - -	0·0	0·1		6·1	13·0							
September - -	1·0	} 10·1		2·2	} 41·8		3·3	} 17·1		4·8	} 16·8	
October - -	4·9			14·3			9·9			9·7		
November - -	4·2	25·3		3·9	2·3							
December - -	3·4	8·2		1·7	3·5							
Year - -	22·0	—		—	91·0		—	—		85·8	—	

(continued.)

Place . . . . .	. . . SHENKOTTAH . . .			. . . TRICHINOPOLY . . .			. . . COIMBATORE . . .			. . . DODABETTA.		
Latitude . . . . .	. . . 9° 17' N.. . .			. . . 10° 20' N.. . .			. . . 11° 0' N.. . .			. . . 11° 25' N.		
Longitude . . . . .	. . . 78° 10' E.. . .			. . . 77° 10' E.. . .			. . . 77° 1' E.. . .			. . . 77° 25' E.		
Height . . . . .	. . . . .			. . . 250 feet . . .			. . . . .			. . . 8,640 feet.		
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	7 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.				
	1842 to 1846.		April to September.	1842 to 1848.		April to September.	1844 to 1846.		April to September.	1847 and 1848.		April to September.				
January - -	in. 1·3	in. } 4·6	in. 20·3	in. 2·0	in. } 6·7	in. 15·4	in. 0·7	in. } 3·9	in. 9·7	in. 0·1	in. } 19·8	in. 47·8				
February - -	0·3	} 7·4	16·9	0·2	} 4·6	15·2	0·2	} 3·1	10·9	7·4	} 28·3	53·5				
March - -	1·6			0·5			0·8			3·6						
April - -	2·2	} 9·3		1·4	} 5·8		0·5	} 3·3		19·8	} 31·9					
May - -	3·6			2·7			1·8			4·9						
June - -	4·3	} 15·9		1·3	} 13·5		1·5	} 10·3		4·6	} 12·3					
July - -	3·9			2·6			1·6			7·4						
August - -	1·1	} 3·0		1·9	} 4·5		0·2	} 3·0		9·3	} 3·0					
September - -	1·8			5·3			5·3			7·5						
October - -	8·2	} 3·0		5·6	} 3·0		4·5	} 3·0		12·5	} 3·0					
November - -	5·9			2·6			0·5			11·9						
December - -	3·0			4·5			3·0			12·3						
Year - -	37·2	—	—	30·6	—	—	20·6	—	—	101·3	—	—				

MADRAS PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i> . . .	. . . ANJARAKANDY . . .			. . . CANNANORE . . .			. . . CANNANORE . . .			. . . MERCARA.		
<i>Latitude.</i> . . .	. . . 11° 40' N. . .			. . . 11° 52' N. . .			. . . 11° 52' N. . .			. . . 12° 24' N.		
<i>Longitude.</i> . . .	. . . 75° 40' E. . .			. . . 75° 30' E. . .			. . . 75° 30' E. . .			. . . 75° 48' E.		
<i>Height</i> . . .	. . . . .			. . . 15 feet . . .			. . . 15 feet . . .			. . . 4,500 feet.		
MONTH.	14 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	7 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	10 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.
	1810 to 1823.			1842 to 1848.			1850 to 1859.			1838 to 1840.		
January - -	in. 0·0	in. } 1·3	in. 10·3	in. 0·5	in. } 2·2	in. 12·0	in. 0·1	in. } 2·0	in. 15·2	in. 0·0	in. } 0·6	in. 8·1
February - -	0·1	} 8·4	10·3	0·1	} 18·2	12·0	0·2	} 17·5	15·2	0·4	} 11·5	8·1
March - -	0·3			0·6			0·3			1·5		
April - -	1·2	} 92·5	112·9	5·1	} 84·1	108·3	2·8	} 84·9	107·3	2·6	} 113·3	135·2
May - -	6·9			12·5			14·4			7·4		
June - -	31·1	} 21·0	112·9	38·0	} 15·8	108·3	34·7	} 18·1	107·3	30·4	} 16·9	135·2
July - -	38·9			29·0			34·9			55·9		
August - -	22·5	} 21·0	112·9	17·1	} 15·8	108·3	15·3	} 18·1	107·3	27·0	} 16·9	135·2
September - -	12·3			6·6			5·2			11·9		
October - -	6·2	} 21·0	112·9	7·5	} 15·8	108·3	10·3	} 18·1	107·3	4·6	} 16·9	135·2
November - -	2·5			1·7			2·6			1·4		
December - -	1·2	} 21·0	112·9	1·6	} 15·8	108·3	1·7	} 18·1	107·3	0·2	} 16·9	135·2
Year - -	123·2	—	—	120·3	—	—	122·5	—	—	143·3	—	—

(continued.)

<i>Place</i> . . .	. . . MERGUI . . .			. . . BANGALORE . . .			. . . ST. THOMAS'S MOUNT . . .			. . . POONAMALLEE.		
<i>Latitude.</i> . . .	. . . 12° 27' N. . .			. . . 12° 57' N. . .			. . . 13° 0' N. . .			. . . 13° 2' N.		
<i>Longitude</i> . . .	. . . 98° 42' E. . .			. . . 77° 38' E. . .			. . . 80° 15' E. . .			. . . 80° 10' E.		
<i>Height</i> . . .	. . . 200 feet . . .			. . . 3,000 feet . . .			. . . 60 feet . . .			. . . . .
MONTH.	7 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	7 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.
	1853 to 1859.			1859.			1842 to 1848.			1847 and 1848.		
January - -	in. 4·0	in. } 7·0	in. 37·0	in. 0·0	in. } 0·1	in. 4·1	in. 1·9	in. } 10·6	in. 29·6	in. 0·0	in. } 10·7	in. 35·9
February - -	1·0	} 20·0	37·0	0·0	} 5·1	4·1	0·3	} 3·2	29·6	0·1	} 1·8	35·9
March - -	2·0			0·0			0·4			0·0		
April - -	3·0	} 90·0	128·0	1·3	} 12·6	20·9	0·3	} 5·6	12·1	1·3	} 34·7	16·1
May - -	15·0			3·8			2·5			0·5		
June - -	24·0	} 48·0	128·0	1·6	} 7·2	20·9	0·9	} 22·3	12·1	1·9	} 34·7	16·1
July - -	36·0			5·6			2·3			2·2		
August - -	30·0	} 48·0	128·0	5·4	} 7·2	20·9	2·4	} 22·3	12·1	5·7	} 34·7	16·1
September - -	20·0			3·2			3·7			4·5		
October - -	24·0	} 48·0	128·0	1·1	} 7·2	20·9	8·4	} 22·3	12·1	10·3	} 34·7	16·1
November - -	4·0			2·9			10·2			15·9		
December - -	2·0	} 48·0	128·0	0·1	} 7·2	20·9	8·4	} 22·3	12·1	9·6	} 34·7	16·1
Year - -	165·0	—	—	25·0	—	—	41·7	—	—	52·0	—	—

MADRAS PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

Place . . .	POONAMALLEE . . .			FORT ST. GEORGE . . .			MADRAS . . .			MADRAS.		
Latitude . . .	13° 2' N. . . .			13° 4' N. . . .			13° 6' N. . . .			13° 6' N.		
Longitude . . .	80° 10' E. . . .			80° 14' E. . . .			80° 21' E. . . .			80° 21' E.		
Height . . .	. . . . .			. . . . .			. . . . .			. . . . .
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	31 Years.	Winter, Spring, Summer, Autumn.	October to March.	23 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1855 to 1859.		April to September.	1811 to 1841.		April to September.	1822 to 1844.		April to September.	1845 to 1850.		April to September.
January - -	in. 0·1	in. } 4·9	in. 30·2	in. 1·2	in. } 5·9	in. 21·8	in. 1·3	in. } 4·8	in. 27·7	in. 1·1	in. } 11·9	in. 37·3
February - -	0·1	} 3·7	18·4	0·1	} 2·2	15·8	0·2	} 2·0	16·8	0·8	} 2·6	17·7
March - -	0·0			0·7			0·4			0·0		
April - -	1·2	} 10·2	18·4	0·4	} 10·0	15·8	0·6	} 10·4	16·8	1·5	} 12·1	17·7
May - -	2·5			1·1			1·0			1·1		
June - -	2·1	} 29·8	18·4	1·5	} 29·5	15·8	2·0	} 27·3	16·8	3·1	} 28·4	17·7
July - -	5·1			3·7			3·2			4·0		
August - -	3·0	} 29·8	18·4	4·8	} 29·5	15·8	5·2	} 27·3	16·8	5·0	} 28·4	17·7
September - -	4·5			4·3			4·8			3·0		
October - -	11·7	} 29·8	18·4	11·1	} 29·5	15·8	10·1	} 27·3	16·8	13·0	} 28·4	17·7
November - -	13·6			14·1			12·4			12·4		
December - -	4·7	} 29·8	18·4	4·6	} 29·5	15·8	3·3	} 27·3	16·8	10·0	} 28·4	17·7
Year - -	48·6	—	—	47·6	—	—	44·5	—	—	55·0	—	—

(continued.)

Place . . .	TAVOY . . .			TAVOY . . .			NELLORE . . .			HURRYHUR.		
Latitude . . .	14° 7' N. . . .			14° 7' N. . . .			14° 20' N. . . .			14° 31' N.		
Longitude . . .	98° 18' E. . . .			98° 18' E. . . .			80° 0' E. . . .			75° 51' E.		
Height . . .	12 feet			12 feet			50 feet			1,831 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	11 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1831.		April to September.	1849 to 1859.		April to September.	1859 and 1860.		April to September.	1857 to 1859.		April to September.
January - -	in. 0·0	in. } 0·0	in. 24·5	in. 0·3	in. } 2·8	in. 15·6	in. 0·6	in. } 2·6	in. 39·0	in. 0·0	in. } 0·0	in. 0·7
February - -	0·0	} 23·3	185·0	1·8	} 32·6	185·0	0·0	} 2·4	21·1	0·0	} 1·1	3·1
March - -	0·0			1·2			0·0			0·1		
April - -	0·0	} 133·0	185·0	3·2	} 122·9	185·0	1·5	} 15·3	21·1	0·6	} 2·0	3·1
May - -	23·3			28·2			0·9			0·4		
June - -	36·4	} 53·2	185·0	41·3	} 42·3	185·0	1·5	} 39·8	21·1	0·8	} 0·7	3·1
July - -	57·4			43·0			8·7			0·3		
August - -	39·2	} 53·2	185·0	38·6	} 42·3	185·0	5·1	} 39·8	21·1	0·9	} 0·7	3·1
September - -	28·7			30·7			3·4			0·1		
October - -	24·5	} 53·2	185·0	10·2	} 42·3	185·0	4·3	} 39·8	21·1	0·5	} 0·7	3·1
November - -	0·0			1·4			32·1			0·1		
December - -	0·0	} 53·2	185·0	0·7	} 42·3	185·0	2·0	} 39·8	21·1	0·0	} 0·7	3·1
Year - -	209·5	—	—	200·6	—	—	60·1	—	—	3·8	—	—

MADRAS PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i> . . . . .	. . . KURNOOL . . .			. . . MASULIPATAM . . .			. . . GUNTOOR . . .			. . . BELLARY.		
<i>Latitude</i> . . . . .	. . . 15° 50' N. . .			. . . 16° 10' N. . .			. . . 16° 20' N. . .			. . . 17° 0' N.		
<i>Longitude</i> . . . . .	. . . 78° 5' E. . .			. . . 81° 13' E. . .			. . . 80° 30' E. . .			. . . 77° 0' E.		
<i>Height</i> . . . . .	. . . 800 feet . . .			. . . . .			. . . 100 feet . . .			. . . 1,500 feet.		
MONTH.	3 Years.	Winter, Spring, Summer, Autumn	October to March.	7 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	19 Years.	Winter, Spring, Summer, Autumn.	October to March.				
	1857 to 1859.		April to Sep- tember.	1842 to 1848.		April to Sep- tember.	1855 to 1859.		April to Sep- tember.	1841 to 1859.		April to Sep- tember.				
January - -	in. 0·0	in. 0·0	in. 13·1	in. 0·2	in. 3·7	in. 11·8	in. 0·0	in. 1·0	in. 11·0	in. 0·2	in. 0·6	in. 8·3				
February - -	0·0	} 10·8	58·8	1·6	} 2·4	22·0	0·0	} 8·0	30·5	0·0	} 4·1	13·4				
March - -	0·0			0·3			0·9			1·0						
April - -	2·7	} 40·0		0·2	} 14·0		2·5	} 17·7		1·0	} 6·5					
May - -	8·1			1·9			4·6			2·1						
June - -	14·4	} 21·1		4·5	} 13·7		4·1	} 14·8		1·8	} 10·5					
July - -	17·2			4·6			5·9			3·0						
August - -	8·4	} 15·3		4·9	} 10·4		7·7	} 9·7		3·0	} 26·8					
September - -	8·0			5·9			5·7			3·8						
October - -	8·7	} 10·5		6·7	} 8·3		7·0	} 6·5		5·6	} 4·1					
November - -	4·4			1·1			2·1			1·1						
December - -	0·0	} 8·3		1·9	} 0·6		1·0	} 0·0		0·4	} 0·2					
Year - -	71·9			—			—			33·8			—	—	41·5	—

(continued.)

<i>Place</i> . . . . .	. . . SAMULCOTTAH . . .			. . . SECUNDERABAD . . .			. . . SECUNDERABAD . . .			. . . VIZAGAPATAM.		
<i>Latitude</i> . . . . .	. . . 17° 4' N. . .			. . . 17° 28' N. . .			. . . 17° 28' N. . .			. . . 17° 41' N.		
<i>Longitude</i> . . . . .	. . . 82° 14' E. . .			. . . 78° 32' E. . .			. . . 78° 32' E. . .			. . . 83° 21' E.		
<i>Height</i> . . . . .	. . . 50 feet . . .			. . . 1,800 feet . . .			. . . 1,800 feet					
MONTH.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.				
	1857 to 1859.		April to September.	1843 and 1844.		April to September.	1850 to 1859.		April to September.	1847 and 1848.		April to September.				
January - -	in. 0·0	in. } 0·5	in. 11·2	in. 2·3	in. } 2·4	in. 10·5	in. 0·4	in. } 1·8	in. 8·4	in. 0·0	in. } 0·7	in. 21·0				
February - -	0·0	} 4·5	31·7	0·0	} 9·7	32·1	0·6	} 2·9	18·9	0·0	} 5·0	20·9				
March - -	1·0			3·8			0·5			0·0						
April - -	2·5	} 22·6		0·1	} 20·1		0·7	} 12·9		3·1	} 9·4					
May - -	1·0			5·8			1·7			1·9						
June - -	6·1	} 15·3		0·4	} 10·4		3·3	} 9·7		3·8	} 26·8					
July - -	10·0			13·7			4·8			2·1						
August - -	6·5	} 8·3		6·0	} 8·3		4·8	} 6·5		3·5	} 4·1					
September - -	5·6			6·1			3·6			6·5						
October - -	9·7	} 0·2		4·3	} 0·6		4·6	} 0·0		15·8	} 0·2					
November - -	0·0			0·0			1·5			4·5						
December - -	0·5	} 0·0		0·1	} 0·0		0·8	} 0·0		0·7	} 0·0					
Year - -	42·9			—			—			42·6			—	—	27·3	—

MADRAS PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i>	VIZAGAPATAM			DAPOOLEE			TONGHOO.					
<i>Latitude</i>	17° 41' N.			18° 33' N.			18° 57' N.					
<i>Longitude</i>	83° 21' E.			72° 2' E.			96° 30' E.					
<i>Height</i> . . . . .	. . . . .			900 feet			300 feet.				
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.			
	1859.		April to September.	1844 to 1847.		April to September.	1859.		April to September.			
January - -	in. 0·6	} 1·7	in. 16·4	in. 0·0	} 0·0	in. 2·4	in. 0·0	} 0·1	in. 7·8			
February - -	1·0			0·0			0·0					
March - -	0·7	} 3·5	12·6	0·0	} 4·2	117·1	1·9	} 10·7	61·8			
April - -	0·7			2·9			2·4					
May - -	2·1	} 13·6		1·3	} 98·7		6·4	} 43·7				
June - -	3·3			34·3			16·8					
July - -	5·3	} 20·2		46·4	} 16·6		12·0	} 15·1				
August - -	5·0			18·0			14·9					
September - -	6·2	} 15·1		14·2	} 16·6		9·3					
October - -	11·0			1·5			4·7					
November - -	3·0	} 0·1		0·9			1·1					
December - -	0·1			0·0			0·1					
Year - -	39·0	—	—	119·5	—	—	69·6	—	—			

(continued.)

<i>Place</i>	TANNA			BERHAMPORE			RANGOON (British Burmah).					
<i>Latitude</i>	19° 11' N.			19° 20' N.			26° 48' N.					
<i>Longitude</i>	73° 6' E.			84° 50' E.			96° 10' E.					
<i>Height</i> . . . . .	. . . . .			112 feet					
MONTH.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.			
	1844 to 1847.		April to September.	1859 and 1860.		April to September.	1852 and 1853.		April to September.			
	in.	in.	in.	in.	in.	in.	in.	in.	in.			
January - -	0·0	} 0·0	0·0	0·0	} 6·0	8·5	0·0	} 0·2	0·4			
February - -	0·0			0·1			0·0					
March - -	0·0	} 0·0	105·4	0·0	} 0·0	24·5	0·2	} 9·1	23·9			
April - -	0·0			0·0			0·9					
May - -	0·0	} 90·1		0·0	} 17·4		8·0	} 15·0				
June - -	34·3			0·0			15·0					
July - -	38·4	} 90·1		10·3	} 17·4		0·0	} 0·0				
August - -	17·4			7·1			0·0					
September - -	15·3	} 15·3		7·1	} 9·6		0·0					
October - -	0·0			2·4			0·0					
November - -	0·0	} 0·1		0·1			0·0					
December - -	0·0			5·9			0·2					
Year - -	105·4	—	—	33·0	—	—	24·3	—	—			

TABLES showing the MONTHLY, QUARTERLY, HALF-YEARLY, and YEARLY FALLS of RAIN at STATIONS in the BOMBAY PRESIDENCY, arranged in the order of Latitude.

TABLE CXL., showing the Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain at Stations situated between the Latitudes 15° 8' N. and 26° 20' N., and Longitudes 67° 2' E. and 77° 28' E., principally in the Presidency of Bombay.

Place . . . . .	. . . BELLARY . . .			. . . VINGORLA . . .			. . . DHARWAR . . .			. . . DHARWAR.		
Latitude . . . .	. . . 15° 8' N. . . .			. . . 15° 50' N. . . .			. . . 15° 50' N. . . .			. . . 15° 50' N.		
Longitude . . . .	. . . 76° 59' E. . . .			. . . 73° 41' E. . . .			. . . 75° 10' E. . . .			. . . 75° 10' E.		
Height . . . . .	. . . 1,500 feet . . .			. . . 20 feet . . . .			. . . 2,482 feet . . .			. . . 2,482 feet.		
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1841 and 1842.		April to September.	1856 to 1859.		April to September.	1844 to 1847.		April to September.	1859 and 1860.		April to September.
January - - -	in. 0·0	} 0·0	in. 4·0	in. 0·0	} 0·0	in. 3·0	in. 0·0	} 0·2	in. 8·8	in. 0·0	} 0·0	in. 2·5
February - - -	0·0			0·0			0·0			0·0		
March - - -	0·0	} 3·0		0·0	} 17·1		0·8	} 4·6		0·3	} 7·7	
April - - -	2·1			0·4			0·9			2·0		
May - - -	0·9	} 8·4	17·9	16·7	} 92·1	115·4	2·9	} 20·5	27·4	5·4	} 19·1	
June - - -	3·6			29·0			6·1			1·6		
July - - -	0·9	} 10·5		40·9	} 9·2		4·7	} 10·9		11·8	} 5·0	29·3
August - - -	3·9			22·2			9·7			5·7		
September - - -	6·5	} 10·5		6·2	} 9·2		3·1	} 10·9		2·8	} 5·0	
October - - -	3·8			2·9			3·5			1·5		
November - - -	0·2	} 10·5		0·1	} 9·2		4·3	} 10·9		0·7	} 5·0	
December - - -	0·0			0·0			0·2			0·0		
Year - - -	21·9	—	—	118·4	—	—	36·2	—	—	31·8	—	—

(continued.)

Place . . . . .	. . . BELGAUM . . .			. . . BELGAUM . . .			. . . SAWUNT WAREE . .			. . . KULLADGHEE.		
Latitude . . . .	. . . 15° 52' N. . . .			. . . 15° 52' N. . . .			. . . 15° 56' N. . . .			. . . 16° 11' N.		
Longitude . . . .	. . . 74° 42' E. . . .			. . . 74° 42' E. . . .			. . . 74° 1' E. . . .			. . . 75° 33' E.		
Height . . . . .	. . . 2,260 feet . . .			. . . 2,260 feet . . .			. . . . .			. . . 1,750 feet.		
MONTH.	8 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1841 to 1847.		April to September.	1858 and 1859.		April to September.	1848 and 1849.		April to September.	1855 to 1859.		April to September.
January - - -	in. 0·0	} 0·0	in. 8·1	in. 0·0	} 0·0	in. 9·2	in. 0·0	} 0·0	in. 2·9	in. 0·1	} 0·5	in. 7·9
February - - -	0·0			0·0			0·0			0·0		
March - - -	0·8	} 7·6		0·6	} 9·3		0·0	} 2·2		0·1	} 5·4	
April - - -	3·5			2·4			0·0			1·5		
May - - -	3·3	} 30·6	41·9	6·3	} 34·1	46·1	2·2	} 109·7	128·4	3·8	} 7·0	16·4
June - - -	7·6			8·9			32·2			1·6		
July - - -	14·8	} 11·8		15·8	} 11·9		48·3	} 19·4		2·9	} 11·4	
August - - -	8·2			9·4			29·2			2·5		
September - - -	4·5	} 11·8		2·3	} 11·9		16·5	} 19·4		4·1	} 11·4	
October - - -	4·9			6·3			2·6			6·7		
November - - -	2·4	} 11·8		2·3	} 11·9		0·3	} 19·4		0·6	} 11·4	
December - - -	0·0			0·0			0·0			0·4		
Year - - -	50·0	—	—	55·0	—	—	131·3	—	—	24·3	—	—

BOMBAY PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

Place	SOORAPORE			KOLAPORE			KOLAPORE			RUTNAGHERRY.		
Latitude . . . . .	.16° 32' N. . . . .			.16° 42' N. . . . .			.16° 42' N. . . . .			.17° 0' N.		
Longitude . . . . .	.76° 52' E. . . . .			.74° 18' E. . . . .			.74° 18' E. . . . .			.73° 20' E.		
Height . . . . .	. . . . .			.1,797 feet . . . . .			.1,797 feet . . . . .			.150 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1847.		April to September.	1847.		April to September.	1850 to 1859.		April to September.	1844 to 1847.		April to September.
January - -	in. 0·0	} 0·0	in. 0·0	in. 0·0	} 0·0	in. 8·1	in. 0·4	} 0·5	in. 6·3	in. 0·0	} 0·0	in. 47·9
February - -	0·0		0·0	0·0			0·0			0·0		
March - -	0·0	} 0·0	34·2	0·0	} 0·0		0·6	} 5·6		0·0	} 1·4	
April - -	0·0			0·0			1·4			0·0		
May - -	0·0	} 25·4	34·2	0·0	} 11·8	12·6	3·6	} 23·6	33·2	1·4	} 93·4	106·0
June - -	8·1			1·6			6·6			41·6		
July - -	9·0	} 8·8		6·4	} 8·9		11·9	} 9·8		36·0	} 59·1	
August - -	8·3			3·8			5·1			15·8		
September - -	8·8	} 8·8		0·8	} 8·9		4·6	} 9·8		11·2		
October - -	0·0			4·7			4·5			45·4		
November - -	0·0	} 8·8		3·4	} 8·9		0·7	} 9·8		2·5	} 59·1	
December - -	0·0			0·0			0·1			0·0		
Year - -	34·2	..	..	20·7	..	..	39·5	..	..	153·9	..	..

(continued.)

Place	RUTNAGHERRY			JHUTT			SHOLAPORE			PUNDIPORE.		
Latitude . . . . .	.17° 0' N. . . . .			.17° 1' N. . . . .			.17° 40' N. . . . .			.17° 40' N.		
Longitude . . . . .	.73° 20' E. . . . .			.75° 16' E. . . . .			.76° 0' E. . . . .			.75° 24' E.		
Height . . . . .	.150 feet . . . . .			. . . . .			.1,821 feet . . . . .			....
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	11 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1855 to 1859.		April to September.	1848.		April to September.	1850 to 1860.		April to September.	1848.		April to September.
January - -	in. 0·0	} 0·0	in. 4·3	in. 0·0	} 0·0	in. 4·4	in. 0·1	} 1·1	in. 7·5	in. 0·0	} 0·0	in. 10·9
February - -	0·0			0·0			0·5			0·0		
March - -	0·0	} 2·2	94·6	0·0	} 1·6		0·3	} 4·5		0·0	} 0·8	
April - -	0·0			0·0			1·9			0·0		
May - -	6·8	} 78·7	94·6	1·6	} 10·5	16·0	2·3	} 14·2	25·2	0·8	} 14·6	17·7
June - -	28·2			3·1			3·7			2·0		
July - -	32·7	} 13·4		4·8	} 8·3		4·3	} 12·9		4·4	} 15·2	
August - -	17·8			2·6			6·2			6·2		
September - -	9·1	} 13·4		3·9	} 8·3		6·8	} 12·9		4·3	} 15·2	
October - -	3·8			2·2			4·7			8·4		
November - -	0·5	} 13·4		2·2	} 8·3		1·4	} 12·9		2·5	} 15·2	
December - -	0·0			0·0			0·5			0·0		
Year - -	98·9	..	..	20·4	..	..	32·7	..	..	28·6	..	..

BOMBAY PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—continued.

Place . . . . .	. . . SATTARA . . .			. . . SATTARA . . .			. . . DAPOOLEE . . .			. . . MALCOLM PAIT.		
Latitude . . . .	. . . 17° 40' N. . .			. . . 17° 40' N. . .			. . . 17° 48' N. . .			. . . 17° 56' N. . .		
Longitude . . . .	. . . 74° 2' E. . .			. . . 74° 2' E. . .			. . . 73° 16' E. . .			. . . 73° 41' E. . .		
Height . . . . .	. . . 2,320 feet . . .			. . . 2,320 feet . . .			. . . 600 feet . . .			. . . . .
MONTH.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1844 to 1847.		April to September.	1855 to 1859.		April to September.	1858 and 1859.		April to September.	1820.		April to September.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - - -	0·9	} 0·8	7·3	0·6	} 1·2	6·6	0·0	} 0·0	4·3	0·0	} 0·0	0·0
February - - -	0·1			0·0			0·0			0·0		
March - - -	0·1	} 4·4		0·1	} 4·4		0·0	} 3·8		0·0	} 0·0	
April - - -	3·0			1·0			0·1			0·0		
May - - -	1·3	} 21·2	30·0	3·3	} 25·2	32·6	3·7	} 97·1	118·0	0·0	} 158·8	196·4
June - - -	7·5			5·0			26·3			53·6		
July - - -	10·4	} 10·9		13·1	} 8·4		41·5	} 21·4		43·6	} 37·6	
August - - -	3·3			7·1			29·3			61·6		
September - - -	4·5	} 37·6		3·1	} 0·0		17·1	} 0·0		37·6	} 0·0	
October - - -	3·7			4·7			4·0			0·0		
November - - -	2·7	} 0·0		0·6	} 0·0		0·3	} 0·0		0·0	} 0·0	
December - - -	0·7			0·6			0·0			0·0		
Year - - -	37·3	..		39·2	..	..	122·3	..	..	196·4	..	..

(continued.)

Place . . . . .	. . . MALCOLM PAIT . . .			. . . MAHABLESHWUR . . .			. . . PHULTUN . . .			. . . POORUNDHUR.		
Latitude . . . .	. . . 17° 56' N. . .			. . . 17° 59' N. . .			. . . 17° 59' N. . .			. . . 18° 12' N. . .		
Longitude . . . .	. . . 73° 41' E. . .			. . . 73° 30' E. . .			. . . 74° 31' E. . .			. . . 73° 54' E. . .		
Height . . . . .	. . . . .			. . . 4,500 feet . . .			. . . . .			. . . 4,200 feet. . .		
MONTH.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	15 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1842 to 1847.		April to September.	1829 to 1843.		April to September.	1846 to 1848.		April to September.			April to September.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - - -	0·4	} 0·5	6·3	0·0	} 0·2	7·0	0·0	} 0·8	8·1	0·1	} 1·8	9·2
February - - -	0·0			0·2			0·0			0·3		
March - - -	1·7	} 6·2		0·1	} 4·7		0·2	} 5·4		0·2	} 6·4	
April - - -	2·3			1·3			1·8			0·5		
May - - -	2·2	} 255·4		3·3	} 246·8		3·4	} 13·9		5·7	} 63·1	
June - - -	48·6			46·5			3·2			10·2		
July - - -	100·2	} 117·1		92·1	} 210·9		1·8	} 5·5		23·0	} 49·5	
August - - -	68·3			72·3			0·5			16·3		
September - - -	33·8	} 37·9		31·3	} 38·0		2·2	} 9·3		7·4	} 14·6	
October - - -	2·4			4·6			2·7			6·5		
November - - -	1·7	} 0·0		2·1	} 0·0		4·4	} 0·0		0·7	} 0·0	
December - - -	0·1			0·0			0·8			1·4		
Year - - -	261·7	..	..	253·8	..	..	21·0	..	..	72·3	..	..

BOMBAY PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

Place . . . . .	. . . POONA . . . .			. . . POONA . . . .			. . . POONA . . . .			. . . ALIBAUGH.		
Latitude . . . .	. . . 18° 30' N. . . .			. . . 18° 30' N. . . .			. . . 18° 30' N. . . .			. . . 18° 40' N.		
Longitude . . . .	. . . 74° 0' E. . . .			. . . 74° 0' E. . . .			. . . 74° 0' E. . . .			. . . 72° 58' E.		
Height . . . . .	. . . 1,800 feet . . . .			. . . 1,800 feet . . . .			. . . 1,800 feet . . . .			. . . . .
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	8 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1826 to 1830.			1842 to 1849.			1856 to 1860.			1845.		
January - - -	in. 0·5	in. } 0·8	in. 5·1	in. 0·0	in. } 0·0	in. 2·1	in. 0·3	in. } 0·3	in. 10·8	in. 0·0	in. } 0·0	in. 0·0
February - - -	0·0	} 2·0	17·7	0·0	} 2·4	19·9	0·0	} 5·7	27·6	0·0	} 0·0	67·2
March - - -	0·0			0·0			1·3			0·0		
April - - -	0·2	} 13·4	17·7	0·8	} 15·1	19·9	0·6	} 18·7	27·6	0·0	} 58·8	67·2
May - - -	1·8			1·6			3·8			0·0		
June - - -	5·7	} 6·6	17·7	5·0	} 4·5	19·9	2·8	} 13·7	27·6	29·7	} 8·4	67·2
July - - -	5·5			7·3			8·6			19·1		
August - - -	2·2	} 8·3	17·7	2·8	} 12·4	19·9	7·3	} 12·9	27·6	10·0	} 7·7	67·2
September - - -	2·3			2·4			4·5			8·4		
October - - -	3·4	} 8·4	17·7	1·2	} 8·4	19·9	3·7	} 8·4	27·6	0·0		67·2
November - - -	0·9			0·9			5·5			0·0		
December - - -	0·3	} 8·4	17·7	0·0	} 8·4	19·9	0·0	} 8·4	27·6	0·0		
Year - - -	22·8	..	..	22·0	..	..	38·4	..	..	67·2	..	..

(continued.)

Place . . . . .	. . . SEROOR . . . .			. . . BOMBAY. . . .			. . . BOMBAY . . . .			. . . NASSIK.		
Latitude . . . .	. . . 18° 50' N. . . .			. . . 18° 53' N. . . .			. . . 18° 53' N. . . .			. . . 20° 0' N.		
Longitude . . . .	. . . 77° 25' E. . . .			. . . 72° 52' E. . . .			. . . 72° 52' E. . . .			. . . 73° 47' E.		
Height . . . . .	. . . 1,752 feet . . . .			. . . . .			. . . . .			. . . . .
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	34 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	12 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	4 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1854 to 1858.			1817 to 1850.			1847 to 1858.			1844 to 1847.		
January - - -	in. 0·1	in. } 0·4	in. 5·2	in. 0·0	in. } 0·0	in. 1·3	in. 0·1	in. } 0·2	in. 3·9	in. 0·0	in. } 0·0	in. 4·8
February - - -	0·3	} 4·2	15·9	0·0	} 0·0	75·9	0·0	} 1·1	65·7	0·0	} 0·0	23·8
March - - -	0·4			0·0			0·0			0·0		
April - - -	0·9	} 8·2	15·9	0·0	} 0·0	75·9	0·1	} 56·5	65·7	0·0	} 16·9	23·8
May - - -	2·9			0·0			1·0			0·0		
June - - -	3·7	} 8·3	15·9	22·1	} 63·8	75·9	23·4	} 12·9	65·7	6·8	} 7·7	23·8
July - - -	3·0			24·9			24·0			6·7		
August - - -	1·5	} 8·3	15·9	16·8	} 12·4	75·9	9·1	} 12·9	65·7	3·4	} 7·7	23·8
September - - -	3·9			11·1			10·1			2·9		
October - - -	3·7	} 8·4	15·9	1·3	} 8·4	75·9	2·1	} 8·4	65·7	3·3	} 8·4	23·8
November - - -	0·7			0·0			0·7			1·5		
December - - -	0·0	} 8·4	15·9	0·0	} 8·4	75·9	0·1	} 8·4	65·7	0·0		
Year - - -	21·1	..	..	76·2	..	..	68·7	..	..	28·6	..	..

BOMBAY PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

Place . . . . .	. . . AURUNGABAD . . .			. . . MULLIGAUM . . .			. . . DHOOOLIA . . .			. . . KAMPTEE.		
Latitude . . . .	. . . 19° 30' N. . .			. . . 20° 32' N. . .			. . . 20° 54' N. . .			. . . 21° 16' N.		
Longitude . . . .	. . . 75° 30' E. . .			. . . 74° 30' E. . .			. . . 74° 45' E. . .			. . . 79° 14' E.		
Height . . . . .	. . . . .			. . . 1,300 feet . . .			. . . 1,000 feet					
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.				
	1848.		April to September.	1860 ?		April to September.	1853 to 1858.		April to September.	1843.		April to September.				
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.				
January - -	0·0	} 0·0	2·9	0·0	} ..	..	0·0	} 0·5	14·4	4·3	} 4·3	9·9			
February - -	0·0			0·0			0·2			0·0						
March - - -	0·0	} 5·8	41·2	0·0	} ..	..	0·6	} 3·4	69·9	2·2	} 2·5	31·9			
April - - -	0·1			0·1			0·5			0·0						
May - - -	5·7	} 17·1		0·6	} ..		2·3	} 46·2		0·3	} 24·2					
June - - -	7·9			4·9			15·3			0·8						
July - - -	6·8	} 21·2	..	2·6	} ..	..	21·4	} 34·2	..	18·8	} 10·8	..			
August - - -	2·4			0·9			9·5			4·6						
September - -	18·3	} 4·7	..	0·0	} ..	..	20·9	} ..	..	7·4	} ..	..			
October - - -	1·0			0·0			13·3			3·4						
November - - -	1·9	} ..		0·0	} ..		0·0	} ..		0·0	} ..					
December - -	0·0			0·0			0·3			0·0						
Year - - -	44·1	..	..	9·1	..	..	84·3	..	..	41·8	..	..		

(continued.)

Place . . . . .	. . . . BARODA . . . .			. . . . BARODA . . . .			. . . . RAJCOOTE . . . .			. . . . AHMEDABAD.		
Latitude . . . .	. . . . 22° 16' N. . . .			. . . . 22° 16' N. . . .			. . . . 22° 18' N. . . .			. . . . 23° 0' N.		
Longitude . . . .	. . . . 73° 14' E. . . .			. . . . 73° 14' E. . . .			. . . . 70° 50' E. . . .			. . . . 72° 0' E.		
Height . . . . .	. . . . 90 feet . . . .			. . . . 90 feet . . . .			. . . . 450 feet . . . .			. . . . 320 feet.		
MONTH.	7 Years.	Winter, Spring, Summer, Autumn.	October to March.	11 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.			
	1847 to 1853.		April to September.	1837 to 1847.		April to September.	1857 to 1860.		April to September.	1843.		April to September.			
January - - -	in. 0·0	} 0·2	in. .	in. 0·0	} 0·0	in. .	in. 0·0	} 0·0	in. .	in. 0·0	} 0·0	in. .			
February - - -	0·1		0·7	0·0		1·0	0·0		0·0	0·0					
March - - -	0·1	} 0·7	35·2	0·0	} 1·0	33·1	0·0	} 0·0	26·6	0·0	} 2·0	16·0			
April - - -	0·0			0·0			0·0			0·0					
May - - -	0·6	} 30·3	..	1·0	} 26·3		0·0	} 21·4		2·0	} 14·0				
June - - -	6·3			6·2			4·2			4·2					
July - - -	15·9	} 4·7	..	13·2	} 6·8	..	8·3	} 5·2	..	7·6	} 0·0	..			
August - - -	8·1			6·9			8·9			2·2					
September - - -	4·3	} ..	..	5·8	} ..	..	5·2	} ..	..	0·0	} ..	..		
October - - -	0·4			1·0			0·0			0·0					
November - - -	0·0	} ..	..	0·0	} ..	..	0·0	} ..	..	0·0	} ..	..		
December - - -	0·1			0·0			0·0			0·0					
Year - - -	35·9	..	..	34·1	..	..	26·6	..	..	16·0	..	..	

BOMBAY PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i>	<i>. . . AHMEDABAD . . .</i>			<i>. . . AHMEDNUGGUR . . .</i>			<i>. . . AHMEDNUGGUR . . .</i>			<i>KOTRI near HYDERABAD.</i>					
<i>Latitude . . .</i>	<i>. . . 23° 0' N. . . .</i>			<i>. . . 23° 34' N. . . .</i>			<i>. . . 23° 34' N. . . .</i>			<i>. . . 23° 54' N.</i>					
<i>Longitude . . .</i>	<i>. . . 72° 0' E. . . .</i>			<i>. . . 73° 1' E. . . .</i>			<i>. . . 73° 1' E. . . .</i>			<i>. . . 68° 46' E.</i>					
<i>Height</i>	<i>. . . 320 feet . . .</i>			<i>. . . 1,900 feet . . .</i>			<i>. . . 1,900 feet . . .</i>			<i>....</i>					
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	6 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.			
	1858 and 1859.		April to Sep- tember.	1844 to 1847.		April to Sep- tember.	1854 to 1859.		April to Sep- tember.	1845 to 1849.		April to Sep- tember.			
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.			
January - -	0·0	} 0·0	0·0	0·0	} 0·3	3·0	0·1	} 0·7	6·7	0·0	} 0·0	0·1			
February - -	0·0			0·2			0·0			0·0					
March - - -	0·0	} 0·0	0·0	0·6	} 5·5	21·9	0·2	} 2·7	19·4	0·1	} 0·5	1·7			
April - - -	0·0			0·8			0·2			0·0					
May - - -	0·0	} 25·3	31·3	4·1	} 10·3		2·3	} 10·5		0·4	} 1·3				
June - - -	1·8			5·1			4·3			1·3					
July - - -	15·9	} 6·0	6·0	3·1	} 8·8	8·8	2·1	} 12·2	12·2	0·0	} 0·0	0·0			
August - - -	7·6			2·1			4·1			0·0					
September - -	6·0	} 6·0	6·0	6·7	} 8·8		6·4	} 12·2		0·0	} 0·0	0·0			
October - - -	0·0			0·2			5·2			0·0					
November - -	0·0	} 6·0	6·0	1·9	} 8·8		0·6	} 12·2		0·0	} 0·0	0·0			
December - -	0·0			0·1			0·6			0·0					
Year - - -	31·3	..	..	24·9	..	..	26·1	..	..	1·8	..	..	

(continued.)

<i>Place</i>	<i>. . . NEEMUCH . . .</i>			<i>. . . MOUNT ABOO . . .</i>			<i>. . . KURRACHEE . . .</i>			<i>. . . DEESA.</i>		
<i>Latitude</i>	<i>. . . 24° 27' N. . . .</i>			<i>. . . 24° 45' N. . . .</i>			<i>. . . 24° 51' N. . . .</i>			<i>. . . 25° 14' N.</i>		
<i>Longitude</i>	<i>. . . 74° 54' E. . . .</i>			<i>. . . 72° 49' E. . . .</i>			<i>. . . 67° 2' E. . . .</i>			<i>. . . 72° 5' E.</i>		
<i>Height</i>	<i>. . . 1,476 feet . . .</i>			<i>. . . 4,000 feet . . .</i>			<i>. . . 27 feet</i>			<i>. . . 400 feet.</i>		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1860.		April to Sep- tember.	1855 to 1859.		April to Sep- tember.	1856 to 1860.		April to Sep- tember.	1857 to 1859.		April to Sep- tember.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	0·0	} 0·6	0·8	0·8	} 1·0	1·0	0·4	} 0·9	0·9	0·6	} 0·8	0·8
February - -	0·3			0·2			0·3			0·2		
March - -	0·0	} 0·3		0·0	} 0·6		0·0	} 0·0		0·0	} 0·0	
April - -	0·0			0·3			0·3			0·0		
May - -	0·3	} 29·2	33·3	0·3	} 52·2	63·7	0·0	} 3·3	3·7	0·0	} 18·6	23·8
June - -	1·7			10·3			0·0			3·8		
July - -	11·8	} 4·0	4·0	25·9	} 9·9		1·8	} 0·4	0·4	8·6	} 5·2	5·2
August - -	15·7			17·0			1·5			6·2		
September - -	3·8	} 4·0	4·0	9·9	} 9·9		0·4	} 0·4	0·4	5·2	} 5·2	5·2
October - -	0·2			0·0			0·0			0·0		
November - -	0·0	} 4·0	4·0	0·0	} 9·9		0·0	} 0·4	0·4	0·0	} 5·2	5·2
December - -	0·3			0·0			0·2			0·0		
Year - -	34·1	..	..	64·7	..	..	4·6	..	..	24·6	..	..

BOMBAY PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i>	HYDERABAD			BIJAPORE			NUSSEERABAD.					
<i>Latitude</i>	25° 30' N.			26° 2' N.			26° 20' N.					
<i>Longitude</i>	69° 5' E.			77° 28' E.			74° 50' E.					
<i>Height</i>	99 feet						1,500 feet.					
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.			
	1856 and 1857.		April to September.	1848.		April to September.	1859 and 1860.		April to September.			
	in.	in.	in.	in.	in.	in.	in.	in.	in.			
January - -	0·6	} 1·1	1·1	0·0	} 0·0	8·4	0·0	} 0·9	0·9			
February - -	0·5			0·0			0·9					
March - -	0·0	} 0·6	19·4	0·0	} 0·0	17·0	0·0	} 0·4	14·9			
April - -	0·6			0·0			0·0					
May - -	0·0	} 16·7		0·0	} 13·0		0·4	} 14·2				
June - -	0·0			0·8			0·3					
July - -	1·9	} 2·1		3·7	} 12·4		6·1	} 0·3				
August - -	14·8			8·5			7·8					
September - -	2·1	} 0·3		4·0	}		0·3					
October - -	0·0			4·6			0·0					
November - -	0·0			3·8			0·0					
December - -	0·0			0·0			0·0					
Year - -	20·5	..	..	25·4	..	..	15·8	..	..	

TABLES showing the MONTHLY, QUARTERLY, HALF-YEARLY, and YEARLY FALLS OF RAIN at Stations in the BENGAL PRESIDENCY, arranged in the order of Latitude.

TABLE CXLI., showing the Monthly, Quarterly, Half-yearly, and Yearly FALLS OF RAIN at Stations situated between the Latitudes 19° 48' N. and 34° 20' N., and Longitudes 71° 29' E. and 92° 56' E., for the most part in the PRESIDENCY of BENGAL.

<i>Place</i>	POREE, or JUGGERNAUT.			AKBAR			THULET MYO			CUTTACK.					
<i>Latitude</i>	19° 48' N.			20° 8' N.			20 18' N.			20° 29' N.					
<i>Longitude</i>	85° 49' E.			92° 56' E.			92° 46' E.			85° 54' E.					
<i>Height</i> . . . . .	. . . . .			. . . . .			240 feet . . . . .			....		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.			
	1851.		April to Sep- tember.	1851.		April to Sep- tember.	1859.		April to Sep- tember.	1851.		April to Sep- tember.			
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.			
January - -	0·0	..	..	0·0	} 2·5	16·6	0·0	} 0·4	7·5	0·1	} 0·1	12·1	
February - -	0·4	..	..	0·0			0·0			0·0			
March - -	0·0	..	..	0·0	} 11·0	138·4	0·3	} 3·1	41·8	0·3	} 2·7	38·1	
April - -	1·0	..	..	0·0			0·5			1·6			
May - -	0·5	..	..	11·3	} 109·5		2·3	} 33·2		0·8	} 29·6		
June - -	4·5	..	..	59·5			16·5			7·3			
July - -	14·3	..	..	22·4	} 31·7		6·9	} 11·6		10·2	} 17·8		
August - -	7·4	..	..	27·6			9·8			12·1			
September - -	4·4	..	..	17·6	}		4·8	}		6·1	}		
October - -	{ blown down.	..	..	14·1			6·8			11·7			
November - -	..	..	..	0·0			0·0			0·0		
December - -	..	..	..	2·5			0·4			0·0		
Year - -	..	..	..	155·0	..	..	48·3	..	..	50·2	..	..	

BENGAL PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

Place	BHOORE			SEETABULDEE			NAGPORE			BALASORE.		
Latitude	20° 56' N.			21° 10' N.			21° 10' N.			21° 31' N.		
Longitude	79° 3' E.			79° 9' E.			79° 10' E.			86° 58' E.		
Height	2,350 feet			939 feet . . . . .			....			....
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	7 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1848.			1858 to 1860.			1826 to 1832.			1851.		
January - - -	0·0	in. } 0·0	in. 5·7	0·0	in. } 2·0	in. 3·1	0·4	in. } 2·4	in. 7·9	0·5	in. } 0·8	in. 11·3
February - - -	0·0	} 2·1		0·9	} 3·2		0·8	} 1·9		0·3	} 4·7	
March - - -	0·0			0·2			1·2			1·2		
April - - -	0·0	} 20·8	23·8	2·2	} 29·3	43·4	0·1	} 31·9	40·7	3·4	} 12·7	19·6
May - - -	2·1			0·8			0·6			0·1		
June - - -	2·4	} 6·6		3·8	} 12·0		10·7	} 4·1		3·2	} 13·7	
July - - -	13·2			13·1			11·5			5·9		
August - - -	5·2	} 0·0		12·4	} 0·0		9·7	} 0·0		3·6	} 0·0	
September - - -	0·9			11·1			8·1			3·4		
October - - -	1·5	} 0·0		0·9	} 0·0		3·4	} 0·0		9·1	} 0·0	
November - - -	4·2			0·0			0·9			0·2		
December - - -	0·0	} 0·0		1·1	} 0·0		1·2	} 0·0		0·0	} 0·0	
Year - - -	29·5	..	..	46·5	..	..	48·6	..	..	30·9	..	..

(continued.)

Place	BAITOU			CHITTAGONG			MIDNAPORE			CALCUTTA.		
Latitude	21° 51' N.			22° 20' N.			22° 25' N.			22° 34' N.		
Longitude	77° 58' E.			91° 47' E.			87° 19' E.			88° 25' E.		
Height . . . . .	. . . . .			. . . . .			. . . . .			80 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	15 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1859.			1851.			1851.			1836 to 1850.		
January - - -	0·0	in. } 0·0	in. 0·2	0·0	in. } 2·3	in. 13·1	0·3	in. } 0·5	in. 9·4	0·4	in. } 1·3	in. 7·1
February - - -	0·0	} 1·2		1·9	} 10·0		0·2	} 3·2		0·6	} 6·8	
March - - -	0·0			0·0			1·5			0·8		
April - - -	0·0	} 26·9	31·8	2·5	} 47·0	73·3	1·7	} 11·6	13·3	1·9	} 34·7	49·7
May - - -	1·2			7·5			0·0			4·1		
June - - -	3·5	} 3·9		25·9	} 27·1		3·1	} 7·4		10·6	} 4·6	
July - - -	14·5			13·1			4·4			10·6		
August - - -	8·9	} 0·0		8·0	} 0·0		4·1	} 0·0		13·5	} 0·0	
September - - -	3·7			16·3			0·0			9·0		
October - - -	0·0	} 0·0		10·8	} 0·0		7·4	} 0·0		4·0	} 0·0	
November - - -	0·2			0·0			0·0			1·0		
December - - -	0·0	} 0·0		0·4	} 0·0		0·0	} 0·0		0·3	} 0·0	
Year - - -	32·0	..	..	86·4	..	..	22·7	..	..	56·8	..	..

BENGAL PRESIDENCY.—Monthly, Quarterly, Haly-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i>	<i>. . FORT WILLIAM . .</i>			<i>. . . BURISAU . .</i>			<i>. . . HOSINGABAD . .</i>			<i>. . . HOOGLY.</i>		
<i>Latitude</i>	<i>. . . 22° 34' N. . .</i>			<i>. . . 22° 35' N. . .</i>			<i>. . . 22° 44' N. . .</i>			<i>. . . 22° 58' N.</i>		
<i>Longitude</i>	<i>. . . 88° 25' E. . .</i>			<i>. . . 90° 17' E. . .</i>			<i>. . . 77° 44' E. . .</i>			<i>. . . 88° 26' E.</i>		
<i>Height</i>	<i>. . . 18 feet . . .</i>			<i>.</i>			<i>.</i>			<i>.</i>		
<i>MONTH.</i>	<i>5 Years.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>
	<i>1855 to 1859.</i>		<i>April to September.</i>	<i>1851.</i>		<i>April to September.</i>	<i>1849.</i>		<i>April to September.</i>	<i>1851.</i>		<i>April to September.</i>
	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>
January - -	0·3	} 0·7	7·7	0·0	} 2·5	23·7	1·5	} 1·5	1·5	1·0	} 1·6	11·6
February - -	0·4			2·5			0·0			0·6		
March - -	1·6	} 9·2		0·0	} 4·3		0·0	} 0·8		0·0	} 2·1	
April - -	1·6			3·2			0·1			2·1		
May - -	6·0	} 40·2	57·4	1·1	} 59·6	70·8	0·7	} 9·1	9·9	0·0	} 19·6	24·4
June - -	10·9			20·7			9·1			5·8		
July - -	14·1	} 15·0		17·9	} 28·1		0·0	} 0·0		9·6	} 12·7	
August - -	15·2			21·0			0·0			4·2		
September - -	9·6			6·9			0·0			2·7		
October - -	5·4			21·2			0·0			10·0		
November - -	0·0			0·0			0·0			0·0		
December - -	0·0			0·0			0·0			0·0		
Year - -	65·1	..	..	94·5	..	..	11·4	..	..	36·0	..	..

(continued.)

<i>Place</i>	<i>. . . JESSORE . . .</i>			<i>. . . JUBBLEPORE . .</i>			<i>. . . BURDWAN . .</i>			<i>. . . BANCOORAH.</i>		
<i>Latitude</i>	<i>. . . 23° 9' N. . .</i>			<i>. . . 23° 9' N. . .</i>			<i>. . . 23° 13' N. . .</i>			<i>. . . 23° 13' N.</i>		
<i>Longitude</i>	<i>. . . 89° 10' E. . .</i>			<i>. . . 79° 59' E. . .</i>			<i>. . . 87° 52' E. . .</i>			<i>. . . 87° 6' E.</i>		
<i>Height</i>	<i>.</i>			<i>.</i>			<i>.</i>			<i>.</i>		
<i>MONTH.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>
	<i>1851.</i>		<i>April to September.</i>	<i>1851.</i>		<i>April to September.</i>	<i>1851.</i>		<i>April to September.</i>	<i>1851.</i>		<i>April to September.</i>
	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>
January - -	0·4	} 0·4	7·5	0·5	} 1·4	3·1	0·3	} 1·4	7·9	0·9	} 1·8	5·8
February - -	0·0			0·9			1·1			0·9		
March - -	0·0	} 4·4		0·0	} 0·5		0·3	} 0·7		1·1	} 6·3	
April - -	3·9			0·0			0·4			4·2		
May - -	0·5	} 22·9	32·7	0·5	} 27·1	35·8	0·0	} 17·3	20·3	1·0	} 15·9	25·2
June - -	8·6			6·0			3·3			4·4		
July - -	9·9	} 12·5		17·2	} 9·9		8·8	} 7·8		8·8	} 7·0	
August - -	4·4			3·9			5·2			2·7		
September - -	5·4			8·2			2·6			4·1		
October - -	7·1			1·3			5·6			2·9		
November - -	0·0			0·4			0·6			0·0		
December - -	0·0			0·0			0·0			0·0		
Year - -	40·2	..	..	38·9	..	..	28·2	..	..	31·0	..	..

BENGAL PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

Place	KISHNUGHUR			TIPPERAGH			DACCA			BEERBHOOM		
Latitude	23° 24' N.			23° 27' N.			23° 43' N.			23° 44' N.		
Longitude	88° 22' E.			91° 5' E.			90° 23' E.			87° 34' E.		
Height . . . . .	. . . . .			. . . . .			22 feet . . . . .			....
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.
	1851.			1851.			1851.			1851.		
January - -	in. 2·5	in. 3·7	in. 6·2	in. 0·8	in. 2·0	in. 15·5	in. 0·7	in. 1·7	in. 14·4	in. 0·0	in. 1·8	in. 6·7
February - -	1·2			1·2			1·0			0·6		
March - -	0·0			0·0			0·0			1·2		
April - -	2·6	2·6		5·5	8·6		4·3	7·0		2·5	3·7	
May - -	0·0			3·1			2·7			0·0		
June - -	4·1		51·5	19·5		80·5	18·8		54·6	3·5		25·4
July - -	23·0	37·9		16·1	60·9		13·8	42·9		11·3	30·2	
August - -	10·8			25·3			10·3			5·4		
September - -	11·0			11·0			4·7			2·7		
October - -	2·5	13·5		13·5	24·5		12·7	17·4		4·9	7·6	
November - -	0·0			0·0			0·0			0·0		
December - -	0·0			0·0			0·0			0·0		
Year - -	57·7	..	..	96·0	..	..	69·0	..	..	32·1	..	..

(continued.)

Place	HAZAREEBAUGH			HAZAREEBAUGH			BERILAMPORE			MOORSHEDABAD		
Latitude	24° 0' N.			24° 0' N.			24° 5' N.			24° 11' N.		
Longitude	85° 24' E.			85° 24' E.			88° 17' E.			88° 13' E.		
Height	1,900 feet			1,900 feet			76 feet			76 feet		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to Sep- tember.
	1851.			1858 to 1860.			1857 to 1859.			1851.		
January - -	in. 0·0	in. 1·0	in. 3·1	in. 0·0	in. 2·9	in. 11·4	in. 0·1	in. 0·8	in. 6·2	in. 0·2	in. 1·9	in. 9·0
February - -	1·0			1·3			0·5			1·7		
March - -	0·4			2·0			0·5			0·0		
April - -	0·4	1·3		0·7	6·8		1·4	8·0		2·3	4·9	
May - -	0·5			4·1			6·1			2·6		
June - -	8·8		29·0	12·1		61·5	6·9		43·6	4·6		31·5
July - -	7·9	22·4		15·5	44·2		13·6	30·2		10·7	23·0	
August - -	5·7			16·6			9·7			7·7		
September - -	5·7			12·5			5·9			3·6		
October - -	0·9	7·4		6·5	19·0		4·9	10·8		7·1	10·7	
November - -	0·8			0·0			0·0			0·0		
December - -	0·0			1·6			0·2			0·0		
Year - -	32·1	..	..	72·9	..	..	49·8	..	..	40·5	..	..

BENGAL PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i>	<i>. . . . BAULIAH</i>			<i>. . . . MYMENSING</i>			<i>. . . . CACHAR</i>			<i>. . . . SYLHET.</i>		
<i>Latitude</i>	<i>. . . . 24° 23' N. . . .</i>			<i>. . . . 24° 49' N. . . .</i>			<i>. . . . 24° 48' N. . . .</i>			<i>. . . . 24° 53' N.</i>		
<i>Longitude</i>	<i>. . . . 88° 33' E. . . .</i>			<i>. . . . 90° 24' E. . . .</i>			<i>. . . . 92° 47' E. . . .</i>			<i>. . . . 91° 50' E.</i>		
<i>Height</i>	<i>.</i>			<i>.</i>			<i>.</i>			<i>.</i>		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1851.			1851.			1851.			1851.		
January - - -	in. 0·0	in. 0·6	in. 4·3	in. 0·8	in. 4·0	in. 15·2	in. 0·0	in. 0·5	in. 13·8	in. 0·3	in. 5·2	in. 27·8
February - - -	0·6			3·2			0·0			4·5		
March - - -	0·2			0·5			0·0			2·2		
April - - -	0·2	0·7		5·3	13·1		12·1	39·9		19·3	64·9	
May - - -	0·3			7·3			27·8			43·4		
June - - -	6·9		27·3	35·3		94·8	15·4		89·1	39·7		182·1
July - - -	11·6	23·4		20·0	75·7		15·6	39·9		33·5	101·5	
August - - -	4·9			20·4			8·9			28·3		
September - -	3·4			6·5			9·3			17·9		
October - - -	3·3	6·9		10·7	17·2		11·3	22·6		20·4	38·3	
November - - -	0·2			0·0			2·0			0·0		
December - - -	0·0			0·0			0·5			0·4		
Year - - -	31·6	..	..	110·0	..	..	102·9	..	..	209·9	..	..

(continued.)

<i>Place</i>	<i>. . . . GYAH</i>			<i>. . . . UTTRA MULLAY</i>			<i>. . . . CHUNAR</i>			<i>. . . . BH AUGULPORE.</i>		
<i>Latitude</i>	<i>. . . . 24° 48' N. . . .</i>			<i>. . . . 24° 55' N. . . .</i>			<i>. . . . 25° 5' N. . . .</i>			<i>. . . . 25° 14' N.</i>		
<i>Longitude</i>	<i>. . . . 85° 3' E. . . .</i>			<i>. . . . 85° 20' E. . . .</i>			<i>. . . . 83° 0' E. . . .</i>			<i>. . . . 87° 0' E.</i>		
<i>Height</i>	<i>.</i>			<i>. . . . 4,600 feet</i>			<i>. . . . 250 feet</i>			<i>.</i>		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	3 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	10 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1851.			1844 to 1846.			1850 to 1859.			1851.		
January - - -	in. 0·3	in. 1·6	in. 4·6	in. 4·3	in. 22·5	in. 102·3	in. 0·5	in. 3·3	in. 7·1	in. 0·8	in. 2·3	in. 10·2
February - - -	1·3			0·2			1·5			1·5		
March - - -	0·0			4·9			0·8			0·0		
April - - -	0·0	0·0		3·6	28·2		0·5	1·8		0·8	1·6	
May - - -	0·0			19·7			0·5			0·8		
June - - -	3·3		20·1	37·0		127·6	10·0		43·0	10·5		32·4
July - - -	9·3	15·9		36·7	97·2		14·0	36·0		14·4	28·4	
August - - -	3·3			23·5			12·0			3·5		
September - -	4·2			7·1			6·0			2·4		
October - - -	2·5	7·2		50·2	82·0		2·5	9·0		7·9	10·3	
November - - -	0·5			24·7			0·5			0·0		
December - - -	0·0			18·0			1·3			0·0		
Year - - -	24·7	..	..	229·9	..	..	50·1	..	..	42·6	..	..

BENGAL PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

Place	CHIRRAPOONGEE			CHIRRAPOONGEE . . . . .			. . . . . BENARES . . . . .			. . . . . BENARES.		
Latitude	25° 16' N.			25° 16' N.			25° 18' N.			25° 18' N.		
Longitude	91° 44' E.			91° 44' E.			83° 3' E.			83° 3' E.		
Height.	4,500 feet.			4,500 feet.			270 feet			270 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	2 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1851.			1859 and 1860.			1851.			1858 and 1859.		
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - - -	0·8	3·8	45·4	0·0	1·8	22·3	2·3	3·9	8·4	1·2	1·4	4·5
February - - -	3·0			1·8			1·6			0·1		
March - - -	1·3			3·0			0·7			0·1		
April - - -	27·6	143·1		15·9	28·4		0·0	0·7		0·3	0·4	
May - - -	115·2			9·5			0·0			0·0		
June - - -	147·2		565·0	243·3		593·0	6·3		28·7	8·9		33·0
July - - -	99·4	350·5		143·3	489·7		7·1	13·0		6·7	21·5	
August - - -	103·9			103·1			5·6			5·9		
September - - -	71·7			77·9			9·7			11·2		
October - - -	40·3	112·0		17·5	95·4		3·8	13·5		2·0	14·2	
November - - -	0·0			0·0			0·0			1·0		
December - - -	0·0			0·0			0·0			0·1		
Years - - -	610·4	..	..	615·3	..	..	37·1	..	..	37·5	..	..

(continued.)

Place . . . . .	. . . . . MONGHYR . . . . .			. . . . . DINAJEPORE . . . . .			. . . . . DINAPORE . . . . .			. . . . . RUNGPORE.		
Latitude	25° 27' N.			25° 37' N.			25° 37' N.			25° 43' N.		
Longitude	86° 43' E.			88° 41' E.			85° 5' E.			89° 15' E.		
Height . . . . .	. . . . .			. . . . .			. . . . .			. . . . .
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1851.			1851.			1851.			1851.		
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - - -	0·9	2·1	8·9	0·8	1·6	8·4	1·8	2·8	6·6	1·1	1·2	4·9
February - - -	1·2			0·8			1·0			0·1		
March - - -	0·2			0·3			2·0			0·5		
April - - -	0·0	1·6		0·7	3·5		0·0	2·0		3·7	13·9	
May - - -	1·4			2·5			0·0			9·7		
June - - -	8·2		27·8	12·5		38·3	4·5		24·5	23·9		69·7
July - - -	6·7	18·3		12·7	31·9		3·7	15·0		11·7	50·0	
August - - -	3·4			6·7			6·8			14·4		
September - - -	8·1			3·2			7·5			6·3		
October - - -	6·6	14·7		6·5	9·7		3·8	11·3		3·2	9·5	
November - - -	0·0			0·0			0·0			0·0		
December - - -	0·0			0·0			0·0			0·0		
Years - - -	36·7	..	..	46·7	..	..	31·1	..	..	74·6	..	..

BENGAL PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i>	<i>. . . PURNEAH . . .</i>			<i>. . . GHAZEEPORE . . .</i>			<i>. . . GHAZEEPORE . . .</i>			<i>. . . AZINGHUR.</i>		
<i>Latitude</i>	<i>. . . 25° 48' N. . . .</i>			<i>. . . 25° 49' N. . . .</i>			<i>. . . 25° 49' N. . . .</i>			<i>. . . 26° 3' N.</i>		
<i>Longitude</i>	<i>. . . 87° 33' E. . . .</i>			<i>. . . 80° 48' E. . . .</i>			<i>. . . 80° 48' E. . . .</i>			<i>. . . 83° 13' E.</i>		
<i>Height</i>	<i>.</i>			<i>.</i>			<i>.</i>			<i>.</i>		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	4 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1851.		April to September.	1851.		April to September.	1856 to 1859.		April to September.	1851.		April to September.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - - -	2·1	5·4	10·7	1·7	3·1	9·7	0·8	2·9	7·8	3·8	4·9	12·7
February - - -	3·3			1·4			1·7			1·1		
March - - -	1·5	4·2	42·7	0·6	0·6	26·0	0·4	1·3	39·5	0·6	1·4	27·3
April - - -	2·0			0·0			0·4			0·8		
May - - -	0·7	36·7	20·3	0·0	20·3	14·4	0·5	30·4	39·5	0·0	17·0	27·3
June - - -	9·8			8·4			7·4			4·5		
July - - -	15·1	7·1	11·7	6·2	11·7	8·2	8·6	12·7	12·7	8·7	16·7	27·3
August - - -	11·8			5·7			14·4			3·8		
September - - -	3·3	7·1	11·7	5·7	11·7	8·2	8·2	12·7	12·7	9·5	16·7	27·3
October - - -	3·8			6·0			4·2			7·2		
November - - -	0·0	7·1	11·7	0·0	11·7	8·2	0·3	12·7	12·7	0·0	16·7	27·3
December - - -	0·0			0·0			0·4			0·0		
Year - - -	53·4	..	..	35·7	..	..	47·3	..	..	40·0	..	..

(continued.)

<i>Place</i>	<i>. . . TIRHOOT . . .</i>			<i>. . . HUMEERPORE . . .</i>			<i>. . . GWALPOORAH . . .</i>			<i>. . . GOWAHUTTEE.</i>		
<i>Latitude</i>	<i>. . . 26° 7' N. . . .</i>			<i>. . . 26° 7' N. . . .</i>			<i>. . . 26° 11' N. . . .</i>			<i>. . . 26° 11' N.</i>		
<i>Longitude</i>	<i>. . . 85° 26' E. . . .</i>			<i>. . . 79° 47' E. . . .</i>			<i>. . . 90° 40' E. . . .</i>			<i>. . . 91° 47' E.</i>		
<i>Height</i>	<i>.</i>			<i>.</i>			<i>.</i>			<i>.</i>		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1851.		April to September.	1851.		April to September.	1851.		April to September.	1851.		April to September.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - - -	3·8	5·2	10·6	1·5	2·3	3·0	0·7	1·4	11·2	0·5	1·5	7·0
February - - -	1·4			0·8			0·7			0·5		
March - - -	0·9	0·9	22·8	0·0	0·3	34·9	1·0	26·3	104·9	1·4	13·6	45·8
April - - -	0·0			0·3			10·2			5·6		
May - - -	0·0	19·3	29·8	0·0	29·8	17·9	15·1	72·2	72·2	6·6	30·5	45·8
June - - -	3·5			6·7			42·6			16·6		
July - - -	8·5	8·0	5·8	12·6	5·8	7·4	17·9	16·2	16·2	9·4	7·2	45·8
August - - -	7·3			10·5			11·7			4·5		
September - - -	3·5	8·0	5·8	4·8	5·8	8·8	7·4	16·2	16·2	3·1	7·2	45·8
October - - -	4·5			0·7			8·8			3·7		
November - - -	0·0	8·0	5·8	0·0	5·8	0·0	0·0	16·2	16·2	0·4	7·2	45·8
December - - -	0·0			0·0			0·0			0·5		
Year - - -	33·4	..	..	37·9	..	..	116·1	..	..	52·8	..	..

BENGAL PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

Place	TEZPORE			BATTICOTTE			KHERWARAH			ITAWAH		
Latitude	26° 36' N. . . .			26° 40' N. . . .			26° 42' N. . . .			26° 45' N. . . .		
Longitude	92° 50' E. . . .			91° 59' E. . . .			79° 12' E. . . .			79° 3' E. . . .		
Height							1,200 feet . . . .			. . . .
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1851.		April to September.	1847 and 1848.		April to September.	1854 to 1858.		April to September.	1851.		April to September.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - - -	0·0	2·2	7·3	1·5	11·0	42·4	0·0	0·0	0·8	2·8	3·5	3·8
February - - -	1·9			1·2			0·0			0·6		
March - - -	2·1	16·0	56·3	1·1	9·1	14·5	0·0	0·0	26·7	0·0	0·4	28·1
April - - -	4·3			6·5			0·0			0·1		
May - - -	9·6	37·9	21·5	1·5	3·9	32·9	0·0	20·2	7·3	0·3	6·5	6·5
June - - -	16·8			0·9			4·0			0·9		
July - - -	4·5	7·5	8·3	1·3	15·2	15·1	12·3	7·3	0·1	11·4		
August - - -	16·6			1·7			3·9			9·2		
September - - -	4·5	0·0	0·0	2·6	0·0	0·0	6·5	0·0	0·0	6·2		
October - - -	3·0			15·2			0·8			0·3		
November - - -	0·0	0·3	0·1	15·1	8·3	27·5	0·0	..	..	0·0		
December - - -	0·3			8·3			0·0			0·1		
Year - - -	63·6	..	..	56·9	..	..	27·5	..	..	31·9	..	..

(continued.)

Place	GORUCKPORE			ENTESHWUR			DARJEELING			DARJEELING		
Latitude	26° 46' N. . . .			26° 46' N. . . .			27° 3' N. . . .			27° 3' N. . . .		
Longitude	83° 22' E. . . .			79° 5' E. . . .			88° 18' E. . . .			88° 18' E. . . .		
Height							7,000 feet			7,000 feet		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1851.		April to September.	1848.		April to September.	1851.		April to September.	1857 to 1859.		April to September.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - - -	3·6	3·8	15·6	0·0	0·0	2·5	3·5	6·0	19·5	0·0	3·0	12·9
February - - -	0·2			0·0			2·4			2·5		
March - - -	0·2	1·7	46·1	0·0	2·6	35·2	4·0	14·3	105·8	1·8	14·4	109·6
April - - -	0·1			0·0			4·6			4·1		
May - - -	1·4	34·7	21·5	2·6	30·8	4·3	6·7	29·1	0·1	8·5	22·3	22·3
June - - -	15·6			6·0			31·0			20·9		
July - - -	14·1	0·0	0·0	19·8	0·2	0·0	27·2	0·1	0·5	30·1		
August - - -	5·0			5·0			16·7			31·8		
September - - -	9·9	0·0	0·0	1·8	0·0	0·0	19·6	0·1	0·1	14·2		
October - - -	11·6			2·3			9·4			7·7		
November - - -	0·0	0·0	0·0	0·2	0·0	0·0	0·1	0·1	0·1	0·4		
December - - -	0·0			0·0			0·1			0·5		
Year - - -	61·7	..	..	37·7	..	..	125·3	..	..	122·5	..	..

BENGAL PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i> . . . . .	. . . FUTTIGHUR . . .			. . . FUTTIGHUR . . .			. . . AGRA . . .			. . . DEBROGHUR.		
<i>Latitude</i> . . . . .	. . . 27° 23' N. . .			. . . 27° 23' N. . .			. . . 27° 10' N. . .			. . . 27° 31' N.		
<i>Longitude</i> . . . . .	. . . 79° 30' E. . .			. . . 79° 30' E. . .			. . . 78° 5' E. . .			. . . 95° 1' E.		
<i>Height</i> . . . . .	. . . 600 feet . . .			. . . 600 feet . . .			. . . 800 feet . . .			. . . . .
MONTH.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1848 and 1849.		April to September.	1851.		April to September.	1851.		April to September.	1851.		April to September.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	0·9	} 1·2	4·1	4·9	} 5·6	6·7	1·2	} 2·3	2·9	0·6	} 6·1	26·1
February - -	0·0			0·7			1·1			5·5		
March - -	0·0	} 0·0		0·6	} 1·0		0·0	} 0·9		2·3	} 26·2	
April - -	0·0			0·1			0·2			9·4		
May - -	0·0			0·3			0·7			14·5		
June - -	2·7	} 10·6	21·3	3·2	} 24·0	30·6	0·3	} 20·1	25·0	12·8	} 44·9	80·8
July - -	2·5			15·4			9·8			13·7		
August - -	5·4	} 13·6		5·4	} 6·7		10·0	} 4·6		18·4	} 29·7	
September - -	10·7			6·3			4·0			12·0		
October - -	2·9			0·4			0·6			17·7		
November - -	0·0	} 0·0		0·0	} 0·0		0·0	} 0·0		0·0	} 0·0	
December - -	0·3			0·0			0·0			0·0		
Year - -	25·4	..	..	37·3	..	..	27·9	..	..	106·9	..	..

(continued.)

<i>Place</i> . . . . .	. . . DELHI . . .			. . . MEERUT . . .			. . . NYNEE TAL . . .			. . . ROORKEE.		
<i>Latitude</i> . . . . .	. . . 28° 31' N. . .			. . . 28° 59' N. . .			. . . 29° 20' N. . .			. . . 29° 53' N.		
<i>Longitude</i> . . . . .	. . . 77° 13' E. . .			. . . 77° 46' E. . .			. . . 79° 30' E. . .			. . . 77° 57' E.		
<i>Height</i> . . . . .	. . . . .			. . . 900 feet . . .			. . . 6,400 feet . . .			. . . . .
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	9 Years.	Winter, Spring, Summer, Autumn.	October to March.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.
	1851.		April to September.	1859.		April to September.	1846 to 1854.		April to September.	1860.		April to September.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	2·6	} 2·9	5·5	0·2	} 1·2	3·0	4·6	} 7·2	12·4	0·0	} 0·0	0·3
February - -	0·3			0·2			2·4			0·0		
March - -	2·6	} 3·7		1·8	} 4·4		1·7	} 5·5		0·0	} 0·5	
April - -	1·0			2·6			0·9			0·0		
May - -	0·1			0·0			2·8			0·5		
June - -	0·4	} 18·5	19·6	3·6	} 11·0	15·0	14·7	} 66·9	83·2	1·5	} 8·5	10·0
July - -	11·6			1·5			23·4			4·0		
August - -	6·5	} 0·0		5·9	} 1·4		28·8	} 16·1		3·0	} 1·3	
September - -	0·0			1·4			12·6			1·0		
October - -	0·0			0·0			2·7			0·3		
November - -	0·0	} 0·0		0·0	} 0·0		0·8	} 0·2		0·0	} 0·0	
December - -	0·0			0·8			0·2			0·0		
Year - -	25·1	..	..	18·0	..	..	95·6	..	..	10·3	..	..

BENGAL PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

Place . . . . .	. . . DUDOOPORE . . .			. . . UMBALLA . . .			. . . LANDOUR . . .			. . . MEAN MEER.		
Latitude . . .	. . . 30° 12' N. . .			. . . 30° 23' N. . .			. . . 30° 27' N. . .			. . . 30° 34' N.		
Longitude . . .	. . . . .			. . . 76° 44' E. . .			. . . 78° 10' E. . .			. . . 74° 4' E.		
Height . . . . .	. . . . .			. . . 1,050 feet . . .			. . . 7,000 feet . . .			. . . 1,128 feet.		
MONTH.	15 Years.	Winter, Spring, Summer, Autumn.	October to March.	2 Years.	Winter, Spring, Summer, Autumn.	October to March.	10 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1834 to 1848.		April to September.	1851 and 1852.		April to September.	1850 to 1859.		April to September.	1857 to 1859.		April to September.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	0·9	} 3·0	5·2	0·7	} 0·8	7·9	0·6	} 1·5	3·3	1·2	} 2·6	3·0
February - -	1·8			0·0			0·6			1·4		
March - -	1·0	} 2·2	34·9	7·1	} 10·8	18·2	0·3	} 3·7	89·4	0·4	} 1·3	13·3
April - -	0·4			0·9			1·9			0·5		
May - -	0·8	} 28·8	34·9	2·8	} 12·2	18·2	1·5	} 75·7	89·4	0·4	} 10·5	13·3
June - -	6·2			1·3			11·9			1·4		
July - -	13·6	} 6·1	34·9	7·8	} 2·3	18·2	31·5	} 11·8	89·4	5·5	} 1·9	13·3
August - -	9·0			3·1			32·3			3·6		
September - -	4·9	} 6·1	34·9	0·0	} 2·3	18·2	10·3	} 11·8	89·4	1·9	} 1·9	13·3
October - -	1·0			0·0			0·9			0·0		
November - -	0·2	} 6·1	34·9	2·3	} 2·3	18·2	0·6	} 11·8	89·4	0·0	} 1·9	13·3
December - -	0·3			0·1			0·3			0·0		
Year - - -	40·1	..	..	26·1	..	..	92·7	..	..	16·3	..	..

(continued.)

Place . . . . .	. . . FEROZEPORE . . .			. . . FEROZEPORE . . .			. . . LOODIANA . . .			. . . PUNJAB.		
Latitude . . .	. . . 30° 57' N. . .			. . . 30° 57' N. . .			. . . 30° 55' N. . .			. . . 31° 40' N.		
Longitude . . .	. . . 74° 41' E. . .			. . . 74° 41' E. . .			. . . 75° 54' E. . .			. . . 74° 45' E.		
Height . . . . .	. . . 720 feet . . .			. . . 720 feet . . .			. . . 900 feet . . .			. . . 800 to 900 feet.		
MONTH.	1 Year.	Winter, Spring, Summer, Autumn.	October to March.	5 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.	3 Years.	Winter, Spring, Summer, Autumn.	October to March.
	1851.		April to September.	1855 to 1859.		April to September.	1857 to 1859.		April to September.	1857 to 1859.		April to September.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - -	1·2	} 2·9	3·3	1·0	} 1·2	1·8	2·5	} 3·8	4·1	1·1	} 3·7	4·4
February - -	1·7			0·2			1·1			2·0		
March - -	0·4	} 0·6	19·9	0·6	} 1·6	11·8	0·1	} 1·4	12·4	0·7	} 7·1	52·2
April - -	0·1			0·9			0·8			5·2		
May - -	0·1	} 19·7	19·9	0·1	} 8·9	11·8	0·5	} 8·8	12·4	1·2	} 41·6	52·2
June - -	0·7			1·1			1·6			8·4		
July - -	18·8	} 0·0	19·9	6·5	} 1·9	11·8	2·9	} 2·5	12·4	22·7	} 4·2	52·2
August - -	0·2			1·3			4·3			10·5		
September - -	0·0	} 0·0	19·9	1·9	} 1·9	11·8	2·3	} 2·5	12·4	4·2	} 4·2	52·2
October - -	0·0			0·0			0·0			0·0		
November - -	0·0	} 0·0	19·9	0·0	} 1·9	11·8	0·2	} 2·5	12·4	0·0	} 4·2	52·2
December - -	0·0			0·0			0·2			0·6		
Year - - -	23·2	..	..	13·6	..	..	16·5	..	..	56·6	..	..

BENGAL PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued.*

<i>Place</i>	<i>. . . MEERA . . .</i>			<i>. . . RAWUL PINDI . . .</i>			<i>. . . PESHAWUR . . .</i>			<i>. . . PUBNA.</i>		
<i>Latitude</i>	<i>. . . 32° 37' N. . . .</i>			<i>. . . 33° 34' N. . . .</i>			<i>. . . 34° 20' N. . . .</i>			<i>.</i>		
<i>Longitude</i>	<i>. . . 70° 30' E. . . .</i>			<i>. . . 73° 5' E. . . .</i>			<i>. . . 71° 29' E. . . .</i>			<i>.</i>		
<i>Height</i>	<i>.</i>			<i>. . . 1,500 feet. . . .</i>			<i>. . . 1,056 feet</i>			<i>.</i>		
<i>MONTH.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>6 Years.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>
	<i>1848.</i>		<i>April to September.</i>	<i>1859.</i>		<i>April to September.</i>	<i>1855 to 1860.</i>		<i>April to September.</i>	<i>1851.</i>		<i>April to September.</i>
	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>
January - -	0·0	} 0·0	4·7	0·0	} 0·0	0·0	1·2	} 3·6	5·1	0·6	} 1·2	7·9
February - -	0·0			0·0			1·8			1·6		
March - -	0·0	} 2·8		0·0	} 0·0		1·1	} 2·3		0·0	} 2·3	
April - -	0·0			0·0			0·8			2·3		
May - -	2·8	} 40·0	45·1	0·0	} 14·0	17·6	0·4	} 5·7	8·6	0·0	} 22·8	31·2
June - -	10·9			4·1			0·3			8·9		
July - -	22·9	} 7·0		4·8	} 3·6		2·1	} 2·1		7·7	} 11·8	
August - -	6·2			5·1			3·3			6·2		
September - -	2·3	} 7·0		3·6	} 3·6		1·7	} 2·1		6·1	} 11·8	
October - -	2·8			0·0			0·1			5·7		
November - -	1·9	} 7·0		0·0	} 3·6		0·3	} 2·1		0·0	} 11·8	
December - -	0·0			0·0			0·6			0·0		
Year - -	49·8	..	..	17·6	..	..	13·7	..	..	39·1	..	..

(continued.)

<i>Place</i>	<i>. . . BOGRAH . . .</i>			<i>. . . SANDOWY . . .</i>			<i>. . . SEBSAGUR . . .</i>			<i>. . . NAGERCOIL.</i>		
<i>Latitude</i>	<i>.</i>			<i>.</i>			<i>.</i>			<i>.</i>		
<i>Longitude</i>	<i>.</i>			<i>.</i>			<i>.</i>			<i>.</i>		
<i>Height</i>	<i>.</i>			<i>.</i>			<i>.</i>			<i>.</i>		
<i>MONTH.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>1 Year.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>	<i>6 Years.</i>	<i>Winter, Spring, Summer, Autumn.</i>	<i>October to March.</i>
	<i>1851.</i>		<i>April to September.</i>	<i>1851.</i>		<i>April to September.</i>	<i>1851.</i>		<i>April to September.</i>	<i>1841 to 1846.</i>		<i>April to September.</i>
	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>
January - -	0·7	} 2·4	9·6	0·0	} 0·6	12·8	0·8	} 5·7	13·3	1·0	} 6·0	23·8
February - -	1·7			0·0			4·4			0·3		
March - -	1·2	} 5·8		0·0	} 15·7		1·1	} 22·4		1·2	} 9·3	
April - -	1·2			0·5			8·8			1·4		
May - -	3·4	} 31·0	41·8	15·2	} 120·3	165·7	12·5	} 43·2	71·9	6·7	} 7·4	17·9
June - -	14·6			52·2			16·4			5·7		
July - -	8·0	} 12·2		30·6	} 41·9		10·4	} 13·9		1·4	} 18·0	
August - -	8·4			37·5			16·4			0·3		
September - -	6·2	} 12·2		29·7	} 41·9		7·4	} 13·9		1·4	} 18·0	
October - -	6·0			10·9			6·4			11·6		
November - -	0·0	} 12·2		1·3	} 41·9		0·1	} 13·9		5·0	} 18·0	
December - -	0·0			0·6			0·5			4·7		
Year - -	51·4	..	..	178·5	..	..	85·2	..	..	40·7	..	..

BENGAL PRESIDENCY.—Monthly, Quarterly, Half-yearly, and Yearly Falls of Rain—*continued*.

Place . . . . .	. CARAVATAVALUM. .			. . . TRICHOOR . .			. . . CHITTOOR . .			. . . NOWGONG.		
Latitude . . . . .	. . . . .			. . . . .			. . . . .			. . . . .
Longitude . . . . .	. . . . .			. . . . .			. . . . .			. . . . .
Height . . . . .	. . . . 300 feet . . . . .			. . . . 60 feet . . . . .			. . . . 400 feet.				
MONTH.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	5 Years.	Winter, Spring, Summer, Autumn.	October to March. April to September.	1 Year.	Winter, Spring, Summer, Autumn.	October to March. April to September.
	1842 to 1846.			1842 to 1846.			1842 to 1846.			1851.		
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January - - -	2.5	} 7.1	38.3	0.3	} 2.8	17.6	0.6	} 2.0	12.5	0.0	} 4.9	14.4
February - - -	1.0			0.0			0.0			2.9		
March - - -	4.1	} 24.9		0.4	} 17.8		0.8	} 5.9		2.1	} 19.5	
April - - -	3.6			0.6			0.9			8.5		
May - - -	17.2	} 55.8	82.2	16.8	} 59.9	84.2	4.2	} 41.2	50.4	8.9	} 47.1	69.1
June - - -	25.1			31.8			12.1			17.5		
July - - -	17.6	} 32.7		14.0	} 21.3		16.8	} 13.8		7.4	} 12.0	
August - - -	13.1			14.1			12.3			22.2		
September - - -	5.6	} 32.7		6.9	} 21.3		4.1	} 13.8		4.6	} 12.0	
October - - -	20.6			11.4			5.5			7.0		
November - - -	6.5	} 32.7		3.0	} 21.3		4.2	} 13.8		0.4	} 12.0	
December - - -	3.6			2.5			1.4			2.0		
Year - - -	120.5	..		101.8	62.9	83.5

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RAIN CHART

